

Appendix I1

Management Plans

Table of Contents

Spill Contingency Plan, Version 6, March 2016

Water Quality and Flow Monitoring Plan, Version 5, March 2016

Incinerator Waste Management Plan, Version 6, March 2016

Tailings Storage Facility: Operation, Maintenance and Surveillance Manual, Version 6, March 2016

Dewatering Dikes: Operation, Maintenance and Surveillance Manual, Version 4, March 2016

Emergency Response Plan, Version 18, February 2016

SPILL CONTINGENCY PLAN, VERSION 6, MARCH 2016

WATER QUALITY AND FLOW MONITORING PLAN, VERSION 5, MARCH 2016

INCINERATOR WASTE MANAGEMENT PLAN, VERSION 6, MARCH 2016

**TAILINGS STORAGE FACILITY: OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL,
VERSION 6, MARCH 2016**

**DEWATERING DIKES; OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL, VERSION
4, MARCH 2016**

EMERGENCY RESPONSE PLAN, VERSION 18, FEBRUARY 2016

SPILL CONTINGENCY PLAN, VERSION 6, MARCH 2016



MEADOWBANK GOLD PROJECT

Spill Contingency Plan

**Meadowbank Mine Site
All Weather Access Road (AWAR)
Baker Lake Facilities**

In Accordance with Water License 2AM-MEA1525

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 6
March 2016

EXECUTIVE SUMMARY

This document presents the Spill Contingency Plan for Agnico Eagle Mines Limited (AEM) Meadowbank Mine Site, All Weather Access Road (AWAR) and Baker Lake Marshalling Facilities, which is a requirement of the Meadowbank Gold Project Type A Water License No. 2AM-MEA1525 issued on July 23, 2015. The Spill Contingency Plan (SCP) designates lines of authority, responsibility, establishes proper reporting and details plans of action in the event of a spill. This plan applies to the operational phase of the mine and is applicable to all AEM employees and any contractors associated with the project located at latitude 65°01'52"N longitude 96°04'22"W approximately 70 km north of Baker Lake in Nunavut including the Baker Lake Marshalling Facilities located at latitude 64°18'36"N and longitude 95°58'04"W and the AWAR.

IMPLEMENTATION SCHEDULE

As required by Water License 2AM-MEA1525, Part B, Item 14, the implementation schedule for this Plan is effective immediately (March 2016) subject to any modification proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

AEM - Environmental Superintendent

AEM – General Mine Manager

AEM – Engineering Superintendent

AEM – Health and Safety Superintendent

AEM – Geology Superintendent

AEM – Mill Superintendent

AEM – Maintenance Superintendent

AEM – Mine Superintendent

AEM – Energy & Infrastructure Superintendent

AEM – General Services Superintendent

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	08/08/08			Comprehensive plan for Meadowbank Mine Site, Exploration Camp and Baker Lake Facilities
2	11/12/04			Update of Contacts, Spill management materials, include AWAR map and Spill KIT Location Map
3	12/07/25			Update of the hazardous materials stored on site
4	2013/11			Comprehensive revision and update with info for Baker Lake Jet-A Tank
5	2014/11	Appendices I & J		Include the prohibition of adding neutralizing chemicals to drainages or near or within water bodies
6	2015/09	3 Table 4 5.1.3 5.6 Appendix L Appendix M		Change definition of a major spill and minor spill Contact Information Add point that procedure MBK-ENV-0016 will be followed for reporting spills Addition of section on event monitoring. Seepage monitoring included in section. Dyno Nobel Emergency Response Plan added in appendix J MBK-ENV-0016 Spill Response Procedure Added



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Senior Environmental Compliance Technician



Approved By:

Kevin Buck
Environmental Superintendent

Table of Contents

EXECUTIVE SUMMARY	ii
IMPLEMENTATION SCHEDULE	iii
DISTRIBUTION LIST	iii
DOCUMENT CONTROL	iv
SECTION 1 • INTRODUCTION.....	1-1
1.1 PURPOSE AND SCOPE OF THE SPILL CONTINGENCY PLAN.....	1-1
SECTION 2 • PROJECT DESCRIPTION	2-1
2.1 PREVENTION AND INSPECTIONS	2-1
SECTION 3 • DEFINITIONS	3-1
3.1 WHAT IS A SPILL?	3-1
3.2 MATERIALS AND REPORTABLE (to regulatory Authorities) SPILLS ON SITE	3-1
SECTION 4 • RESPONSE ORGANIZATION.....	4-1
4.1 FIRST RESPONDER.....	4-3
4.2 SUPERVISOR	4-3
4.3 INCIDENT COMMANDER.....	4-3
4.4 EMERGENCY RESPONSE TEAM.....	4-4
4.5 EMERGENCY RESPONSE TEAM COORDINATOR	4-4
4.6 ENVIRONMENTAL SUPERINTENDENT OR DESIGNATE.....	4-4
4.7 GENERAL MINE MANAGER ON DUTY	4-5
4.8 HEALTH AND SAFETY SUPERINTENDENT OR DESIGNATE.....	4-5
4.9 ON-SITE HEALTH CARE PROVIDERS.....	4-5
4.10 SPILL RESPONSE TEAM CONTACT INFORMATION.....	4-5
SECTION 5 • ACTION PLAN	5-1
5.1 INITIAL ACTION	5-1
5.1.1 Respond Quickly.....	5-1
5.1.2 Ensure safety	5-2
5.1.3 Report Spill.....	5-2
5.2 SPILLS ON LAND	5-2
5.3 SPILLS ON WATER.....	5-3
5.4 SPILLS ON SNOW AND ICE	5-3
5.5 DISPOSAL OF SPILLED MATERIAL	5-4
5.6 EVENT MONITORING	5-4
SECTION 6 • HAZARDOUS MATERIALS STORED ON SITE.....	6-1
SECTION 7 • POTENTIAL SPILL ANALYSIS.....	7-1

SECTION 8 •	RESPONSE EQUIPMENT	8-1
8.1	GENERAL EQUIPMENT	8-1
SECTION 9 •	TRAINING & EMERGENCY SPILL/EXERCISE	9-1
9.1	TRAINING	9-1
9.1.1	On-site Personnel	9-1
SECTION 10 •	LIST OF ACRONYMS	10-1

LIST OF TABLES

Table 1 - Spill quantities that must be reported to the NT-NU 24-HOUR SPILL REPORT LINE	3-1
Table 2 - Internal Contacts	4-6
Table 3 - Contractor Contacts	4-7
Table 4 - External Contacts	4-8
Table 5 - Materials stored at site during operations	6-1

LIST OF FIGURES

Figure 1 : Layout Meadowbank Mine Site	2-3
Figure 2 : Layout Vault	2-1
Figure 3 : Baker Lake Diesel Fuel Tank Farm.....	2-2
Figure 4 : Baker Lake Jet-A Fuel Tank Farm	2-3
Figure 5 : Major spill/incident reporting procedure	4-2
Figure 6 : Spill Response Equipment Location	8-4
Figure 7 : Map of AWAR Including Locations of Environmental Emergency Sea cans	8-5

LIST OF APPENDICES

- Appendix A: Environmental Department weekly inspection template
- Appendix B: Shipboard Oil Pollution Emergency Plan
- Appendix C: Shipping company certificate of entry and acceptance boats
Communication protocol
Safety management system for entry into confined water
Safety management system for monthly safety meeting
- Appendix D: NWT/NU Spill Report Form
- Appendix E: General Response Procedures for Spilled Chemical Substances Explosives
E.1 Ammonium Nitrate
E.2 Ammonium Nitrate Fuel Oil (ANFO)
- Appendix F: General Response Procedures for Spilled Chemical Substances
F.1 Compressed Gases
- Appendix G: General Response Procedures for Spilled Chemical Substances
G.1 Flammable and Combustible Liquids
- Appendix H: General Response Procedures for Spilled Chemical Substances
H.1 Oxidizing Substances - Liquids
H.2 Oxidizing Substances - Solids
- Appendix I: General Response Procedures for Spilled Chemical Substances
I.1 Poisonous and Toxic Substances (Sodium Cyanide)
- Appendix J: General Response Procedures for Spilled Chemical Substances: Corrosive Substances
J.1 Acids, Liquids
J.2 Acids, Solids
J.3 Bases/Alkali, Liquids
J.4 Bases/Alkali, Solids
- Appendix K: Agnico Eagle Spill Response Training Records
- Appendix L: Dyno Nobel Emergency Response Plan
- Appendix M: MBK-ENV-0016 Spill Reporting Procedure

SECTION 1 • INTRODUCTION

1.1 PURPOSE AND SCOPE OF THE SPILL CONTINGENCY PLAN

The overall purpose of creating a spill contingency plan is to minimize the impacts of spills by the establishment of predetermined lines of response and plans of action. This plan has been designed to facilitate effective communication and the efficient clean-up of spills from potentially hazardous materials. These materials include:

- Hydrocarbon liquids such as diesel fuel, aviation fuel (Jet-A), gasoline, hydraulic oil;
- Soluble solids such as ammonium nitrate prill;
- Soluble liquids, such as glycols, acids, paints; and
- Corrosive liquids such as sulphuric acid and sodium cyanide.

More specifically the objectives of this Spill Contingency Plan (SCP) are to:

- Identify roles, responsibilities, and reporting procedures;
- Provide readily accessible emergency information to the cleanup crews, management, and government agencies;
- Comply with federal and territorial regulations and guidelines pertaining to the preparation of contingency plans and notification requirements;
- Promote the safe and effective recovery of spilled materials; and
- Minimize the environmental impacts of spills to water or land.

This plan has been prepared in accordance with the following reference documents:

- Indian and Northern Affairs Canada (INAC) 2007. *Guidelines for Spill Contingency Planning*;
- Government of Nunavut (GN), *Contingency Planning and Spill Reporting in Nunavut. A Guide to the New Regulations*;
- Government of Nunavut (GN) 2002, *Guideline General Management of Hazardous Wastes in Nunavut*; and
- Northwest Territories Resources Wildlife and Economic Development Environmental Protection Service. 1988. *Spill Contingency Planning and Reporting Regulations*.

SECTION 2 • PROJECT DESCRIPTION

The Meadowbank Gold Project, operated by Agnico Eagle Mines Limited, is located approximately 70 km north of the Hamlet of Baker Lake in Nunavut. The project is located on Inuit Owned surface lands (IOL BL-14) and has the following coordinates:

Latitude: 65°01'52"N
Longitude: 96°04'22"W
NTS map sheet 66H/1

Meadowbank Project components include marshalling facilities in Baker Lake, the 110 kilometer All-Weather Access Road (AWAR) from Baker Lake and the Meadowbank mine site (Figure 7). The Meadowbank mine site consists of the process plant, landfarm, sewage treatment plant, water intake, accommodation buildings, power plant, tank farm, warehouse, truck shop, emulsion plant, open pit (Figure 1) and Vault area (Figure 2). The Baker Lake Marshalling Area consists of a laydown transfer area to temporarily store materials prior to the delivery to the Meadowbank mine site. The Baker Lake fuel farm consists of six (6), ten (10) million liter tanks for diesel fuel, within secondary containment, (Figure 3) and twenty (20), 100,000L double walled tanks, within secondary containment, for aviation fuel (Figure 4). The fuel is delivered in bulk by sealift to the fuel farm. From there, fuel is hauled to the Meadowbank mine site by contractor tanker trucks on the AWAR. Diesel fuel coming from the Baker Lake Tank Farm is stored at the Meadowbank site into a single 5.6 million liter tank, within secondary containment, and the aviation fuel into eight (8) – 50,000L double walled tanks at the airstrip. From there, the diesel is redistributed into different storage tanks by an on-site tanker to mine site fuel tanks and Vault fuel storage tanks. Fuel storage locations have been designed to meet the CCME guidelines for Aboveground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.

Emergency spill response equipment (i.e. spill kits) is installed at each fuel storage location. Spill kits contain the appropriate type, size and quantity of equipment for the volume and type of product present at the storage location. Transport trucks, heavy equipment and light vehicles are all equipped with spill kits.

Construction at the mine site began with the issuance of the Type A Water License and other relevant authorizations in July 2008 with operations commencing in January 2010.

2.1 PREVENTION AND INSPECTIONS

The first step in spill contingency planning is to take actions to prevent spills from occurring. Transport, transfer and storage of materials are performed by trained personnel using secondary containment, with well-maintained equipment and containers. Refueling stations in Baker Lake and at the mine site are equipped with a lined area to contain any minor leaks or spills while refueling. Transfer of fuel from tanks to tanker trucks are performed with the aid of fuel pumps. Good housekeeping practices are adopted especially in areas such as storage facilities, loading and unloading zones. Site orientations are conducted with all employees and spill prevention and response is discussed in detail. Regular worksite inspections are conducted to identify measures to minimize the risk of spills. All personnel are trained to be aware of the potential hazards associated with the fuel/chemicals with which they are assigned to work. In addition to work site inspections conducted by area specific employees, the Environmental Department conducts weekly inspections to audit facilities handling or storing hazardous materials (Appendix A).

AEM supports the following general principles for spill prevention:

- Provide up to date and accessible Material Safety Data Sheets (MSDS) for all hazardous materials;

- Regular inspections of fuel/chemical storage areas for leaks (including flex connectors and plumbing) and platform shifting;
- Regular inspections of hazardous materials storage areas;
- Train workers in the use of safe work procedures for hazardous materials, and procedures to clean up spills;
- Encourage workers to take reasonable measures to prevent spills;
- Keep drums/containers sealed or closed;
- Place drums/containers within a suitable form of secondary or spill containment;
- Keep “overpack” or “salvage” drums nearby to contain leaking drums;
- Keep storage areas secure from unauthorized access;
- Segregate incompatible materials;
- Ensure chemical storage areas are adequately protected from weather and physical damage; and
- Provide adequate spill response materials at storage areas (details of spill response equipment are outlined in Section 8).

Figure 1 : Layout Meadowbank Mine Site

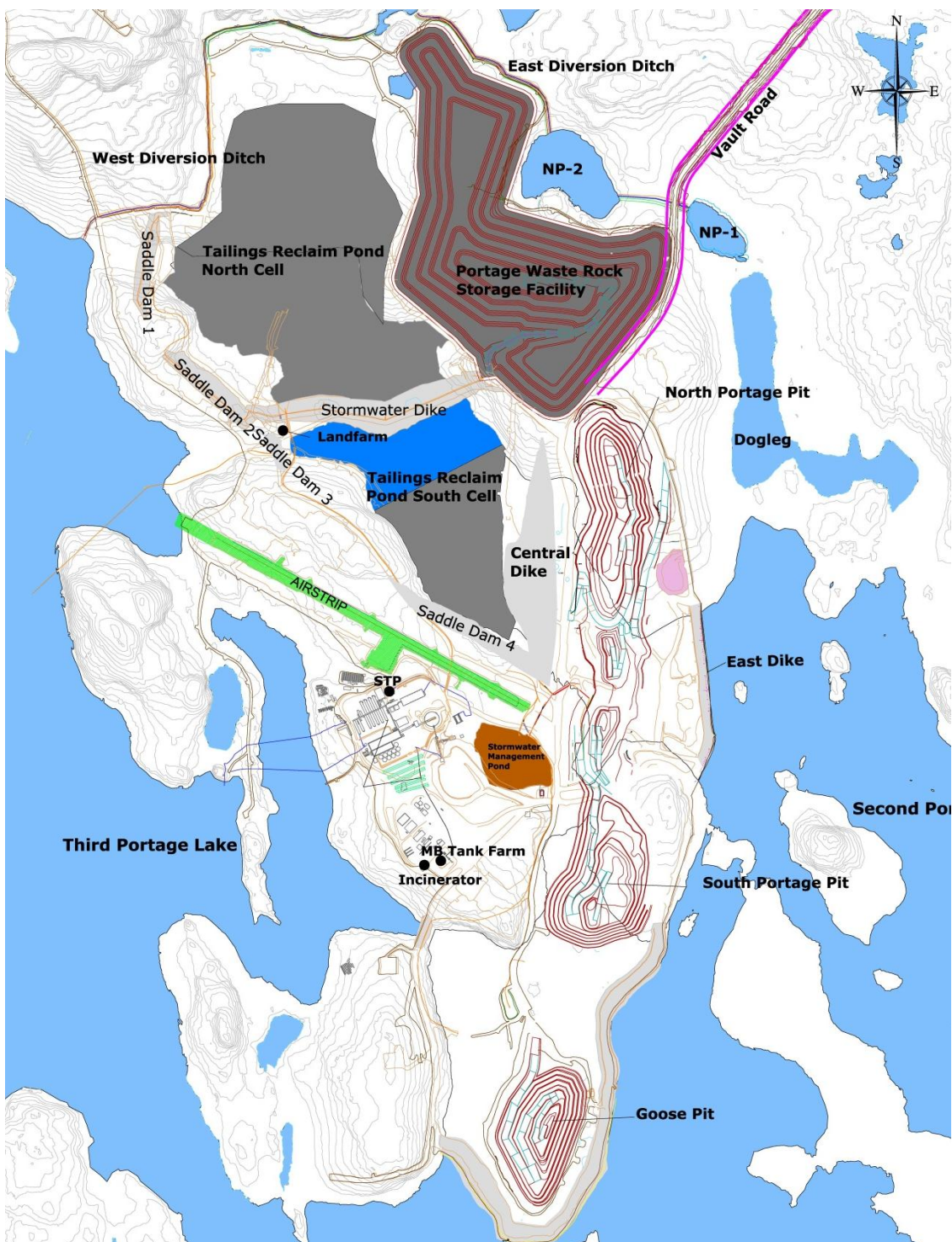


Figure 2 : Layout Vault

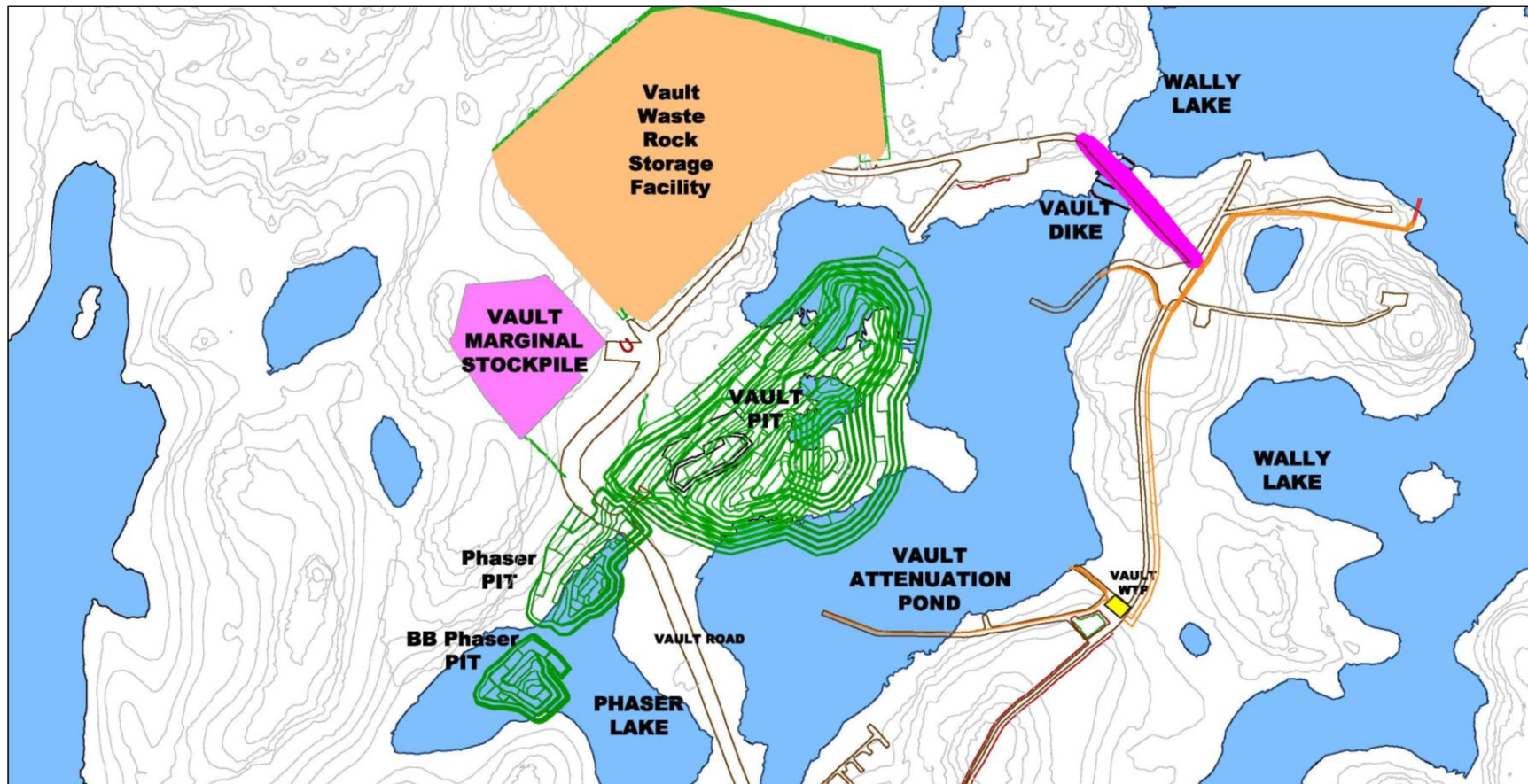


Figure 3 : Baker Lake Diesel Fuel Tank Farm

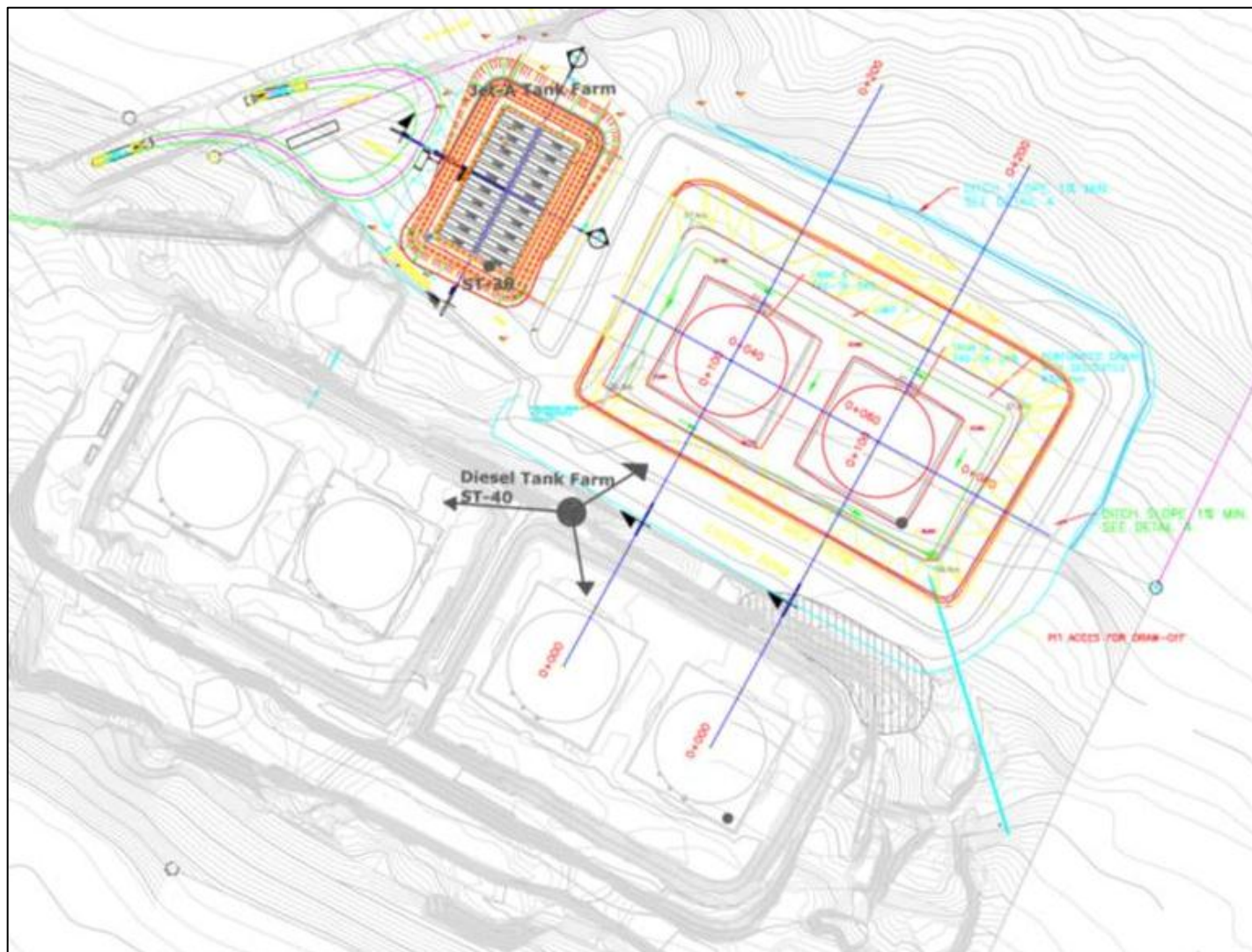
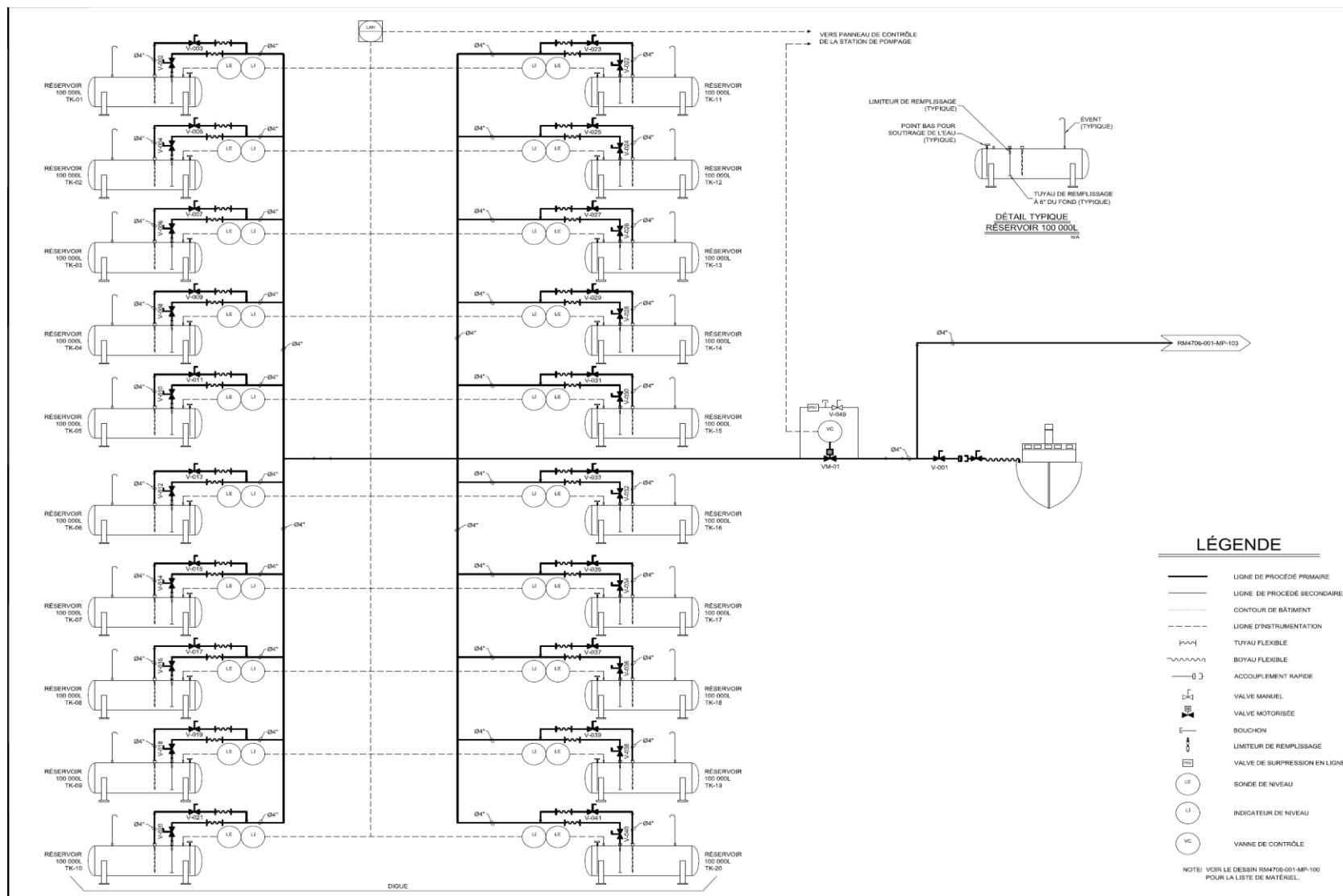


Figure 4 : Baker Lake Jet-A Fuel Tank Farm



SECTION 3 • DEFINITIONS

3.1 WHAT IS A SPILL?

For the purposes of this plan, a Major spill is defined as an accidental release of product into the environment that has the potential for adverse impacts to the receiving environment, AEM property or human health. This can include potential impacts to water, surface and groundwater, land, equipment, buildings, local communities, human health and the atmosphere.

A Minor spill is defined as any spill that does not involve a toxic, reactive, or explosive material in a situation that does not pose a significant risk to the environment, human health or AEM property. Minor spills are generally contained within AEM facilities.

3.2 MATERIALS AND REPORTABLE (TO REGULATORY AUTHORITIES) SPILLS ON SITE

As a precaution, if there is any doubt as to whether the quantity spilled meets the minimum thresholds for reporting to regulatory authorities listed in Table 1, the spill incident will be reported. Furthermore, AEM maintain a detailed log of all spills, reportable to authorities or non-reportable of all materials listed in Section 1.1. As part of AEM's overall environmental management system and in the spirit of a continuous improvement of environmental performance, procedures will be implemented to ensure **all** spills are reported to the Meadowbank Environmental Department.

To ensure compliance with Section 36(3) of the *Fisheries Act* and Section 35 of the *Migratory Bird Regulations* all spills of fuel or hazardous materials, regardless of quantity, into a water body (including frozen), shall be reported immediately to the NT-NU 24-HOUR SPILL REPORT LINE (at 867.920.8130).

Table 1 - Spill quantities that must be reported to the NT-NU 24-HOUR SPILL REPORT LINE

Transportation Class	Type of Substance	Compulsory Reporting Amount
1	Explosives	Any amount
2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity exceeding 100 L
2.2	Compressed gas (non-corrosive, non- flammable)	Any amount from containers with a capacity exceeding 100 L
2.3	Compressed gas	Any amount
2.4	Compressed gas (corrosive)	Any amount
3.1, 3.2, 3.3	Flammable liquid	100 L
4.1	Flammable solid	25 kg
4.2	Spontaneously combustible solid	25 kg
4.3	Water reactant solids	25 kg
5.1	Oxidizing substances	50 L or 50 kg
5.2	Organic peroxides	1 L or 1 kg
6.1	Poisonous substances	5 L or 5 kg
7	Radioactive substances	Any amount
8	Corrosive substances	5 L or 5 kg
9.1 (in part)	Miscellaneous substances	50 L or 50 kg

9.2	Environmentally hazardous	1 L or 1 kg
9.3	Dangerous wastes	5L or 5 kg
9.1 (in part)	PCB mixtures of 5 ppm or more	0.5 L or 0.5 kg
None	Other contaminants	100 L or 100 kg
None	Seepage from TSF and RSF	Any amount

Note: L = litre; kg = kilogram; PCB = polychlorinated biphenyls; ppm = parts per million.

SECTION 4 • RESPONSE ORGANIZATION

This section addresses the response organization and the responsibilities of each individual during response to an incident.

Figure 5 illustrates AEM's Spill Reporting Procedure in the event of a major spill and Sections 4.1- 4.9 list the major responsibilities of site staff that will be participating in the emergency response management.

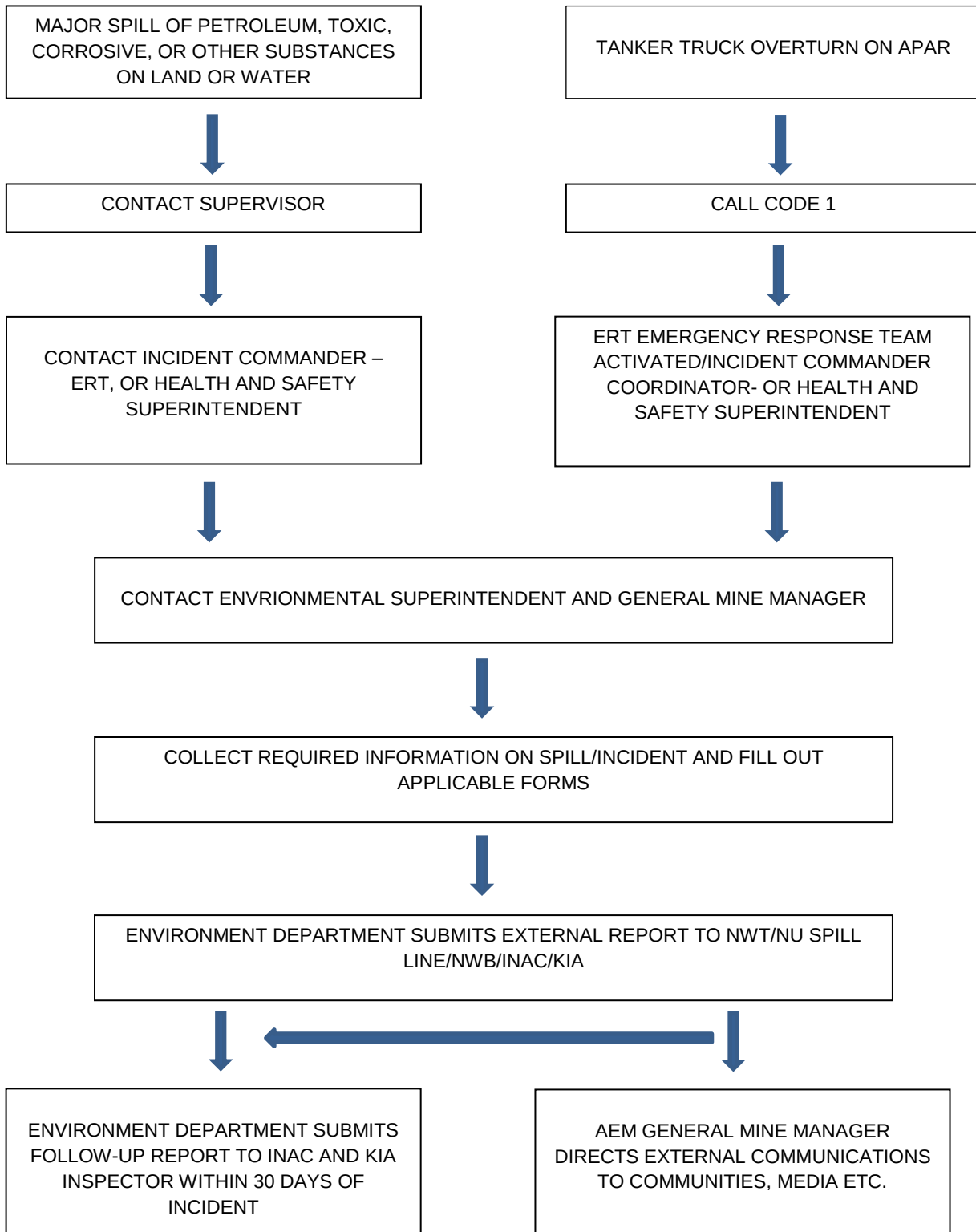
The first person (first responder) to notice, or come in contact with, any spill situation either initiates a Code 1 (i.e. If a tanker truck overturns on the APAR) or reports to his/her immediate supervisor (i.e. All other spills on land or water). The supervisor is responsible to report the incident to the designated Incident Commander for a major spill or to the environmental department for a minor spill. If a Code 1 is initiated, the Incident Commander will respond in conjunction with the ERT. Major responsibilities such as initial coordination, spill clean-up and mobilizing the ERT are part of the Incident Commander's duties.

The Incident Commander will contact the Environmental Superintendent and/or General Mine Manager or alternate, who in turn will inform the Senior Vice President, Environment and Sustainable Development. After all information has been collected, the Environmental Superintendent or alternate will submit a spill report and follow up spill report to the NWT/NU Spill Line, Nunavut Water Board, Kivalliq Inuit Association and Indigenous and Northern Affairs Canada. Incidents that require media communications will be the responsibility of AEM General Mine Manager or alternate.

In the event of a major spill during a ship-to-ship transfer or due to unforeseen circumstances, the shipping company will be the sole owner for the spill. The containment and clean-up of inadvertent spills resulting from the tankers in transporting the fuel is the responsibility of the shipping company. In the unlikely event where a major fuel spill becomes unmanageable, the shipping company could call on external resources such as the Canadian Coast Guard for assistance. In these situations, AEM would provide whatever assistance it can to the shipping company¹. Due to the lack of resources AEM possess to counter act such a large scale marine spill, AEM's assistance would be limited to providing support to preserve the shoreline environment. AEM would put its resources to the best use possible during such an event, and assist as much as possible with the resources at hand. The Shipboard Oil Pollution Emergency Plan (SOPEP) (Appendix B) is the responsibility of the shipping company; it covers the ship-to-ship transfer of fuel near Helicopter Island. Please refer to the *Oil Pollution Emergency Plan* for more details. Please refer to Appendix C for certificate of entry and acceptance boats of shipping company, communication protocol, safety management system for entry into confined water and monthly safety meeting forms.

¹ The Emergency Response Team will not be equipped or trained to respond to spills offshore in the Marine environment. They will however be able to respond to spills in the near shore area.

Figure 5 : Major spill/incident reporting procedure



4.1 FIRST RESPONDER

The person who has caused a spill or the first to observe the spill is the first responder. The responsibilities of the first responder are as follows:

- In case of a tanker truck overturn, initiate a Code 1. Remain on radio to provide guidance to the ERT;
- In case of spill to land or water, contact the supervisor to report the incident;
- Identify and contain the spill, IF SAFE TO DO SO; and
- Participate in spill response as a member of the clean-up crew.

4.2 SUPERVISOR

The responsibilities of the Supervisor are as follows:

- Initial assessment of the severity of the incident;
- Contacts the Incident Commander or Environmental Department;
- Gathers facts about the spill; and
- Participate in spill response as a member of the clean-up crew.

4.3 INCIDENT COMMANDER

Responsibilities of the Incident Commander are as follows:

- Assume complete authority over cleanup personnel and the spill scene, as well as assume responsibility for all mitigation efforts;
- Evaluate the initial situation and assess the magnitude of the problem;
- Activates the initial response plan;
- Alert and assemble key personnel in the response team, as deemed appropriate, to handle the situation;
- In consultation with the Environmental Superintendent or designate, develop the overall plan of action for containment and cleanup of the specific incident, as well as direct and implement the plan;
- Ensure assigned responsibilities are carried out and the activities of team members are coordinated;
- Assess the requirements for people, equipment, materials, and tools to contain the spill in light of what resources are immediately available; urgency will depend on the nature of the spill; and
- In consultation with the Environmental Superintendent or designate mobilize any additional resources that may be required and arrange for the transportation of necessary personnel and/or materials to the site.

4.4 EMERGENCY RESPONSE TEAM

AEM has an Emergency Response Team (ERT) that is trained and responsible for controlling the major spills as well as spills from tanker truck overturns along AWAR, and assisting with medical and other emergencies that may occur at the camp. These team members attend regular training sessions.

4.5 EMERGENCY RESPONSE TEAM COORDINATOR

The responsibilities of the Emergency Response Team Coordinator (ERTC) are as follows:

- Mobilize all ERT personnel, equipment, personal protective equipment and supplies as required to the site of the spill;
- Assist Incident Commander in obtaining any additional resources not available on site;
- Ensure that appropriate PPE is worn properly;
- Assist in developing and implementing emergency response training programs and exercises; and
- Ensure that all spill response personnel receive adequate training to fulfill their responsibilities as part of the ERT.

4.6 ENVIRONMENTAL SUPERINTENDENT OR DESIGNATE

The Environmental Superintendent or designate is responsible for implementing and maintaining the SCP. In addition, the Environmental Superintendent's or designates responsibilities in the case of a spill are to:

- Liaise with the Incident Commander;
- Provide technical advice on the anticipated environmental impacts of the spill;
- Advise on the effectiveness of various containment, recoveries, and disposal options, and suggest the most appropriate approach;
- Prepare and submit any formal reports (see Appendix D for NWT/NU Spill Report Form) to regulators and AEM management detailing the occurrence of a spill;
- Contact the Senior Vice President Environment and Sustainable Development immediately for a major spill;
- Act as the spokesperson with regulatory and government agencies;
- If authorized by the General Mine Manager, act as a spokesperson with the public and media, as required;
- Implement a sampling protocol for the collection and analysis of samples to identify and monitor possible contaminant levels resulting from the spill;
- Ensure on-site resources for spill response and cleanup are available;
- Monitor the effectiveness of the cleanup operation and recommend further work, if necessary;

- Reviews incident occurrences and recommends preventative measures; and
- Assists in implementing training and simulation requirements for spill response personnel.

4.7 GENERAL MINE MANAGER ON DUTY

The General Mine Manager/designate is required to inform team members of the detailed nature of the operations to be performed in the event of a major spill during the operations phase. The responsibilities of the General Mine Manager/designate are as follows:

- Liaise with AEM personnel resources and keep them informed of cleanup activities; and
- Assist the Incident Commander and ERT as needed, particularly in obtaining any additional resources not available onsite for spill response and cleanup.

4.8 HEALTH AND SAFETY SUPERINTENDENT OR DESIGNATE

The following are the responsibilities of the Health and Safety Superintendent or designate in conjunction with the Training Department:

- Maintain emergency and health and safety records;
- Assist in conducting emergency spill response exercises;
- Track all emergency and health and safety training that on-site staff have received, and when retraining will be required;
- Notify the Incident Commander (related to ERT) when retraining is required;
- Ensure that employees are retrained in appropriate emergency response skills, Workplace Hazardous Materials Information System (WHMIS) training, Hazard Communication (HAZCOM), Occupational Health and Safety Administration (OHSA) training, first aid, and respirator fit-testing prior to expiry of existing training certification; and
- Consult with appropriate organizations regarding retraining requirements and schedules.

4.9 ON-SITE HEALTH CARE PROVIDERS

On-site medics are responsible for the following:

- Providing on-site first aid and other medical support; and
- Providing additional training for ERT members.

In addition to the health care providers on site, the Baker Lake Hamlet health professionals will be called first on the scene, if required.

4.10 SPILL RESPONSE TEAM CONTACT INFORMATION

Internal contact information is contained in Table 2 for all AEM personnel involved in spill recovery and subsequent reporting. Table 3 provides contact information for AEM contractors present at the mine site and

transportation contractors. Important external contacts such as regulatory agencies and health organizations are listed in Table 4. Table 5 provides contact information for external contractors should incident warrant assistance from outside sources.

Table 2 - Internal Contacts

Title	Name	Telephone No.
Sr. Vice President, Environment and Sustainable Development	Louise Grondin	416.847.8656 Cell: 819.724.2020
Vice President of Environment	Michel Julien	416-947-1212 ext. 3738 Cell: 514.244.5876
Corporate Director, Communications & Public Affairs	Dale Coffin	416.847.8669 Cell: 647.274.4154
Manager of Regulatory Affairs Nunavut	Stephane Robert	819.759.3700 ext. 5188 Cell: 819.763.0229
Manager of Nunavut Services Group	Jason Allaire	819.759.3555 ext. 6968 M: 819.355.2608
Meadowbank General Mine Manager	Bertin Paradis	819.759.3555 ext. 6725 Cell: 819.355.9348
H&S Superintendent or H&S Ass. Superintendent	Normand Ladouceur or Yves Levesque	819.759.3555 ext.6720 Cell: 819.860.6258 or 819.759.3555 ext.6720 Cell: 819.856.9051
Emergency Response Counselors	André Rouleau Or Philip Beaudoin	819.759.3555 ext.6809 Cell: 819.355.2191 or 819.759.3555 ext.6809 Cell: 450.847.4214

Environmental Superintendent	Kevin Buck	819.759.3555 ext.6838 Cell: 819.856.1956
Senior Environmental Coordinator	Erika Voyer	819.759.3555 ext.6980
Environmental Coordinator	Robin Allard or Martin Theriault	819.759.3555 ext.6744 or 819.759.3555 ext.6759
Environmental Department	Environmental Technicians	819.759.3555 ext.6747/6759
Incident Commander	Erika Voyer Kevin Buck	867.793.4610 ext. 6980 867.793.4610 ext. 6838
On-site Medics	On-site Nurses	819.759.3555 ext.6734 or 6751
Site Security	On-site Security	(867) 793-4610 ext. 6748

Table 3 - Contractor Contacts

Title	Telephone No.	Contact in Emergency for:
Nolinor Aviation Services	Protocol Agent 867.759.3700 ext. 8008	Flight services for additional crew, or additional supplies
First Air	1-800-267-1247	Flight services for additional crew, or additional supplies
Calm Air	1-800-839-2256	Flight services for additional crew, or additional supplies
Dyno Nobel Explosives Ltd.	(819) 825-5441	Heavy Equipment, Man power, Emergency Blasting
Woodward Group of Companies (Shipping)	(709) 896-2421	Fuel Hauler
Baker Lake Contracting & Supplies	(867) 793-2831 Press #1	Man power, equipment, trades personnel i.e. pipefitter, plumber, electrical
Peter's Expediting	(867) 793-2703	Equipment, man power, Ground transportation services
Arctic Fuel Services	(867) 793-2311 Office (867) 793-2301 Supervisor	Fuel hauling, trucking, man power.

Table 4 - External Contacts

Organization/Authority	Telephone Number	Fax Number
NT-NU 24-Hour Spill Report Line	(867) 920-8130 spills@gov.nt.ca	(867) 873-6924
Workers Safety and Compensation Commission	(867) 979-8500	(867) 979-8501
Kivalliq Inuit Association	(867) 645-5725	(867) 645-2348
Nunavut Water Board	(867) 360-6338	(867) 360-6369
INAC Inspector	(867) 645-2830	(867) 979-6445
Environment Canada – West and North Region	780-951-8600	780-495-2615
Government of Nunavut – Department of Environment	(867) 975-7700	(867) 975-7742
Kivalliq Health Services – Baker Lake	(867) 793-2816 <i>Dial 0</i>	(867) 793-2812
Baker Lake Hamlet Office	(867) 793-2509	
Baker Lake Fire Emergency	(867) 793-2900	
RCMP Regular Hour	(867) 793-0123	
RCMP 24 Hour Emergency Number	(867) 793-1111	
Canadian Coast Guard (in the event of a spill to the marine environment)	(800) 265-0237	(519) 337-2498
Superintendent Environmental Response	(519) 383-1954 (519) 381-6186 (cell)	
Transport Canada – Marine Safety		
Jaideep Johar	(204) 984-0397	
Ian Salisbury	(780) 495-8360	(780) 495-8607

**All above phone numbers are current as of March 9, 2016.*

SECTION 5 • ACTION PLAN

Spills may be the result of any of the following occurrences:

- Tanks, drums or containers may develop leaks or rupture;
- Failure of equipment such as valves, piping or containment structures;
- Overfilling;
- Improper storage;
- Spills during transfer of fuel, chemicals or waste products; and
- Spills resulting from accidents during transportation.
- Seepage from tailings impoundment or rock storage facilities that may migrate off site to receiving water or land

5.1 INITIAL ACTION

For all spill emergencies, it is required that priority actions be undertaken. These are:

- Respond Quickly;
- Ensure Safety; and
- Report the Spill.

5.1.1 Respond Quickly

- Identify the spilled material;
- Be alert – ensure safety of yourself and others by notifying them of the incident;
- Shut off ignition sources such as vehicles and unplug electrical equipment – NO SMOKING;
- Attend to the injured;
- Assess the severity of the spill; and
- Contact the Incident Commander, identify the location and request assistance as required. Incident Commander will mobilize the Emergency Response Team if required.

The primary form of ensuring safety is by using preventative measures. All personnel who deal with chemicals must have training in first aid and safe materials handling, including the Workplace Hazardous Materials Information System (WHMIS). In addition, regular training updates and site- specific exercises/drills are integral to preventing incidents.

5.1.2 Ensure safety

- Consult the MSDS and Product Guides for further information on the substance;
- Keep people away from spill site;
- Wear appropriate PPE such as impervious clothing, goggles, and gloves when containing the spill;
- Approach spill from upwind IF IT IS SAFE TO DO SO;
- Assess whether the spill, leak, or system failure can be readily stopped or brought under control;
- Stop product flow or leak if possible and IF IT IS SAFE TO DO SO;
- Do not contain compounds (e.g. gasoline, aviation fuel) if vapors might ignite – allow them to evaporate; and
- Depending on the type of compound spilled and IF IT IS SAFE TO DO SO, contain product using booms, berms, absorbent pads, earthen dike, trenches or improvise with materials at hand.

5.1.3 Report Spill

- Spill reporting will follow Spill Reporting procedure MBK-ENV-0016. This procedure can be found in Appendix K
- Obtain all necessary information to complete the spill report form for spills that meet the criteria listed in Table 1. Spills that meet regulatory reporting criteria must be reported to the NWT-NU 24 Hour Spill Line/INAC/Kivalliq Inuit Association and the Nunavut Water Board by AEM Environment Staff. Minor spills that do not meet regulatory reporting criteria must still be reported. This must be done within 24 hours using the AEM internal Spill Report Form; and
- For spills that meet regulatory reporting criteria, a detailed spill report will be submitted to the INAC Water License Inspector and the KIA Land's Inspector by AEM Environment Staff no later than 30 days after the initial reporting of the spill. This report will contain the amount and type of spilled product, the GPS location of the spill and the measures taken to contain, cleanup and restore the spill site.

Procedures will vary depending on the season and materials spilled. The MSDS for spilled materials and/or Transport Canada's "Emergency Response Guidebook" must be consulted to ensure that safety procedures are followed. Response procedures specific to spills on land, water, snow and ice are presented in the following sections as general guidelines.

5.2 SPILLS ON LAND

Response to spills on land will include control techniques involving the use of two types of barriers: dikes and trenches. Barriers should be placed down-gradient (down-slope) from the source of the spill, and as close as possible to the source of the spill. Barriers will slow the progression of the material spilled and will also serve as containment to allow for recovery.

Depending on the volume spilled, the site of the spill as well as available material, a dike may be built with soil, booms, lumber, snow, etc. A plastic liner, if necessary, can be placed at the toe of and over the dykes to protect the underlying soil or other material and to facilitate recovery of the material. Dikes will be constructed in such a way as to accumulate a thick layer of free product in a single area (V-shaped or U-shaped).

Trenches are useful in the presence of permeable soil and when the spilled material is migrating below the ground surface. A plastic liner should be placed on the down-gradient edge of the trench to protect the underlying soil. Liners should not be placed at the bottom of the trench to allow water to continue flowing underneath the layer floating oil.

The use of absorbent materials to recover a large volume of spilled liquids such as petroleum based material should be avoided. Large volumes of free-product should be recovered, as much as possible, by using vacuums and pumps, and containerized. Mixtures of water and fuel may be processed through an oil-water separator. However absorbent materials work well for smaller volumes of spilled hydrocarbon based materials such as fuel. Absorbent sheets should be used to soak up residual fuel on water, on the ground (soil and rock), and on vegetation. Peat moss may also be sprinkled on vegetation to absorb films of petroleum products.

5.3 SPILLS ON WATER

Response to spills on water will include procedures that include containment, diversion and recovery techniques. The following elements must be taken into consideration when conducting response operations:

- Type of water body or water course (lake, stream, river);
- Water depth and surface area;
- Wind speed and direction;
- Type of shoreline; and
- Seasonal considerations (open-water, freeze-up, break-up, frozen).

The most common type of spill that could be anticipated is a petroleum hydrocarbon (fuel oil) spill during fuel transfers/transport. Containment of an oil slick in water will require the deployment of mobile floating booms to intercept, control, contain and concentrate (i.e., increase thickness) the floating oil. One end of the boom will be anchored to shore while the other will be towed by a boat and used to circle the oil slick and return it close to shore for recovery using a skimmer. Reducing the surface area of the slick will increase its thickness and thereby improve recovery. Mechanical recovery equipment (i.e., skimmers and oil/water separators) will be mobilized to site if required.

Measures will be taken to protect sensitive and accessible shoreline. The oil slick will be monitored to determine the direction of migration. In the absence of strong winds the oil will likely flow towards the discharge of the lake. Measures will be taken to block and concentrate the oil slick at the lake discharge using booms where it will subsequently be recovered using a portable skimmer, vacuum, or sorbent materials.

In small slowly-flowing rivers, streams, channels, inlets or ditches, inverted weirs (i.e., siphon dams) will be used to stop and concentrate moving oil for collection while allowing water to continue to flow unimpeded. In the case of floating oil, in a stream, heading for a culvert (i.e., at a road crossing) a culvert block will be used to stop and concentrate moving oil for collection while allowing water to continue to flow unimpeded. In both cases oil will then be recovered using a portable skimmer or sorbent materials.

In the case of spills in larger rivers, with fast moving currents, diversion booming will be used to direct the oil slick ashore for recovery. Single or multiple booms (i.e., cascading) may be used for diversion. Typically, the booms are anchored across the river at an angle. The angle will depend on the current velocity. Choosing a section of a river that is both wider and shallower will make boom deployment easier. Diversion booming may also be used to direct an oil slick away from a sensitive area to be protected.

5.4 SPILLS ON SNOW AND ICE

In general, snow and ice will slow the movement of hydrocarbons. The presence of snow may also hide the

oil slick and make it more difficult to follow its progression. Snow is generally a good natural sorbent, as hydrocarbons will have a tendency to be soaked up by snow through capillary action. However, the use of snow as a sorbent material will be limited as much as possible. Snow and frozen ground will also prevent hydrocarbons from migrating down into soil or at least slow the migration process. Ice will prevent seepage of fuel into the water.

Most response procedures for spills on land discussed previously may be used for spills on snow and ice. The use of dykes (i.e., compacted snow berms lined with plastic sheeting) or trenches (dug in ice) will slow the progression of the fuel and will also serve as containment to allow recovery of the fuel.

Free-product will be recovered by using a vacuum, a pump, or sorbent materials. Contaminated snow and ice will be scraped up manually or using heavy equipment depending on volumes. The contaminated snow and ice will be placed in containers or within plastic lined berms on land.

5.5 DISPOSAL OF SPILLED MATERIAL

For this section you can refer to the *Landfarm Design and Management Plan*. All contaminated spill pads, and booms are placed within Quatrex bags for shipment to an approved disposal facility. All the petroleum hydrocarbon contaminated soil is placed into the landfarm for treatment. Spills over 100 L of non-petroleum hydrocarbon material (e.g. solvents, glycol) will be placed in drums and stored in the on-site hazardous material area for shipment south to approve facilities during barge season. Spills of non-petroleum hydrocarbon material fewer than 100 L will be placed in the Tailings Storage Facility. For spills fewer than 100 L of petroleum hydrocarbon contaminated snow will be placed in a designated area of the landfarm and treated as contact water after snowmelt. For spills over 100 L of petroleum hydrocarbon contaminated snow will be excavated and stored in labeled drums. After snow melt, the contaminated water will be pumped through the site's oil-water separator (carbon filter) to remove petroleum hydrocarbon residue. The treated water will be sampled per Part F, Item 6 of the NWB Water License, and discharged to the Stormwater Management Pond if criteria are met. If criteria are not met, water will be treated as hazardous material and shipped south. Also, after snowmelt, visible product will be cleaned up with absorbent pads or booms.

5.6 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 a spill or an emergency (Meadowbank Gold Project Emergency Response Plan; March 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 accidental release, 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.

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 sampling is to 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), and the quantity of spill material. 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.

In the event of a seepage from the tailings storage facility (TSF) and rock storage facility (RSF), water will be pumped back to the North Cell TSF (or South Cell if necessary) as per the 2016 Freshet Action Plan (March 2016). Visual inspections will be conducted regularly to confirm that the seepage is appropriately contained and will not enter into the receiving environment.

SECTION 6 • HAZARDOUS MATERIALS STORED ON SITE

A variety of petroleum products and other hazardous materials will be used as part of the mining operations. Large quantities of petroleum products will be stored at various sites. Explosives will also be stored on site. Other hazardous materials will be used but in smaller quantities. Nonetheless, all these products are considered as potential environmental and safety hazards.

Material Safety Data Sheets (MSDS) of all materials transported, stored and used on-site will be made available at strategic locations near to where hazardous materials or toxic substances are stored or utilized. Appendices E to J provide General Response Procedures for Spilled Chemical Substances.

Table 5 identifies the predominant hazardous materials transported, stored and generated at the site. You can refer to the *Hazardous Materials Management Plan* for more details.

Table 5 - Materials stored at site during operations

Material	Maximum Amount present on Site	Maximum Amount transported per unit	Storage Location
Acetylene	500 cylinders	300 cylinders per sea can	Inventory Lay down
Activated Carbon	350 Mt	10 Mt per sea can	Inventory Lay down and Process Plant lay down
Ammonium Nitrate	10 000 Mt	20 Mt per sea can	Emulsion plant
Ammonium Nitrate Fuel Oil (ANFO)	Manufactured on demand	20 000 kg per truck	Emulsion plant
Motor Oil	Estimated at 800 000L	20 800L per sea can	Inventory Lay down, garage
Trojan Boosters (Blasting Systems)	34 000 kg	15 Mt per sea can	Emulsion plant
Borax, Anhydrous	7 500 kg	3 375 kg per sea can	Inventory Lay down and Process Plant lay down
Calcium Chloride	600 000L	10 000L per sea can	Inventory Lay down
Calcium Hydroxide	NOT IN INVENTORY		Inventory Lay down
Calcium Oxide	NOT IN INVENTORY		
Calcium Peroxide	NOT IN INVENTORY		
Carbon Dioxide	10 cylinders	10 cylinders per sea can	
Copper Sulphate	500 Mt	20 Mt per sea can	Inventory Lay down and Process Plant lay down
Diesel Fuel	5.5 million Liters	40 000L per tanker	Tank farm
Dyno Split (Detagel)	135 000 kg	15 Mt per sea can	Emulsion plant

Nonel EZTL	1 400 kg	15 Mt per sea can	Emulsion plant
Nonel MS	1 800 kg	15 Mt per sea can	Emulsion plant
Ethylene Glycol	60 000L	10 000L per sea can	Inventory Lay down
Ferric Chloride Hexahydrate	NOT IN INVENTORY		
Ferric Subsulfate Solution	NOT IN INVENTORY		
Hydrofluoric Acid	NOT IN INVENTORY		
Hydrogen Peroxide	NOT IN INVENTORY		
Jet A Fuel	50 000L	11 000L Tanker	Tank, tarmac
Lead Acid Batteries	500L	500L per sea can	Warehouse
Magnafloc 10 (Flocculant)	300 Mt	15 Mt per sea can	Inventory Lay down
Nitric Acid	120 000L	8 000L per sea can	Inventory Lay down
Portland Cement	3 500 Mt	20 Mt per sea can	Dyke and Construction lay down
Sodium Cyanide	1 300 Mt	19 Mt per sea can	Inventory Lay down and Process Plant lay down
Sodium Hydroxide	10 kg	10 kg in sea can	Warehouse
Sodium Nitrate	10.2 Mt	5.1 Mt per sea can	Inventory Lay down
Sulfur	4 600 Mt	20 Mt per sea can	Inventory Lay down Process Plant lay down Quarry 1
Unleaded Gasoline	50 000L	40 000L tanker	Tank farm
Varsol	4 000L	2000 L per sea can	Inventory Lay down

SECTION 7 • POTENTIAL SPILL ANALYSIS

In order to prepare for emergency spill response, potential spill analysis was conducted and on various worst case scenarios. The exercise serves to identify potential risk areas, as well as to determine the fate of spilled products and their environmental effects. One potential scenario was identified for the Meadowbank Gold Project:

- Road between Baker Lake and the Meadowbank Mine Site – spill contents of a tanker truck into water body.

Scenario #1: Road Accident Tanker Truck Spill on AWAR

Description of incident: Spill of the contents of a fuel tanker to the ground or water during transport from the Baker Lake to the Meadowbank Mine Site.

Potential causes: Vehicle accident, human error, mechanical failure

Hazardous products spilled: Diesel fuel, aviation fuel

Maximum volume spilled: 40,000 litres

Immediate receiving medium: Stream, river or lake

Distance and direction to nearest receiving body of water: N/A

Resources to protect: Streams, rivers and lakes

Estimated emergency response time: Maximum time is 90 minutes depending on location of spill (assuming truck driver is injured and cannot commence spill response procedures). Minimum time to respond to a spill on the AWAR is 15 minutes.

Spill response procedures: Contain and recover oil slick downriver as described in Section 5.3, protect shorelines using sorbent booms. Collect free-product for temporary storage. Clean-up soiled shorelines. If the response crew arrives before the complete spill, seal the leak where feasible, contain and recover oil spill on ground using dykes, sumps or trenches as described in Section 5.2. Also if the truck driver is not injured, he will act as a first responder and immediately initiate the spill contingency plan as defined in Section 5 using the spill kit kept in the fuel trucks.

SECTION 8 • RESPONSE EQUIPMENT

8.1 GENERAL EQUIPMENT

This section addresses the emergency response machinery, equipment, tools and other resources that will be made available on-site for spill counter measures.

Mobile Equipment available to AEM, that will be used for spill contingency include:

- Graders
- Cranes
- Snowmobiles
- Vacuum Truck
- Loaders
- Backhoe
- Bulldozer
- Forklift
- Water Trucks
- Excavators
- Winch Trucks
- Pickup Trucks
- Generator Sets
- Fire Truck
- Aluminum Boats
- Fuel Trucks
- Bobcat
- Haul Trucks
- Snow Cat

If required, additional equipment on site will be made available to assist with spill recovery.

Temporary containment systems are also available on site and include:

- Booms
- Drums
- Tanks
- Tailings Pond
- Spill absorbent material packages/pads
- Silt fencing
- Maritime Barrier

Emergency transportations that will be used under an emergency situation are:

- Aircraft (fixed wing or helicopter)
- 4-wheel drive vehicles
- Snowmobiles
- Boats
- Tundra Buggy

Communication equipment on site includes radios, telephones, faxes and other wireless communication systems that will be used in the event of an emergency situation.

Spill Response kits are strategically located where required (Figure 6). Each department and work area is responsible for providing sufficient spill response kits in their respective work areas. The kits are kept in marked and accessible locations. The locations include all fuel storage areas, chemical storage areas and so on.

All of the mobile equipment on site (heavy equipment) contains an emergency spill kit.

An Environmental Emergency Trailer which is easily accessible and mobile is located on site which contains the following items:

- Pump Elastec
- Pump accessories
- Vacuum ends
- 45 gallons top
- Tubing 2 inches diameter
- Tubing 3 or 4 inches diameter
- Diesel Fuel jerry can (place on a miniberm)
- Spill kit accessory (red box)
- Drums opener
- Wescot (to open empty drum screw)
- Empty drums
- 2 drums berm
- 4 drums berm 4x8
- Tarp 20x30
- Tarp 30x50
- Oil white spill pads
- Universal boom 5x10
- Universal boom 8x10
- ABS pipe : 10' (4")
- ABS pipe : 10' (6")
- Cell U-Sorb
- Sphagsorb
- 3 Size of Wedge wood
- Plug pattie
- Quattrex bags
- Hand shovel
- Ice braker chisel
- Sledge hammer
- Rod bar (4')

Along the AWAR there are 9 environmental emergency sea cans. These sea cans are strategically placed along the road at water crossings (Figure 7). Each environmental emergency sea can contains the following material:

- Empty drums (Sealed)
- Mini berm 36"x36" x4'
- 4 drum spill berm 4x8
- Tarp 20'x30'
- Tarp 30'x50'
- Oil white spill pads
- Universal boom 5"x10' (Chemical)
- Universal boom 8"x10' (Chemical)
- Oil only booms 5"x10' (Hydro-carbons)
- Maritime barrier (Baffle)
- ABS pipe : 10' (4")
- Cell U-Sorb
- Amerisorb peat moss

- Oil gator absorbent
- Plug pattie
- Quattrex bags
- Fork lift crate (pallets)
- Long handle round point shovel
- Chisel point crow bar 16 lbs 57"
- Ice braker chisel
- Sledge hammer 12 lbs 36"
- Rod bar (4')

If required, external resources are available in the Hamlet of Baker Lake and those contacts are found in Table 5.

Figure 6 : Spill Response Equipment Location

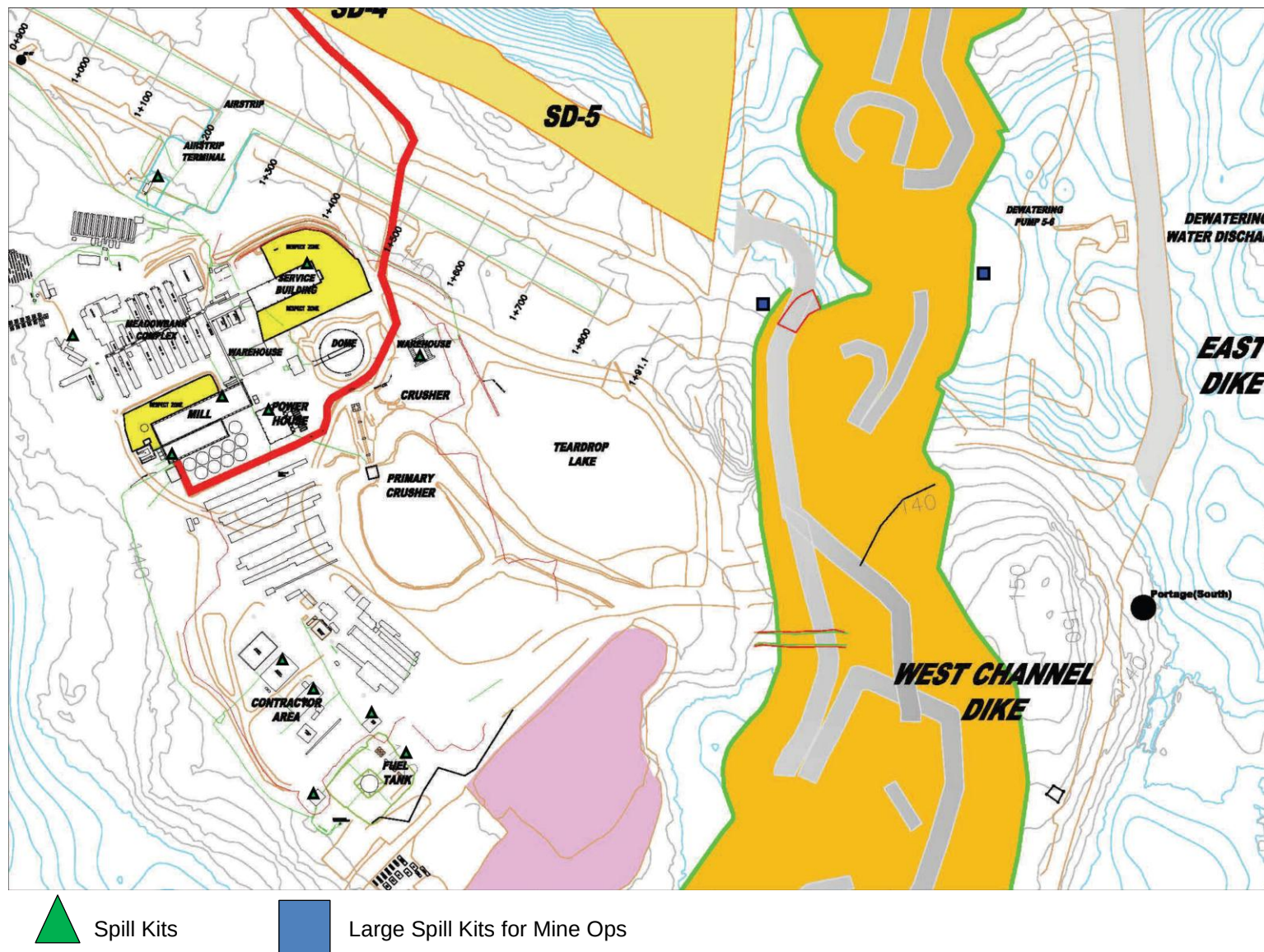
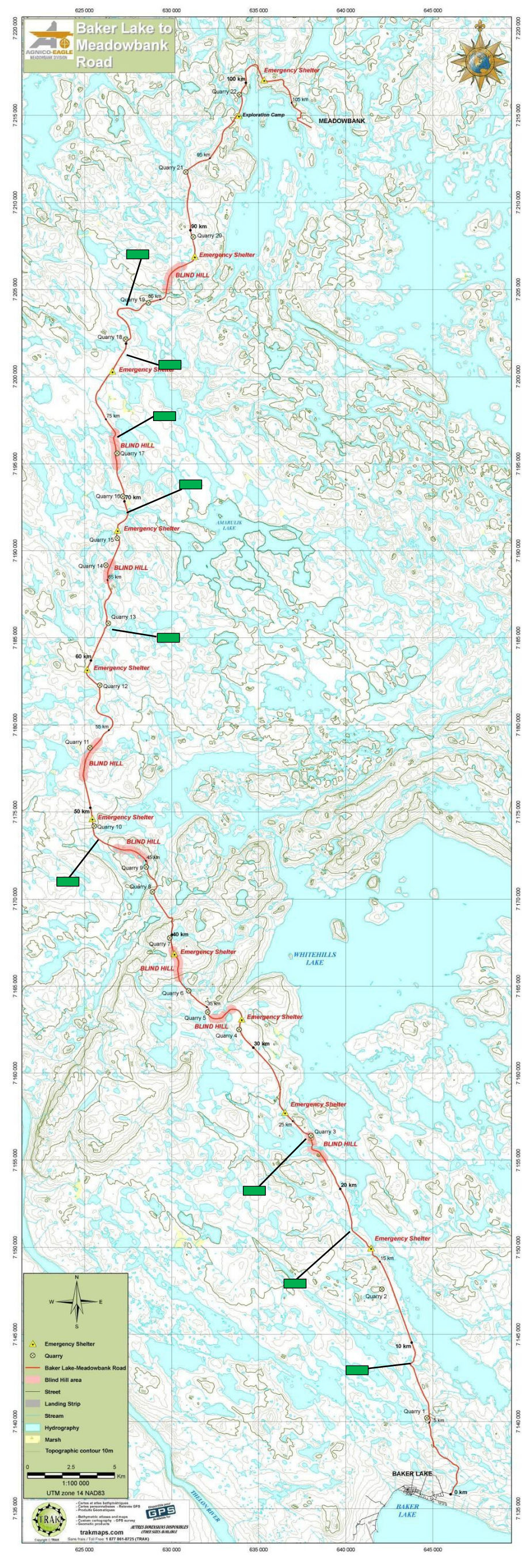


Figure 7 : Map of AWAR Including Locations of Environmental Emergency Sea cans



Environmental Emergency Sea cans

SECTION 9 • TRAINING & EMERGENCY SPILL/EXERCISE

9.1 TRAINING

9.1.1 On-site Personnel

A designated ERT consisting of on-site personnel has been established. AEM will ensure that the ERT is trained and present for major spill response at all times. All members of the team are trained and familiar with emergency and spill response resources, including their location and access, the SCP, and appropriate emergency spill response methodologies. The ERT has up to 40 members, each of whom train 8 hours per month.

The following training is included:

- A review of the spill response plan and responsibilities of the ERT members;
- The nature, status, and location of fuel and chemical storage facilities;
- The on-site and off-site spill response equipment and how to use it;
- Emergency contact lists;
- Desktop exercises of “worst case” scenarios; and
- The likely causes and possible effects of spills.

Every employee at AEM receives spill and waste management training during their initial site orientation so they are able to respond to small spills and raise the alarm if a larger response is required. ERT members receive more extensive HAZMAT training and learn how to respond while wearing personal protective clothing. The road crew between Baker Lake and Meadowbank also received training regarding the actions that they have to do during an emergency or major spill on the road. You can find records of different trainings that AEM personnel have attended in Appendix K. The Environmental Department regularly attends tool-box sessions to provide information on spill response, spill prevention and spill reporting procedures.

SECTION 10 • LIST OF ACRONYMS

ANFO	Ammonium Nitrate Fuel Oil
AWAR	All-Weather Access Road
CCME	Canadian Council of Ministers of the Environment
DFO	Fisheries and Oceans Canada
EMS	Environmental Management System
ERP	Emergency Response Plan
ERT	Emergency Response Team
ERTC	Emergency Response Team Coordinator
GN	Government of Nunavut
HCN	Hydrogen Cyanide
HMMP	Hazardous Materials Management Plan
AANDC	Aboriginal Affairs and Northern Development Canada
LEL	Lower Explosion Limit
AEM	Agnico Eagle Mines Limited
MSDS	Materials Safety Data Sheets
NIOSH	National Institute for Occupational Safety and Health
OHSP	Occupational Health & Safety Plan
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
SCP	Spill Contingency Plan
TDG	Transportation of Dangerous Goods
WHMIS	Workplace Hazardous Materials

Appendix A

Environmental Department weekly inspection template

Agnico-Eagle Mines: Meadowbank Division

Environment Department



Environmental Inspection report for Refuelling station and Tank farm

Date:
Location:

Inspected By:
Responsible department:

Meadowbank:

Subject	Conform	Non-conform	N/A	Picture(s) #
Spills on the ground				
Spill kit				
Refuelling procedures followed (secondary containment at every connection and 3 persons)				
Water in secondary containment (If discharge is needed, NWB Type A Water License Part F needs to be followed)				
Date of last pipe and tank visual inspection (monthly)				
Date of last env. visual inspection (weekly)				
Non-smoking sign, Extinguisher and tank identification present				

Comments: _____

Recommendations: _____

Agnico-Eagle Mines: Meadowbank Division

Environment Department



Environmental Inspection report for Refuelling station and Tank farm

Date:
Location:

Inspected By:
Responsible department:

Baker Lake:

Subject	Conform	Non-conform	N/A	Picture(s) #
Spills on the ground				
Spill kit				
Refuelling procedures followed (secondary containment at every connection and 3 persons)				
Water in secondary containment (If discharge is needed, NWB Type A Water License Part F needs to be followed)				
Date of last pipe and tank visual inspection (monthly)				
Date of last env. visual inspection (weekly)				
Non-smoking sign, Extinguisher and tank identification present				

Comments: _____

Recommendations: _____



Picture 1: Description



Picture 2: Description



Picture 3: Description



Picture 4: Description



Picture 5: Description



Picture 6: Description

Agnico-Eagle Mines: Meadowbank Division

Environment Department



HAZMAT Storage Area: Environmental Inspection report

Date: _____ Inspected By: _____

Location: _____ Responsible department: _____

Subject	Conform	Non-conform	N/A	Picture(s) #
Are storage containers clearly labelled to identify Hazmat substance?				
Are storage containers in good condition? Is there any visible damage or leaks? Can the doors be sealed shut?				
Is HAZMAT in containers properly segregated?				
Is HAZMAT arrangement to prevent from falling or dislodging?				
Where necessary – Is HAZMAT placed on pallets i.e. Drums?				
Where necessary – Are containers with product stored in an upright position?				
Where necessary – Are Quatrex bags closed properly?				
Do you see any potential environmental hazards posed by these HAZMAT containers/materials?				

Comments: _____

Recommendations: _____



Picture 1: Description



Picture 2: Description



Picture 3: Description



Picture 4: Description



Picture 5: Description



Picture 6: Description

Appendix B

Shipboard Oil Pollution Emergency Plan

The WOODWARD GROUP OF COMPANIES



Coastal Shipping Ltd.
The Woodward Group of Companies
114 Main Street, P.O. Box 910
Lewisporte, NL A0G 3A0 CANADA

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN (SMPEP)

In accordance with MARPOL 73/78, Annex I
IMO Res. MEPC. 78(43)

MT "ALSTERSTERN"
IMO 9053220



**M/T ALSTERSTERN
Shipboard Marine Pollution
Emergency Plan (SMPEP)**

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

CONFIRMATION OF ACKNOWLEDGE

Shipboard Marine Pollution Emergency Plan

Date Entered:	Rank:	Name:	Signature:
			.



M/T ALSTERSTERN
Shipboard Marine Pollution
Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

INDEX OF CORRECTIONS

Date of Correction	SMPEP pages exchange (date)		APPENDIX 2 Date of Current List of Contact Points
	IN	OUT	



M/T ALSTERSTERN
Shipboard Marine Pollution
Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN

In accordance with Regulation 37 of Annex I and Regulation 17 of MARPOL 73/78

SHIP'S IDENTIFICATION

GL- REGISTER - NUMBER	34583
NAME OF SHIP	ALSTERSTERN
CALL SIGN	XJAZ
IMO NUMBER	9053220
TYPE OF SHIP	CHEMICAL / OIL TANKER
PORT OF REGISTRY	ST. JOHN'S
GROSS TONNAGE	11426
FLAG	CANADA
OFFICIAL NUMBER	835794



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

TABLE OF CONTENTS

INTRODUCTION	6
SECTION 1 PREAMBLE	7
SECTION 2 Reporting Requirements	9
2.1 <u>General</u>	9
2.2 <u>Reporting Procedures</u>	9
2.2.1 When to Report	9
2.2.1.1 Actual Discharge	9
2.2.1.2 Probable Discharge	9
2.2.2 Information Required	10
2.2.3 Whom to contact	15
2.2.3.1 Coastal State contacts	15
2.2.3.2 Port Contacts	15
2.2.3.3 Ship Interest Contacts	15
SECTION 3 STEPS TO CONTROL DISCHARGE	16
3.1 <u>Operational Spills</u>	16
3.1.1 Operational Spill Prevention	16
3.1.2 Pipeline Leakage	18
3.1.3 Tank Overflow	18
3.1.4 Hull Leakage	18
3.1.5 Spills caused by Equipment in Machinery Spaces	19
3.2 <u>Spills resulting from Casualties</u>	19
3.2.1 Ship grounded / stranded	19
3.2.1.1 Prevention of Fire and Explosion	20
3.2.1.2 Hull Damage / Hull Failure / Containment Failure	20
3.2.1.3 Procedures to reduce or Stop Outflow of Oil or NLS	21
3.2.1.4 Refloating by own means	21
3.2.1.5 Securing the Ship	22
3.2.2 Fire / Explosion	22
3.2.3 Collision	22
3.2.4 Excessive List	23
3.2.5 Dangerous reactions of Cargo	23
3.2.6 Other Dangerous Cargo and /or Vapour Release	24
3.2.7 Loss of Tank environmental control	24
3.2.8 Ship submerged / foundered / wrecked	24
3.3 <u>Priority Actions</u>	24
3.4 <u>Mitigating Activities</u>	26
3.5 <u>Transfer of Bunkers / Cargo - Lightering</u>	27
3.6 <u>Damage Stability and Hull Stress Calculation</u>	28

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

3.7	<u>General Responsibilities of the Master and designated Officers / crew members</u>	30

SECTION 4	NATIONAL AND LOCAL CO-ORDINATION	32
APPENDICES		36

<u>Appendix 1</u>	Spill Equipment Inventory	37
<u>Appendix 2</u>	Ships Drawings and Diagrams	39
	Layout of General Arrangement Stowage Plan	
	Diagram of Fuel Bunkering	
	Tank Plan	
	Diagram of Fuel Service Lines	
	Lubricating Oil System	
	Stripping System	



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

INTRODUCTION

1. This Shipboard Marine Pollution Emergency Plan (hereafter referred to as the "Plan") is written in accordance with the requirements of regulation 37 of Annex I and regulation 17 of Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 there to and amended by Res. MEPC. 78 (43).
As recommended by IMO this plan is a **combination of a SOPEP and a Shipboard Marine Pollution Emergency Plan for noxious liquid substances.**
2. The purpose of the Plan is to provide guidance to the Master, officers and operating personnel onboard the Ship, with respect to the steps to be taken when an oil or marine pollution incident has or is likely to occur. The appendices contain communication data of all contacts referenced in the Plan, as well as other reference material.
3. The Plan contains all information and operational instructions required by the "Guidelines for the development of the Shipboard Marine Pollution Emergency Plan" as developed by the Organization (IMO) and published under MEPC. 85(44) and MPEC.54 (32) amended by MPEC.86(44). .
4. This Plan has been examined by Germanischer Lloyd or GL on behalf of Transport Canada and, except as provided below, no alteration or revision shall be made to any part of it without prior approval by or on behalf of GL.
5. Changes to Sections 4 and the appendices will not be required to be approved by the Board. The appendices should be maintained up to date by the Owners, Operators, and Managers.
6. For the purposes of this Plan, the Master is taken to be that person who is a member of the vessel's operational personnel and to which is given senior responsibility for the vessel and any circumstances pertaining thereto.
7. Before entering a port of call, the Master should be aware of local emergency response procedures and organizations and have up to date contact information readily available.



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

SECTION 1 • Preamble

- 1.1 This Plan is intended to assist the ship's personnel in dealing with an unexpected discharge of oil or noxious liquid substances (NLS). Its primary purpose is to set in motion the necessary actions to stop or minimize the discharge of those substances and to mitigate its effects.
- 1.2 Effective planning ensures that the necessary actions are taken in a structured, logical and timely manner.
- 1.3 The primary objectives of this Plan are to:
- prevent pollution
 - stop or minimize outflow when a damage to the ship or its requirement occurs
 - stop or minimize outflow when an operational spill occurs in excess of the quantity or instantaneous rate permitted under the present Convention.
- 1.4 Further, the purpose of the Plan is to provide the Master, officers and certain crew members with a practical guide to the prevention of marine spills and in carrying out the responsibilities associated with regulation 37 of Annex I and Reg. 17 of Annex II of MARPOL 73 / 78.
- procedures to report an oil / marine incident.
 - Coastal States (Focal Points) and Port Contact Lists to be contacted in the event of any pollution incident.
 - co-ordination with national and local Authorities in combating a pollution.
- 1.5 In summary, the Plan will serve to promote a practiced response when the ship's personnel is faced with a spill.
- 1.6 Although the Plan is designed as a ship-specific tool it must be also be considered as an additional instrument and is a link to shore-based plans. With this the Plans allows an efficient co-ordination between the ship and shore-based Authorities /Organizations in mitigating the effects of any pollution incident.
- 1.7 The Plan includes a summary flowchart (See page 8) to guide the Master through reporting and acting procedures required during an oil pollution incident response.
- 1.8 The Plan is likely to be a document used on board by the Master and the officers of the ship and must therefore be available in the working language used by them.
- 1.9 The Plan is not applicable if the vessel operates in U.S waters within the EEZ (exclusive economic zone). The Vessel Response Plan (VRP) has to be activated.
- 1.10 All Procedures in this Plan are in line with Coastal emergency procedures which can be found in the file Emergency Preparedness as part of the Safety Management System (SMS). They should be referred to in any case for obtaining additional information.

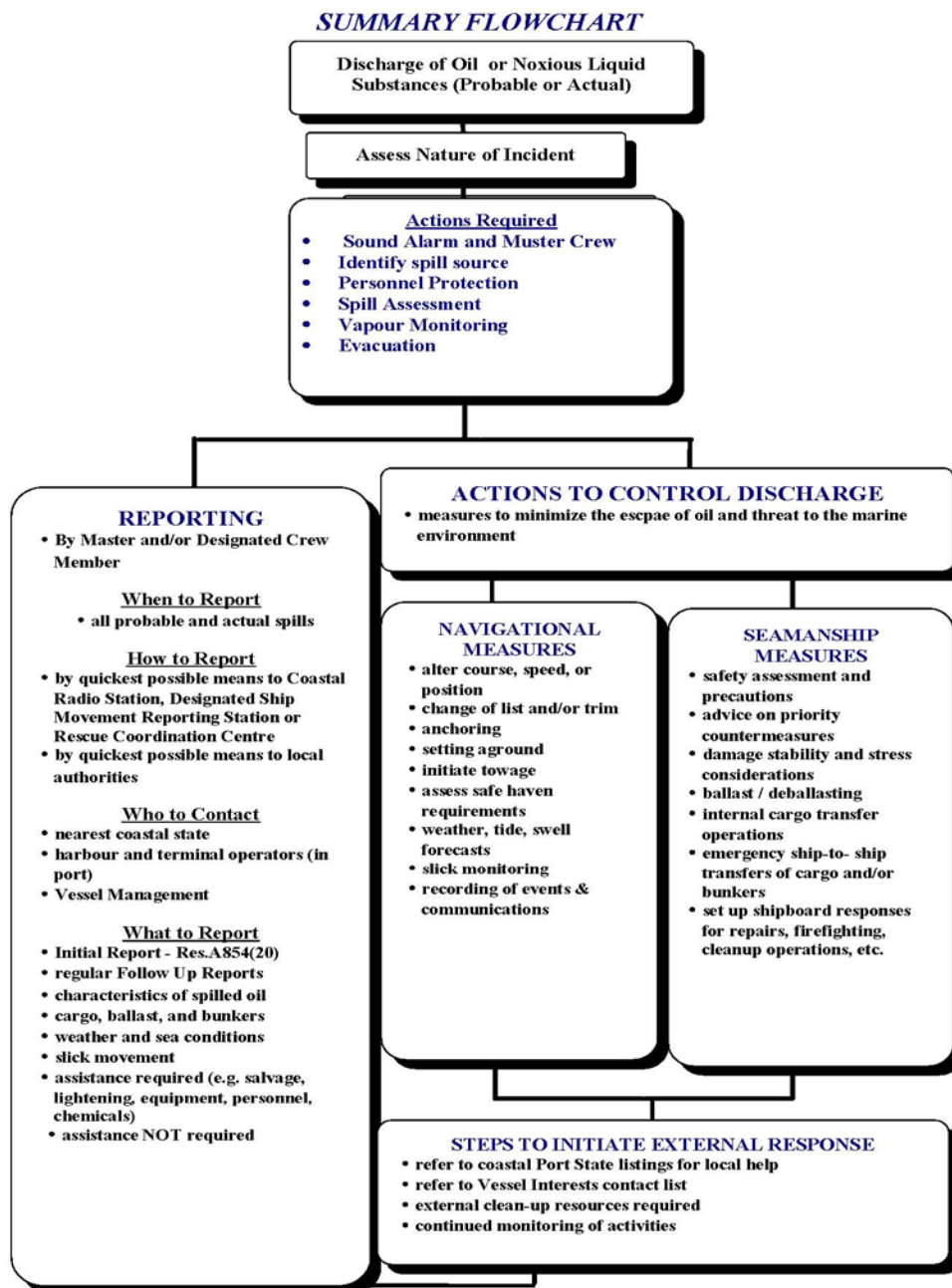


M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN - SUMMARY FLOWCART

This flow diagram is an outline of the course of action that shipboard personnel should follow in responding to a pollution emergency based on the guidelines published by the Organization. This diagram is not exhaustive and should not be used as a sole reference in response. Consideration should be given inclusion of specific reference to the Plan. The steps are designed to assist ship personnel in action to stop or minimize the discharge of oil or NLS and mitigate its effects. These steps fall into two main categories - reporting and actions.





M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

SECTION 2: Reporting Requirements

2.1 GENERAL

The reporting requirements of this section comply with those of regulation 37 Annex I and 17 Annex II of MARPOL 73 / 78.

When the ship is involved in an incident which results in the discharge of oil or NLS, the Master is obliged under the terms of MARPOL 73 / 78 to report details of the incident, without delay, to the nearest Coastal state by means of the fastest telecommunication channels available.

The intent of these requirements are to ensure that Coastal States are informed, without delay, of any incident giving rise to pollution, or threat of pollution of the marine environment, as well as of the assistance and salvage measures, so that appropriate action may be taken.

Without interfering with ship owner's liability, some coastal states consider that it is their responsibility to define techniques and means to be taken against a marine pollution incident and approve such operations which might cause further pollution i.e. lightening. States are in general entitled to do so under the International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 and the Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil, 1973

2.2 Reporting Procedures

For easy reference the reporting requirements in the context of this plan are divided in to the following information blocks:

2.2.1 **When to Report**

Taking the summary flowchart as shown on page 5 as a basic guide into consideration reports are necessary in the following cases:

2.2.1.1 **Actual discharge**

The Master is obliged to report to the nearest Coastal state whenever there is a discharge of oil resulting

- from damage to the ship
- from damage to the ship's equipment
- for the purpose of securing the safety of a ship or saving life at sea
- during the operation of the Ship in excess of the quantity or instantaneous rate permitted under the present Convention.

2.2.1.2 **Probable discharge**

The Master is obliged to report even when no actual discharge of oil or NLS has occurred but there is a probability that one could.

However, as it is not practicable to lay down precise definitions of all types of situations involving probable discharge of oil / NLS which would warrant an obligation to report the Master

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

is obliged to judge by himself whether there is such a probability and whether a report should be made.

Therefore, it is recommended that, at least, the following events

- o damage, failure or breakdown which affects the safety of the ship (e.g. collision, fire, grounding, explosion, structural failure, flooding, cargo, cargo shifting, list, etc.)

or

- o failure or breakdown of machinery or equipment which results in impairment of the safety of navigation (e.g. failure or breakdown of steering gear, propulsion, electrical generating system, essential shipborne navigation aids etc.)

are carefully considered by the Master - taking into account the nature of the damage failure or breakdown of the ship, machinery or equipment as well as the ship's location, proximity to land, weather, state of the sea and traffic density - as cases in which a probable discharge is more likely.

If in doubt, the Master should always make a report in cases aforementioned.

In all cases the Authorities should be kept informed by the Master as how the situation progress and be advised when all threats of pollution has passed.

2.2.2 Information Required

As required in article 8 and Protocol I of MARPOL 73 / 78 Convention the Master or other persons having charge of the ship should report the particulars of any pollution incident. In this context the International Marine Organization (IMO), in 1997, adopted Resolution A. 851 (20) "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents involving Dangerous Goods, Harmful Substances and / or Marine Pollutants"

The intent of the Resolutions aforementioned is to enable Coastal States and other interested parties to be informed, without delay, of any incident giving rise to pollution, or threat of pollution of the marine environment, as well as of assistance and salvageable measures, so that appropriate action may be taken.

Nothing in this chapter relieves the Master in using sound judgment to make sure that any incident or probable discharge is reported as quick as possible in the prevailing situation.

When Transmitting initial reports to the authorities of the nearest Coastal State, the Master or other persons dealing with such a transmission should take note of IMO Resolution A 851(20).

Date: May 31, 2013 Rev: 0	Page 10 of 40	Prepared By: PMC Approved By:

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

Especially, the format of the initial report as well as supplementary of the follow up reports should conform with the guidance contained in Resolution A 851(20). All reporting whether initial or follow up, should follow IMO's reporting format as outlined below and should contain the following information:



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

FORMAT AND INFORMATION REQUIRED FOR OFFICIAL REPORT

AA VESSEL NAME, CALL SIGN, FLAG

BB DATE AND TIME (GMT) OF INCIDENT: 11/1935 meaning 11th of month at 7:35 pm.

CC SHIPS POSITION: 2230N 0600E meaning 22 deg. 30 min. N, 6 deg. E

or

DD SHIPS POSITION BY TRUE BEARING (3 DIGITS) AND DISTANCE FROM CLEARLY IDENTIFIED LANDMARK.

EE TRUE COURSE (3 DIGITS)

FF SPEED IN KNOTS AND TENTHS OF A KNOT (3 DIGITS)

LL ROUTE INFORMATION - INTENDED TRACK

MM RADIO STATIONS AND FREQUENCIES GUARDED

NN TIME OF NEXT REPORT (same as in BB)

OO DRAFT (4 DIGITS - meters and centimeters)

PP TYPES AND QUANTITIES OF CARGO AND BUNKERS ON BOARD

QQ BRIEF DETAILS OF DAMAGE, LIMITATIONS ETC. (must include condition of vessel and ability to transfer cargo, ballast, or fuel)

RR BRIEF DETAILS OF ACTUAL POLLUTION (oil type, estimate of quantity discharged, whether discharge continues, cause, estimate of slick movement)

SS WEATHER AND SEA CONDITIONS (wind force/direction, relevant tidal and/or current information)

TT NAME, ADDRESS, FAX, TELEPHONE NUMBERS OF VESSEL OWNER OR REPRESENTATIVE

UU DETAILS OF LENGTH, BREADTH, TONNAGE, AND TYPE OF VESSEL

WW TOTAL NUMBER OF PERSONS ON BOARD

XX MISC. DETAILS (This includes brief details of incident, actions taken, injuries sustained and assistance required. If no outside assistance is required, then this should be clearly stated.)



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

SHIPBOARD MARINE POLLUTION EMERGENCY PLAN

INITIAL NOTIFICATION

AA(SHIPS NAME; CALL SIGN; FLAG)

BB(DATE AND TIME OF EVENT; UTC)

D	D	H	H	M	M

CC (POSITION; LAT; LONG)

OR

DD (BEARING; DISTANCE FROM LANDMARK)

				N	S
d	d	m	m		

d	d	d	N miles

					E	W
d	d	d	m	m		

EE (COURSE)

FF(SPEED)

d	d	d

kn	kn	1/ 10

LL (INTENDED TRACK)

MM (RADIO STATION(S) GUARDED)

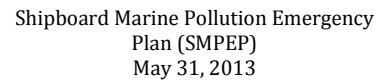
NN (DATE AND TIME OF NEXT REPORT; UTC)

D	D	H	H	M	M

OO (DRAFT; METERS, centimeters)

M	M	cm	cm

PP(TYPE AND QUANTITY OF CARGO/ BUNKERS ON BOARD)





M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

All follow up reports by the Master should include information relevant to the Coastal State Authorities to keep them informed as the incident develops.

Follow up reports should include information on any significant changes in the ship's condition, the rate of release and spread of the substances, weather and sea conditions and clean-up activities underway.

In this context details of bunker and cargo disposition, condition of any empty tanks and nature of any ballast carried are information needed by those involved in order to assess the threat posed by an actual or probable discharge from the damaged ship.

2.2.3 Whom to Contact

The Master is responsible for reporting any incident involving an actual or probable discharge of oil or NLS.

Contact information for coastal State and other concerned parties (port contacts, vessel interest contacts) is located in Section 4.

2.2.3.1 Coastal State Contacts

The vessel, in accordance with the regulations, has onboard a **declaration** that the vessel's management has, in accordance with 167 of the Canada Shipping Act 2001, entered into an arrangement with response organization, **ECRC** to which a certificate of designation has been issued pursuant to section 169 in respect of the quantity of oil that is carried both as fuel and cargo on board the vessel.

The **Director of Operations**, identified in the **declaration**, shall be responsible for contacting and mobilizing the response organization, **ECRC at 613-930-9690**.

2.2.3.2 Port Contacts

As Ports of Call vary, MASTER to ensure that prior to entering port any local contacts are obtained and displayed in MASTERS designated location. After departure contacts are to be added to manual and updated as necessary.

2.2.3.3 Vessel Interest Contacts

Vessel interest contacts are outlined on **page 31**



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

SECTION 3: Steps to Control Discharge

Ship personnel will most probably be in the best position to take quick action to mitigate or control the discharge of oil or noxious liquid substances from their ship

Therefore, this Plan provides the Master with clear guidance on how to accomplish this mitigation for a variety of situations.

It is the Master's responsibility to initiate a response in the event of a discharge of oil/NLS or substantial threat of discharge - actual or probable - into waters.

In no case action should be taken that in any way could jeopardize the safety of personnel either onboard or ashore.

In cases of a discharge of a noxious liquids substances the Master has to refer to the "Material Safety Data Sheet" (MSDS) provide onboard for any NLS cargo. Consideration to be made to any danger resulting from discharge of such substances, i.e. mixing with water, air, other materials / substances.

Special consideration is to be taken in case of the necessity to transfer cargo into another compartment onboard the compatibility of the material to be transferred and the material of pipes and tanks to be used for such actions.

In cases of small spills on deck, the vessel's crew should take whatever actions are necessary to prevent oil from escaping over the side. Once the spill is contained on deck, the crew will need to take action to clean up the oil. **SPILED OIL SHALL NOT BE WASHED OVER THE SIDE.** Once oil is in the water, the crew's ability to respond in a practical manner is greatly reduced.

The following list specifies different kinds of possible operational spills with regard to reactions to be taken.

3.1 OPERATIONAL SPILLS

3.1.1 Operational Spill Prevention

All crew members shall maintain a close watch for the escape of oil or NLS during bunker or cargo operations.

Prior to bunker or cargo transfer the competent crew members should mobilize the spill equipment, as far as available on board, and place it close to the planned operation, e.g. along the railing on the side at which bunker operation takes place. All deck scuppers and open drains must be effectively plugged. Accumulations of water should be drained periodically and scupper plugs replaced immediately after the water has run off. Any free floating substances should be removed prior to draining.

Bunker or Cargo tanks which have been topped up should be checked frequently during the remaining operations to avoid an overflow.



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

Unless there are permanent means for retention of any slight leakage at ship / shore connections for bunker or cargo transfer, it is essential that a drip tray is in place to catch any leaking substance.

All crew members of the ship's crew should be familiar with the fundamentals of the ship's vital systems including the ventilation and electrical systems. Crew members should be able to isolate the accommodation and/or machinery spaces using the louvers and fan shutoffs and, from the distribution panels, isolate electrical circuits in areas of risk.

In the event of an operational spill which occurs during bunkering or cargo operations, it is important that the bunkering party terminate any and all bunkering operations and close all manifold valves.

Before closing any manifold valves, the bunkering / cargo party must immediately inform the terminal / loading master so that they may take action to eliminate the possibility of over-pressurization of the shore side transfer components.

After dealing with the cause of the spill, it may be necessary to obtain permission from local authorities and/or the terminal before resuming bunkering or cargo operations.

If the possibility of fire or explosion exists, nonessential air intakes to accommodations and machinery spaces should be closed and all sources of ignition should be eliminated. See Section 1.3.3 of this Plan.

Care must be taken to consider stability and stress when taking action to mitigate the spillage of oil. Internal transfers should be undertaken only with a full appreciation of the likely impact on the vessel's overall stress and stability. Please refer to the "Approved Stability Book" carried on board.

Operational Spill Checklist

Action Considered	Designated Person	Completed
Sound emergency alarm	Person Discovering Incident	Y / N
Mobilize Oil Pollution Prevention Team	Chief Engineer / Master	Y / N
Cease all bunkering operations	Chief / 2nd Engineer	Y / N
Locate source of leakage	Chief / 2nd Engineer	Y / N
Operate manifold valves	Chief / 2nd Engineer	Y / N
Close all nonessential vent intakes and tank vents as required	Chief / 2nd Engineer	Y / N
Stop or reduce outflow	Chief Engineer / Deckhand	Y / N
Assess fire risk	Chief Officer	Y / N
Commence clean up	Chief Officer	Y / N
Assess Stress / Stability	Master / Chief Officer	Y / N
Transfer fuel from damaged area to slack tanks or other containment space	Chief / 2nd Engineer	Y / N

Date: May 31, 2013
Rev: 0

Page 17 of 40

Prepared By: PMC
Approved By:



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

Request outside assistance if required	Master	Y / N
Counter excessive list if required / possible	Chief Officer	Y / N

3.1.2 Pipeline Leakage

In the event of leakage from an oil / NLS pipeline, valve, hose or metal arm, the Chief Engineer must ensure that the following actions are taken:

- Stop oil flow, close manifold and other valves.
- Sound emergency alarm and mobilize Oil Pollution Prevention Team
- Locate source and drain affected section into an available empty or slack tank. Repair if possible
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Absorb spill with any absorbent materials on hand and dispose of oil soaked materials in an appropriate container.
- If oil is overboard, report to proper authorities immediately (as per section 4 of this plan).

3.1.3 Tank Overflow

In the event of an oil tank overflow, the Chief Engineer must ensure that the following actions are taken:

- Stop oil flow, close manifold and other valves.
- Sound emergency alarm and mobilize Oil Pollution Prevention Team
- Place drain buckets under overflow pipes to contain possible spills.
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Drain or transfer oil to slack or empty tanks if possible with due consideration paid to vessel stability. If no slack or empty tanks are available, oil may be pumped back ashore through delivery lines, having first gained permission to do so.
- Absorb spill with any absorbent materials on hand and dispose of oil soaked materials in an appropriate container.
- If oil is overboard, report to proper authorities immediately (as per section 4 of this plan).

3.1.4 Hull Leakage

If oil is noticed on the water near the vessel during normal operations and cannot be accounted for, the possibility of hull leakage should be suspected.

In the event of a hull leakage, the Master must ensure that the following actions are taken:

- Sound emergency alarm and mobilize Oil Pollution Prevention Team.
- Stop any transfer or bunkering operations.
- Identify damage and report to proper authorities immediately (as per section 4 of this plan). Consider a diver if necessary and possible.



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

- If possible, contain spill using materials on hand and dispose of oil soaked materials in an appropriate container.
- If there is any possibility of vapours entering the engine room or accommodation intakes, appropriate preventative steps must be taken quickly.
- Transfer fuel away from suspected leaks to empty or slack tanks if possible, or to a ballast tank if necessary. If in port, arrangements can be made to pump oil ashore to tanks or trucks. Due consideration is to be paid to vessel stress and stability.
- If it is not possible to identify the leaking tank, reduce level in all tanks in the vicinity, giving due consideration to vessel stress and stability.

3.1.5 Spills caused by Equipment in Machinery Spaces

- If operational spills are caused by failure of equipment in machinery spaces, any further operation of this equipment should be stopped immediately and measures are to be taken to avoid a spill. Such equipment may be
 - Oily - water separating equipment or oil filtering equipment or oil filtering equipment to de-oil bilge water from the engine room bilges.
 - Valves in pipes connecting ballast / cargo systems
 - Cooling pipes in cooler systems
 - Gearing of bow thruster
 - Stern tubes
- Sound emergency alarm and mobilize Oil Pollution Prevention Team.
- Absorb spill with any absorbent material in hand and dispose of oil soaked materials in an appropriate container.
- Do not restart equipment until problem has been rectified.

3.2 Spills Resulting from Casualties

In the event of a casualty the Master's first priority will be to ensure the safety of personnel and the vessel and initiate action to prevent escalation of the incident and marine pollution.

3.2.1 Ship grounded / stranded

If the vessel grounds, the Master must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and Mobilize Oil Pollution Prevention Team once safe to do so.
- Eliminate all avoidable sources of ignition and ban smoking onboard. Action must be taken to prevent hazardous vapours from entering accommodation and machinery spaces. See section 1.1.3.
- Identify damage by means of a visual inspection.
- Take soundings around vessel to determine the nature and gradient of seabed.
- Check differences in tidal range at grounding site.
- Evaluate tidal current in grounding area.
- Take soundings of all tanks on shell and compare with departure soundings.



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

- Determine probability and/or quantity of oil released
- If oil release is determined or is probably, this is to be included in the casualty report.
- Determine other possible hazards to the vessel such as sliding off the grounding site or further damage from seas / swell, and torsion forces.

At this point, determine risk of additional damage to vessel by attempting to refloat. If remaining aground is determined to be less of a risk then:

- Use anchors to prevent vessel movement.
- Take on ballast in empty tanks with due consideration paid to stress and stability. Please refer to the approved stability book.
- Consider transfer of fuel from damaged tanks with due consideration paid to stress and stability. Please refer to the approved stability book.
- Reduce longitudinal stress on the hull by transfer of fluids internally. Please refer to the approved stability book.
- If the change in stability and stress cannot be calculated onboard, contact the vessel's management to arrange for the necessary calculations. Refer to appendix 3 for information which should be provided.

3.2.1.1 Prevention of Fire and Explosion

If a fire or explosion occurs on board, the vessel's fire control party must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.
- Determine extent of damage and what damage control measures can be taken.
- Determine whether there are casualties.
- Request assistance as deemed necessary.
- Take necessary actions to prevent smoke and other hazardous vapours from entering the accommodation and machinery spaces.
- Assess possibility of oil leakage.
- Determine possible actions to control the discharge of oil. This will depend largely on the damage to the ship and cargo.
- If there is a discharge or possible discharge of oil, this to be included in the casualty report.
- Should abandonment be necessary, the Master must ensure that every effort is made to maneuver survival craft upwind of any oil spill.

3.2.1.2 Hull Damage / Hull Failure / Containment Failure

If the vessel suffers structural hull failure, the Master must ensure that the following actions are taken:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

- Reduce speed or stop to minimize stress on hull.
- Assess immediate danger of sinking or capsizing.
- Initiate damage control measures if possible.
- If lightening is required, all efforts should be made to wait for a barge or other ship to receive the cargo.
- If oil has spilled, or if it is necessary to jettison oil to maintain stability, make a report as per section 2.
- If the change in stability and stress cannot be calculated onboard, contact the vessel's management to arrange for the necessary calculations.
- Consider forecasted weather conditions and their effect on the situation.
- Should abandonment be necessary, the Master must ensure that every effort is made to maneuver survival craft upwind of any oil spill.

3.2.1.3 Procedures to reduce or Stop Outflow of Oil or NLS

The Master should assess the possibility of damage to the environment and whatever action can be taken to reduce further damage from any release, such as;

- Transfer /cargo internally, provided shipboard piping system is in an operational condition and in careful view of the compatibility of the substance and the tanks/pipes used for transfer, and taking into account the impact on the ship's overall stress and stability.
- Isolate damaged/penetrated tanks hermetically to ensure that hydrostatic pressure in tanks remains intact during tidal changes.
- Evaluate the necessity of transferring bunkers / cargo to barges or other ships and request such assistance accordingly.
- Evaluate the possibility of additional release of oil or NLS in close co-operation with coastal states.

In case of large differences between the tide levels, the Master should try to isolate the damaged tanks to reduce additional to reduce additional loss of substances.

3.2.1.4 Refloating by own means

The Master should also evaluate the question of refloating the vessel by own means. Before such an attempt is made, it must be determined:

- whether the ship is damaged in such a way that it may sink, break up or capsize after getting off
- whether the ship , after getting off, may have maneuvering problems upon leaving the dangerous area on its own.
- whether machinery, rudder or propeller are damaged due to grounding or may be damaged by trying to get off ground by own means.
- whether the ship may be trimmed or lightened sufficiently to avoid damage to other tanks in order to reduce additional pollution.
- weather evaluation; whether there is time/reason to await improvements in weather or tide.

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

- whether ship's structure permits refloating/consultation of GL Emergency Response Service
- whether all steps of Coastal Shipping Ltd. procedure "Grounding" have been complied with.

3.2.1.5 Securing the Ship

If the risk of further damage the ship is greater in an attempt to refloat the ship by own means, than in remaining aground until professional assistance has been obtained, the ship's Master should try to secure the ship as much as possible:

- Trying to prevent the ship from moving from its present position
- By dropping anchors (adequate water depth and anchor ground provided)
- By taking ballast into empty tanks, if possible
- Trying to reduce longitudinal strain on hull by transferring ballast or bunkers internally
- Reducing fire risk by removing all sources of ignition.

Inform in line with Section 2 all parties interested about Grounding and the actions taken so far.

3.2.2 Fire /Explosion

Should an explosion and a fire occur onboard, sound the GENERAL ALARM immediately. Further actions should be initiated in accordance with the ship's Muster List.

In case of fire and explosion the following priorities exist:

- Rescuing lives
- Limiting damage /danger to the ship and cargo
- Preventing environmental pollution

The Coastal Shipping Emergency Procedure " **Fire and Explosion**" in the file Emergency Preparedness should be complied with.

Steps to control the discharge of oil will depend largely on the damage to the ship and cargo. Special information thereto is contained in subparagraphs 3.2.4, 3.2.5 and 3.2.6.

Inform in line with Section 2 all parties interested about the Fire /Explosion and the actions taken so far.

3.2.3 Collision

The Master shall follow the emergency plan as given in Coastal Shipping Ltd Emergency procedure "Collision" in file: Emergency Preparedness as follows:

- Sound emergency alarm, muster crew, and mobilize Oil Pollution Prevention Team once safe to do so.
- Determine whether there are casualties.
- If there is a possibility of fire or explosion, eliminate all avoidable sources of ignition and ban smoking onboard. Action should be taken to prevent flammable vapours from entering the accommodation and machinery spaces. .



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

- Decide whether separation of vessels may cause or increase spillage of oil, or increase the risk of sinking.
- If any oil tanks are penetrated, isolate these tanks or transfer oil to slack or empty tanks with due attention paid to stress and stability of the vessel. Please refer to the approved stability book.
- If there is an oil spill, make a report as per section 4.
- If possible to maneuver, the Master, in conjunction with the appropriate shore authorities should consider moving his ship to a more suitable location in order to facilitate emergency repair work or lightening operations, or to reduce the threat posed to any sensitive shoreline areas.

3.2.4 Excessive List

Should the ship for some reasons suddenly start to list excessively during discharging/loading operations, or bunkering, all ongoing operations should be stopped immediately until the cause has been determined.

The Officer on duty should inform the Master and/or Chief Officer without delay.

The Master should try to determine the reason for excessive list, and take steps to rectify the situation and to stabilize the ship's condition:

- Check reasons for list
- Soundings / Ullage to be taken in all tanks
- Bunker / Ballast / Cargo pumps to be made ready
- Consider measures to minimize list in transferring liquid from one compartment to another
- Ensure water tightness of empty spaces
- Close all opening
- Secure vent pipes to avoid ingress of water
- If bunkering: Change to corrective tanks for rectifying the situation
- If ballasting/deballasting: Change to corrective tanks to rectify the situation
- If there is reason to believe that the list may cause any spill, notify as per Section 4
- If the ship's crew is in jeopardy, prepare lifeboats for launching, and notify as per Section 4

If the situation is brought under control, inform all parties interested.

3.2.5 Dangerous reaction of cargo

In case of spillage of NLS cargo on deck, to the sea or incidents mixture with other cargo through internal tanks leakage consider dangerous reactions of such mixture. Promptly consult the Material Sheet Data Sheet (MSDS) available for the cargo shipped to the information provided. Take necessary actions for the safety of the crew for the case of (possible) contamination with spilled material or its vapours



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

3.2.6 Other dangerous cargo and/or vapour release

In case release of dangerous liquid noxious substances take necessary actions for the protection of the crew against health hazards, especially by contamination with materials or its toxic vapours. Avoid material or vapours spreading over the ship. If any dangerous material or vapour is released from any part of the containment system, take arrangements to free the deck area as far as possible by turning the ship to have the accommodation upwind of the point of release.

Evacuate crew members from the endangered area. If persons have to carry out any unavoidable duties within the endangered area, care for the personal protection for those persons to avoid direct contact.

All possible sources of ignition should be eliminated and non-essential air intakes shut down to prevent intake of vapour into accommodation and engine spaces.

Take measures to reduce tanks level or pressure to stop any emission of material or vapour.

Report about such spillage to nearest coastal state in order to arrange precautionary measures for the environment.

3.2.7 Loss of tank environmental control

Consider any hazards arising out of loss of environmental control in view of possible explosion dangers by contacting the Material Safety Data Sheets (MSDS) of the cargo concerned. Avoid any intake of air into the uncontrolled spaces to avoid a dangerous mixture to be built within the respective.

3.2.8 Ship submerged/foundered/wrecked

If the ship is wrecked to the extent that it or parts of it are submerged, take all measures to evacuate all persons onboard. Avoid contact with any spilled cargo or oil. Alert other ships and/or the nearest coastal state for assistance in rescuing lives and the as far as possible.

3.3 Priority Actions

Top priority shall in all cases of emergency be put on the safety of the persons onboard and to take actions to prevent escalation of the incident.

Immediate consideration should be given to the protective measures against fire, fire explosions and personal exposure to toxic vapour.

Detailed information about damage sustained to the ship and its containment system has to be obtained.

On the basis of the information the Master can decide next actions for the protection of lives, the ship, the cargo and the environment.

The Master should take into account the following when he is determining whether salvage assistance will be needed or not:

- Nearest land or hazard to navigation
- Vessel's set and drift

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

- Estimated time of casualty repair
- Determination of nearest capable assistance and its response time.

Detailed information about the cargo, especially NLS Cargo has to be available and to be referred to further actions regarding the cargo.

In case of necessary movement of cargo within the ship careful consideration is to be given to hull strength and stability as well as to the compatibility of all material. (cargo, tanks, coating, piping) in view of any transfer actions planned.

Plans/tables about location and specification of the current cargo as well as bunkers and ballast have to be readily available.

Information about Current cargo/bunker/ballast distribution and the Material Safety Data Sheets (MSDS) for the carried cargo substances are available at:

- Cargo, bunkers, ballast distribution: Cargo Office
- Material Safety Data Sheets (MSDS); Alleyway opposite of the cargo office

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

3.4

Mitigating Activities

If safety of both the ship and the personnel has been addressed the Master shall care for the following issues:

- Assessment of the situation and monitoring of all activities as documented evidence
- Care for further protection of the personnel, use of protection gear, assessment of further risk for health and safety
- Containment of the spilled material by absorption and proper and safe disposal of all material onboard until proper delivery ashore under close guidance of the safety information given by the Product Data Sheet
- Decontamination of Personnel after finishing the cleanup process.

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

3.5 **Transfer of Bunker/Cargo - Lightering**

If the ship has sustained extensive structural damage, it may be necessary to transfer all or part of the cargo/bunker to another ship. In Ship to Ship transfer operations involving a specialized service ship, the Master of that ship will normally be in overall charge.

In the case of non-specialized ships the Master or other person in overall charge of the operation should be mutually agreed and clearly established by the Masters concerned prior to the start of operations.

The actual bunker/cargo transfer should be carried out in accordance with the requirements of the receiving ship.

In all cases each Master remains responsible for the safety to be jeopardized by the action of the other Master, his owner, regulatory officials or others.

The ship to ship transfer operations should be coordinated with the appropriate responsible local Authority. When selecting the area of operation the Masters should consider the following points:

- The need to notify and obtain the agreements of any responsible authority
- The destinations of the ships concerned
- The shelter provided, particularly from sea and swell
- The sea area and depth of water, which should be sufficient for maneuvering during mooring, unmooring, and transfer operations and allow a safe anchorage if operations have to be undertaken at anchor
- The traffic density
- The weather conditions and weather forecasts.

Further, before commencing Ship to Ship Transfer operations each ship should carry out, as far as possible, appropriate preparations like

- Pre-mooring preparations of the ship
- Positioning of fenders if such equipment is available on board
- Mooring equipment arrangements
- Checking the communication channels between the two ships.

In addition to the general principles of Ship to Ship operations as aforementioned the Master should take note of supplemented instructions issued in the Coastal Shipping Ltd bunkering procedures.

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

3.6 Damage Stability and Hull Stress Calculation

Whenever the tank status changes in the course of the incident the stability and stress of the vessel has to be checked using the class approved cargo computer.

In case of hull damage stability shall instantly be checked using the appropriate application of the cargo computer. The damage control plan should be referred to. In addition to that the **GL Emergency Response Service** is to be consulted for proper stress and stability calculations.

Whenever possible the contact to the **GL Emergency Response Service** will be via Coastal Shipping Ltd. office in order to reduce the workload onboard.
Otherwise the vessel can contact the **GL Emergency Response Service** directly using the following numbers:

Phone: **011-49-40-3614-9134**
Mobile: **011-49-172-405-9713**
Fax: **011-49-40-361-493-620**
email: **matthias.galle@gl-group.com**



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

Vessel Stress and Stability Information

VOYAGE PARTICULARS

Departure Port

Departure Date

Time (GMT)

VESSEL CONDITION IMMEDIATELY BEFORE CASUALTY

Mean Draft Forward

Mean Draft Aft

KG(solid)

KG(fluid)

LCG of Vessel

Condition of Tanks and Compartments

#	COMPARTMENT	S.G.	TONNES



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

3.7

General Responsibilities of the Master and designated Officers / crew members

The responsibilities of the Master Officers and the crew onboard in the event of a spill actual or probable to bring the accident under control on board, limit overflows or cleanup procedures, and to secure the ship immediately if an incident occurs.

The following is an example which can be used by the Master to aid in designating officers. Should changes to the team be made, please make a record in this section :

Master
Chief Mate
Chief Engineer

In the event of an emergency, the team should be called out as soon as it is safe to do so.

The team should be given necessary training in the use of such equipment as oil absorbents that the vessel may carry. All members crew should be aware of their duties should an oil spill occur.

Master

- In overall charge.
- Informs terminal authorities or coastal authorities of incident.
- Informs the local agent and requests agent to inform the local underwriter's representative.
- Advises the company's head office of the situation. Keeps everyone updated at regular intervals. and advises of any changes in status of the emergency.
- Keeps log of all events and progress of actions.

Chief Mate

- In charge of deck / cargo operations.
- In charge of lifeboats if required.
- Keeps the Master informed and updated on the situation and of the results of steps taken to contain any spills and limit outflow.
- Insures all openings in the deck and superstructure are closed to limit vapour entry.
- Position sorbent / clean up material to prevent any fluid escape.

Chief Engineer

- In charge of bunkering operations.
- Organizes distribution of oil spill detergents if required.
- Stops bunkering operations if applicable.
- Stops pumps and any unnecessary pieces of machinery.

Other Personnel

Deck Officer on duty

- Alerts and informs Chief Officer / Chief Engineer on the situation.



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

- Mobilize off duty crew as necessary.

Engineer on duty

- Assist the Chief Engineer.
- Prepare for fire fighting.
- Ensure sufficient power and water to deck.
- Organizes onboard clean up equipment.

Deck Officer off duty

- Under the direction of the Master, responsible for the reporting and record keeping of all events.

On duty Ratings

- Alerts the Officer on duty of any leakage.
- Position sorbent / clean up material to prevent any fluid escape.

Off duty personnel

- Assist as required



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

SECTION 4: National and Local Co-Ordination Steps to Control Discharge

In accordance with the Canadian Pollutant Discharge Reporting Regulations, the Master or Owner of a ship must report, without delay, any discharge or anticipated discharge of a pollutant in Canadian waters or fishing zones, to a Pollution Prevention Officer (PPO). Reports must be made in the manner described in Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants, TP 9834, or "General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants" adopted by the IMO by Resolution A.851(20). These initial reports can be made to Marine Communication and Traffic Service (MCTS) or any other Canadian Coast Guard Radio Station (CGRS), on the frequencies listed in the publication, Radio Aids to Marine Navigation (RAMN).

Alternatively, spills may be reported to the appropriate regional center or nearest Vessel Traffic Service Center on VHF channel 16:

CANADA

Atlantic Region

St. John's, NL	Tel:	1-800-563-9089
Halifax, NS	Tel:	1-800-565-1633

Central & Arctic Region

Quebec City, QC	Tel:	1-800-363-4735
Sarnia, ON	Tel:	1-800-265-0237

Western Region

Vancouver, BC	Tel:	1-800-889-8852

GREENLAND

Spill Notification Point

Joint Arctic Command	Tel:	+299 36 40 00
MRCC Greenland	Fax:	+299 36 40 29
Aalisartut Akquttaat 47	Email:	ako@mil.dk
Po Box 1072, 3900 Nuuk, Greenland		ako-commcen@mil.dk

Competent National Authority

Greenland Bureau of Minerals and Petroleum (BMP)	Tel:	(+299) 34 68 00
Imaneq 1A 201,	Fax:	(+299) 32 43 02
PO Box 930, 3900 Nuuk, Greenland	Email:	bmp@nanoq.gl
	Web:	www.bmp.gl

Note:



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

The following contacts have been included as they are within the expected range of operation of the Vessel. Due to the nature of the Vessel's voyages and varied ports of call this list should not be considered exhaustive. For this reason space has been included at the end of this section for addenda.

Within Canada, administrative inquiries related to pollution prevention, compliance and enforcement, vessel regulations, design and construction should be directed to:

Transport Canada
Marine Safety and Security
330 Sparks Street
Ottawa, Ontario
K1A 0N5
Tel: (613) 998-0610 Fax: (613) 954-1032

Inquiries relating to pollution response should be directed to:

Commissioner
Canadian Coast Guard
Department of Fisheries and Oceans
6th Floor, Centennial Towers
200 Kent Street
Ottawa, Ontario
K1A 0E6
Tel: (613) 990-0999/7728 Fax: (613) 990-1866 Email: info@dfo-mpo.gc.ca

ECRC East Coast Response Corporation
1201-275 Slater Street
Ottawa, Ontario
K1P 5H9
Tel: (613) 230-7369



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

Additional Contact Information

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers

Region	
Spill Notification Point	Contact Numbers



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

VESSEL INTEREST CONTACTS

VESSEL MANAGEMENT

Coastal Shipping Limited (Owners)
P. O. Box 300, Station C
Happy Valley-Goose Bay, NL
A0P 1C0
Canada
Ph: (709) 896-2421
Fax: (709) 896-5028

24 HOUR EMERGENCY CONTACTS

General Manager	Dennis White	(709) 896-2421 work (709) 896-1404 cell (709) 896-2870 home
Engineering Superintendent	Jim Babij	(709) 579-6127 work (709) 727-5065 cell (709) 576-0160 home
	Kevin Brewer	(709) 579-6127 work (709) 682-0826 cell (709) 227 2600 home
Fleet Manager	Phillip John	(709) 535-6944 work (709) 541-1807 cell pjohn@woodwards.nf.ca
Designated Person Ashore	Craig Whiteway	(709) 834-1320 work (709) 727-4848 cell cwhiteway@woodwards.nf.ca



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

APPENDICES:

Appendix I:

- **Spill Equipment Inventory**

Appendix II:

- **General Arrangement**
- **Layout of General Arrangement Stowage Plan**
- **Diagram of Fuel Bunkering**
- **Tank Plan**
- **Capacity Plan**
- **Diagram of Fuel Service Lines**
- **Lubricating Oil System**
- **Stripping System**

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

APPENDIX I



M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)

Shipboard Marine Pollution Emergency
Plan (SMPEP)
May 31, 2013

SPILL EQUIPMENT "MT ALSTERSTERN" LOCATION PLAN

Date Checked (dd/mm/yy):

Quantity	Unit	Description
BOX 2 (CATWALK)		
100	Pcs	Oil sorbent pads / sheets
1	Bag	Sorbent boom
2	Bags	Saw Dust
2	Bags	Granules
BOX 3 (CATWALK)		
3	Pcs	Compressed air breathing apparatus
1	Pc	Chemical suit (gas tight)
2	Pairs	Rubber boots
2	Pcs	Safety lamp
2	Pcs	Face mask
3	Pcs	Safety goggles
2	Pcs	Rubber gloves
3	Pcs	CHEMTEx chemical clothing
BOX 4 (CATWALK)		
2	Pcs	Sorbent blanket
2	Bags	Sorbent boom
25	Ltr.	Oil spill dispersant (SEACARE)
1	Pc	Pressure sprayer
1	Pc	Non sparking shovel
2	Pcs	Safety goggles
2	Pairs	Rubber gloves
2	Pairs	Rubber boots
2	Pcs	Plastic scoop
2	Pcs	Galvanized scoop
2	Pcs	Rain suit
BOX 5 (BLOWER EXHAUST)		
2	Bags	Saw dust
2	Bags	Granules
BOX 6 (ACCOMMODATION)		
2	Pcs	Compressed air breathing apparatus
2	Pcs	Chemical suit (gas tight)
2	Pcs	Safety helmet
2	Pcs	Safety lamp
1	Pc	Air drill
2	Pcs	Safety goggles
2	Pairs	Gloves
2	Pairs	Rubber boots
SAFETY LOCKER #415		
7	Pcs	Foam spray (Montage Schaum)
FORECASTLE		
4	Bags	Saw dust
AFT WET LOCKER		
14	Bags	Saw dust
5	Bags	Granules

****TO BE CHECKED MONTHLY AND DATE OF INSPECTION RECORDED****

Date: May 31, 2013
Rev: 0

Page 38 of 40

Prepared By: PMC
Approved By:

	M/T ALSTERSTERN Shipboard Marine Pollution Emergency Plan (SMPEP)	Shipboard Marine Pollution Emergency Plan (SMPEP) May 31, 2013

APPENDIX II

Appendix C

Shipping Company certificate of entry and acceptance boats

Communication protocol

Safety management system for entry into confined water

Safety management system for monthly safety meeting



STEAMSHIP MUTUAL

CERTIFICATE OF ENTRY AND ACCEPTANCE

This is to certify that the ship below has been entered for insurance in
The Steamship Mutual Underwriting Association (Bermuda) Limited
for

Class 1 - Protection and Indemnity

With effect from

Noon G.M.T 20/02/2013 to Noon G.M.T 20/02/2014

until sold, lost, withdrawn or the entry is terminated in accordance with the Rules, to the extent specified and in accordance with the Act, Bye-Laws and the Rules from time to time in force and the special terms specified overleaf.

For the account of:

Coastal Shipping Ltd (Owner)

and Joint Members, if any, under Rule 9 (i) as listed overleaf

whose names have been entered in the Register of Members of the Club as a Member.

Vessel Name:	"DORSCH"	Built:	1980
Gross Tonnage:	6,729	IMO no:	8007195
Class:	GL		
Port of Registry:	ST. JOHN`S, NFL.		

THIS CERTIFICATE OF ENTRY IS EVIDENCE ONLY OF THE CONTRACT OF INDEMNITY INSURANCE BETWEEN THE ABOVE NAMED MEMBER(S) AND THE ASSOCIATION AND SHALL NOT BE CONSTRUED AS EVIDENCE OF ANY UNDERTAKING, FINANCIAL OR OTHERWISE, ON THE PART OF THE ASSOCIATION TO ANY OTHER PARTY.

IN THE EVENT THAT A MEMBER TENDERS THIS CERTIFICATE AS EVIDENCE OF INSURANCE UNDER ANY APPLICABLE LAW RELATING TO FINANCIAL RESPONSIBILITY, OR OTHERWISE SHOWS OR OFFERS IT TO ANY OTHER PARTY AS EVIDENCE OF INSURANCE, SUCH USE OF THIS CERTIFICATE BY THE MEMBER IS NOT TO BE TAKEN AS ANY INDICATION THAT THE ASSOCIATION THEREBY CONSENTS TO ACT AS GUARANTOR OR TO BE SUED DIRECTLY IN ANY JURISDICTION WHATSOEVER. THE ASSOCIATION DOES NOT SO CONSENT.

NOTES

1. REFERENCE IS REQUESTED TO THE RULES AS TO THE CIRCUMSTANCES OF ENTRY BEING CANCELLED AND AS TO THE CIRCUMSTANCES OF AN ALTERATION IN THE RULES OR BYE-LAWS.

2. THE RULES ARE PRINTED ANNUALLY IN BOOK FORM, INCORPORATING ALL PREVIOUS ALTERATIONS AND A COPY IS SENT TO EACH MEMBER. ALTERATIONS CAN BE MADE BY ORDINARY RESOLUTION FOLLOWING A GENERAL MEETING NOTIFIED TO ALL MEMBERS.

3. THIS CERTIFICATE OF ENTRY SUPERSEDES ANY PREVIOUS CERTIFICATE OF ENTRY IN RESPECT OF THESE RISKS AND ENTERED SHIP(S). SAVE AS OTHERWISE EXPRESSLY PROVIDED HEREIN ANY SUCH PREVIOUS CERTIFICATE OF ENTRY SHALL REMAIN IN FULL FORCE AND EFFECT UP TO THE DATE OF THIS CERTIFICATE OF ENTRY.

STEAMSHIP MUTUAL MANAGEMENT (BERMUDA) LTD.
MANAGERS

Hamilton, Bermuda - 07/02/2013



STEAMSHIP MUTUAL

Limit of Liability

Cover hereunder for all claims in respect of Oil Pollution shall be limited to US\$ 1,000,000,000 each vessel any one accident or occurrence.

Inclusions of Cover

Cover as per Rules including but not limited to:

Liabilities in respect of Cargo in accordance with Rule 25 xiii and/save as may be more particularly set out in this Certificate of Entry.

Liability to Persons including Crew for illness, injury or death in accordance with Rule 25 i-iii, and/save as may be more particularly set out in this Certificate of Entry.

Liability for Loss of or Damage to Fixed and Floating Objects (including docks, jetties etc.) in accordance with rule 25 vii and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Pollution in accordance with Rule 25 vi and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Wreck Removal in accordance with Rule 25 xi and/save as may be more particularly set out in this Certificate of Entry.

Subject to the Rules and the Member's terms of entry this vessel is covered for trading to Arctic Waters.

Warranties

Vessel carrying non-persistent oil cargoes only, or held covered at terms and conditions to be agreed.

Trading between 15th June and 30th November annually, and to be laid-up at a safe port with less than 1/4 crew onboard for the remainder of the time

Trading Canadian waters only

Deductibles

US\$5,235 - from all other cargo claims, each single voyage.

US\$4,000 - from all other claims, any one accident or occurrence.

Other Conditions

Sanctions Clause



STEAMSHIP MUTUAL

It is a condition of this insurance that no coverage will be provided and no entries will be accepted in respect of:

1. Vessels owned, managed, operated or chartered by a party (who need not be a Member or prospective Member of the Club); and/or
2. Vessels;

designated under any legislation, regulation or order of any State or International Organisation which howsoever exposes those vessels and/or the Club and/or the Member entering such vessels and/or any other Member of the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever.

If, notwithstanding this condition,

(a) a vessel, in relation to which cover has been provided, or the entry of which has been accepted by the Club (whether or not a certificate of entry has been issued) ; or

(b) such vessel's owner, manager, operator or charterer, (whether or not a Member of the Club)

is or becomes so designated, the entry of that vessel and/or the coverage provided to the Member, shall cease forthwith and no claims, liabilities, costs or expenses shall be paid by or recoverable from the Club in relation thereto.

In the event that any vessel entered (whether or not a certificate of entry has been issued), or a vessel in relation to which cover has been provided, is employed on any voyage, in any trade, or for the carriage of cargo in breach of any legislation, regulation or order of any State or International Organisation which howsoever exposes the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever, the insurance of that vessel and/or the coverage provided to the Member shall cease forthwith and no claims, liabilities, costs or expenses in relation thereto, and arising after the date of such cessation, shall be recoverable hereunder. Save that at any time after such cessation, if the Directors in their absolute discretion so determine, that vessel's entry in the Club or the coverage in relation to that vessel, may be reinstated on such terms and conditions and from such date and time as the Directors or the Managers direct.

Crew Clauses

CANADIAN COMPENSATION EXCLUSION CLAUSE

Excluding any and all liability to crew and/or others employed on or about the vessel under any and all Workmens' Compensation Acts or equivalent legislation applicable under Canadian Federal or Provincial Law

Premium

Cancelling Returns only.



STEAMSHIP MUTUAL

Additional Parties

Joint Members

The cover afforded to:

1. Woodward's Oil Ltd (Other)
2. Labrador Leasing Ltd (Operator)
3. Labrador Motors Ltd (Operator)
4. Woodward's Ltd (Other)
5. Arctic Services Ltd (Other)

as Joint Member shall extend only to risks, liabilities, costs and expenses arising out of operations and/or activities customarily carried on by or at the risk and responsibility of shipowners and which are within the scope of the cover provided under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry.

The conduct of any one Joint Member which is sufficient to bar that Joint Member's right of recovery under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry shall bar absolutely the rights of recovery of all Joint Members thereunder.

All Joint Members shall be jointly and severally liable to pay contributions due to the Club in respect of this entry, and the receipt by any one Joint Member of any sums payable by the Club in respect of this entry shall be sufficient discharge of the Club for the same.

There shall be no recovery out of the funds of the Club in respect of any liability, costs and expenses arising out of or as a result of any claim, dispute or difference between any Joint Members, affiliates and/or any others insured to any extent under one entry.

Loss Payable Clause

Payment of any recovery the Owner is entitled to receive out of the funds of the Association in respect of any liability, costs or expenses incurred by him shall be made to the Owner or to his order unless and until the Association receives notice from:

The Royal Bank of Canada

that the Owner is in default under the Mortgage, in which event all recoveries shall thereafter be paid to:

The Royal Bank of Canada

or their order; provided always that no liability whatsoever shall attach to the Association, its Managers or their Agents for failure to comply with the latter obligation until after the expiry of two clear business days from the receipt of such notice. The Association shall, unless it receives from the Mortgagee notice to the contrary, be at liberty at the request of the Owner to provide bail or other security to prevent the arrest or obtain the release of the vessel, without liability to the Mortgagee.

Affiliated Companies Clause

It is noted that cover has been extended as follows, subject to the terms of Rule 9 (ii):



STEAMSHIP MUTUAL

Should a claim in respect whereof a Member named in this Certificate of Entry is insured by the Association be made or enforced through an Affiliated, Associated or Subsidiary Company of such Member, the Association shall if so requested by the Member indemnify such Company against any loss which as a consequence thereof such Company shall have incurred in that capacity provided always that nothing herein contained shall be construed as extending to any amount which would not have been recoverable from the Association by the Member had such claim been made or enforced against him. Once the Association has made such indemnification it shall not be under any further liability and shall not make any further payment to any person or Company whatsoever, including the Member, in respect of that claim.

Conduct of any one of the parties insured under this entry which is sufficient to bar the insured's rights hereunder shall bar the rights of recovery of all the said insured.

Addenda

War Risk Extension Clause

1) Cover excluded under Rule 21 is hereby reinstated subject to the terms set out in this Certificate of Entry and any Endorsement thereto, and to the following conditions.

2) This special cover shall be subject to an excess of either:

- a) the "proper value" of the entered ship as defined in the Note to Rule 25 xv, (which, for the purpose of this War Risk Extension only, shall be deemed not to exceed US\$100 million), or
- b) the amount recoverable in respect of the claim under any other policy of insurance, whether of war risks or otherwise,

whichever shall be the greater, save that such excess shall not apply where the entry of the ship is solely in the name of or on behalf of a Charterer other than a Charterer by Demise or Bareboat Charterer, provided that the Directors may authorise the payment, in whole or in part, of any claim or part of a claim which falls within such excess, if in their discretion and without having to give any reasons for their decision they decide that the Owner should recover from the Club.

3) Subject to the exception set out below, the limit applying to this special cover shall be US\$500 million, any one event each vessel or any limit set out elsewhere in this Certificate, whichever shall be the lesser.

4) All perils included in the special cover shall be subject to the following:

Chemical, Biological, Bio-chemical, Electromagnetic Weapons and Computer Virus Clause:

In no case shall this insurance cover loss damage liability or expense directly or indirectly caused by or contributed to by or arising from

- a) any chemical, biological, bio-chemical or electromagnetic weapon;
- b) the use or operation, as a means for inflicting harm, of any computer virus.

5) At any time or times before, or at the commencement of, or during the currency of any Policy Year of the Club, the Directors may in their discretion determine that any ports, places, countries, zones or areas (whether of land or sea) be excluded from the insurance provided by this P&I war risks cover. Save as otherwise provided by the Directors, this P&I war risks cover shall cease in



STEAMSHIP MUTUAL

respect of such ports, places, countries, zones or areas at midnight on the seventh day following the issue to the Members of notice of such determination in accordance with the terms of the cover provided pursuant to Rule 21 of the Club's Rules. Unless and to the extent that the Directors in their discretion otherwise decide there shall be no recovery from the Club under this P&I war risks cover in respect of any claim howsoever arising out of any event, accident or occurrence within the said area after such date.

6) Whether or not notice has been given under Clause (5) above, this P&I war risks cover shall terminate automatically:

i) upon the outbreak of war (whether there be a declaration of war or not) between any of the following countries:

United Kingdom, United States of America, France, the Russian Federation, the People's Republic of China and this insurance excludes loss, damage, liability or expense arising from such outbreak of war;

ii) in respect of any vessel, in connection with which cover is granted hereunder, in the event of such vessel being requisitioned either for title or use and this insurance excludes loss, damage, liability or expense arising from such requisition.

7) Notwithstanding any other term or condition of this insurance, the Directors may in their discretion cancel this special cover giving 7 days' notice to the Members (such cancellation becoming effective on the expiry of 7 days from midnight of the day on which notice of cancellation is issued by the Club and the Directors may at any time after the issue of notice of such cancellation resolve to reinstate special cover pursuant to the proviso to the terms of the cover issued pursuant to Rule 21 on such terms and conditions and subject to such limit as the Directors in their discretion may determine.

8) When either a Demise, Time, Voyage, Space or Slot Charterer and/or the Owner of the Entered Ship are separately insured for losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of any other Association which participates in the Pooling Agreement and General Excess Loss Reinsurance Contract, the aggregate of claims in respect of such losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of such other Association(s), shall be limited to the amount set out in the Certificate of Entry in respect of any one ship, any one incident or occurrence. If such claims exceed this limit, the liability of the Club in respect of each Certificate of Entry shall be limited to that proportion of the limit that claims recoverable from the Club under that Certificate bear to the aggregate of the said claims recoverable from the Club and from such other Association(s), if any.

9) Cover for acts of terrorism as defined in the U.S. Terrorism Risk Insurance Act of 2002 (TRIA) is included hereunder, subject to the conditions set out above, the estimated cost of this element of coverage being US\$0.25 cents per entered gross ton.

10) The Club shall not provide insurance hereunder for any losses, liabilities, costs or expenses if the provision of such insurance would create a liability for the (Insured Owner) under the Tanker Oil Pollution Indemnification Agreement 2006 to contribute to the IOPC Supplementary Fund.

11) Sanctions Clause - Excluding coverage for liabilities, costs and expenses to the extent that the payment of any claim or the provision of any benefit in respect of those



STEAMSHIP MUTUAL

liabilities, costs and expenses would expose the Club and/or their reinsurers hereunder to any sanction, prohibition or restriction under United Nations Resolutions or the trade or economic sanctions, laws or regulations of the European Union, United Kingdom or United States of America.

Bio-Chem Clause

1.1 Subject to the terms and conditions and exclusions set out herein, cover is extended to include the liability of the Member:

- (a) To pay damages, compensation or expenses in consequence of the personal injury to or illness or death of any seaman (including diversion expenses, repatriation and substitute expense and shipwreck unemployment indemnity),
- (b) For the legal costs and expenses incurred solely for the purpose of avoiding or minimising any liability or risk insured by an Association (other than under the Omnibus Rule)

1.2 Where such liability is not recoverable under either:

- (a) cover provided by the Club for such liabilities, costs, losses and expenses as would be covered under the Rules but for the exclusion of war risks in Rule 21, or
- (b) Any underlying war risk policies covering the same risks,

1.3 Solely by reason of the operation of an exclusion of liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising from :

- (a) Any chemical, biological, bio-chemical or electromagnetic weapon
- (b) the use or operation, as a means for inflicting harm, of any computer, computer system, computer software program, malicious code, computer virus or process or any other electronic system,

1.4 Other than liabilities, costs, losses and expenses arising from:

- (i) Explosives or the methods of the detonation or attachment thereof
- (ii) The use of the entered ship or its cargo as a means for inflicting harm, unless such cargo is a chemical or bio-chemical weapon.
- (iii) the use of any computer, computer system or computer software program or any other electronic system in the launch and/or guidance system and/or firing mechanism of any weapon or missile.

2. Excluded Areas

2.1 The Directors may in their discretion decide that there shall be no recovery in respect of any liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising out of any event, accident or occurrence within such ports, places, zones or areas, or during such period as they may specify.

2.2 At any time or times before, or at the commencement of, or during the Policy Year, the Club may by notice to the Member change, vary, extend, add to or otherwise alter the ports, places, countries, zones and periods specified in Clause 2.1 from a date and time specified by the Club not being less than 24 hours from midnight on the day the notice is given to the Member.

3. Cancellation

Cover hereunder may by notice to the Member be cancelled by the Club from a date and time specified by the Club, not being less than 24 hours from midnight on the day notice of cancellation is given to the Member.

4. Limit of Liability

4.1 Subject to Clause 4.2 the limit of liability of the Club under this extension of cover in respect of all claims shall be in the aggregate US\$30 million each ship any one accident or occurrence or series thereof arising from any one event.



STEAMSHIP MUTUAL

4.2 In the event that there is more than one entry by any person for Bio-Chem cover as provided herein in respect of the same ship with the Club and/or any other insurer which participates in the Pooling Agreement or General Excess Loss Reinsurance Contract, the aggregate recovery in respect of all liabilities, costs, losses and expenses arising under such entries shall not exceed the amount stipulated in Clause 4.1 and the liability of the Club under each such entry shall be limited to such proportion of that amount as the claims arising under that entry bear to the aggregate of all such claims recoverable from the Club and any such other insurer.

5. Deductible

The deductible shall be the deductible applicable to the relevant cover set out in the Certificate of Entry.

6. Law and Practice

This clause is subject to English law and practice.

Association:

The Steamship Mutual Underwriting Association (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295-4502 Fax: (441) 292-8787

Managers:

Steamship Mutual Management (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295 4502 Fax: (441) 292 8787

Managers' London Representative:

Steamship Insurance Management Services Limited
Authorised and Regulated by the United Kingdom Financial Services Authority
Aquatical House, 39 Bell Lane, London E1 7LU
Tel: 020 7247 5490 Website: www.simsi.com
Registered No: 3855693 England



STEAMSHIP MUTUAL

CERTIFICATE OF ENTRY AND ACCEPTANCE

This is to certify that the ship below has been entered for insurance in
The Steamship Mutual Underwriting Association (Bermuda) Limited
for

Class 1 - Protection and Indemnity

With effect from

Noon G.M.T 20/02/2013 to Noon G.M.T 20/02/2014

until sold, lost, withdrawn or the entry is terminated in accordance with the Rules, to the extent specified and in accordance with the Act, Bye-Laws and the Rules from time to time in force and the special terms specified overleaf.

For the account of:

Coastal Shipping Ltd (Owner)

and Joint Members, if any, under Rule 9 (i) as listed overleaf

whose names have been entered in the Register of Members of the Club as a Member.

Vessel Name:	"NANNY"	Built:	1993
Gross Tonnage:	6,544	IMO no:	9051399
Class:	DNV		
Port of Registry:	ST. JOHN`S, NFL.		

THIS CERTIFICATE OF ENTRY IS EVIDENCE ONLY OF THE CONTRACT OF INDEMNITY INSURANCE BETWEEN THE ABOVE NAMED MEMBER(S) AND THE ASSOCIATION AND SHALL NOT BE CONSTRUED AS EVIDENCE OF ANY UNDERTAKING, FINANCIAL OR OTHERWISE, ON THE PART OF THE ASSOCIATION TO ANY OTHER PARTY.

IN THE EVENT THAT A MEMBER TENDERS THIS CERTIFICATE AS EVIDENCE OF INSURANCE UNDER ANY APPLICABLE LAW RELATING TO FINANCIAL RESPONSIBILITY, OR OTHERWISE SHOWS OR OFFERS IT TO ANY OTHER PARTY AS EVIDENCE OF INSURANCE, SUCH USE OF THIS CERTIFICATE BY THE MEMBER IS NOT TO BE TAKEN AS ANY INDICATION THAT THE ASSOCIATION THEREBY CONSENTS TO ACT AS GUARANTOR OR TO BE SUED DIRECTLY IN ANY JURISDICTION WHATSOEVER. THE ASSOCIATION DOES NOT SO CONSENT.

NOTES

1. REFERENCE IS REQUESTED TO THE RULES AS TO THE CIRCUMSTANCES OF ENTRY BEING CANCELLED AND AS TO THE CIRCUMSTANCES OF AN ALTERATION IN THE RULES OR BYE-LAWS.

2. THE RULES ARE PRINTED ANNUALLY IN BOOK FORM, INCORPORATING ALL PREVIOUS ALTERATIONS AND A COPY IS SENT TO EACH MEMBER. ALTERATIONS CAN BE MADE BY ORDINARY RESOLUTION FOLLOWING A GENERAL MEETING NOTIFIED TO ALL MEMBERS.

3. THIS CERTIFICATE OF ENTRY SUPERSEDES ANY PREVIOUS CERTIFICATE OF ENTRY IN RESPECT OF THESE RISKS AND ENTERED SHIP(S). SAVE AS OTHERWISE EXPRESSLY PROVIDED HEREIN ANY SUCH PREVIOUS CERTIFICATE OF ENTRY SHALL REMAIN IN FULL FORCE AND EFFECT UP TO THE DATE OF THIS CERTIFICATE OF ENTRY.

STEAMSHIP MUTUAL MANAGEMENT (BERMUDA) LTD.
MANAGERS

Hamilton, Bermuda - 07/02/2013



STEAMSHIP MUTUAL

Limit of Liability

Cover hereunder for all claims in respect of Oil Pollution shall be limited to US\$ 1,000,000,000 each vessel any one accident or occurrence.

Inclusions of Cover

Cover as per Rules including but not limited to:

Liabilities in respect of Cargo in accordance with Rule 25 xiii and/save as may be more particularly set out in this Certificate of Entry.

Liability to Persons including Crew for illness, injury or death in accordance with Rule 25 i-iii, and/save as may be more particularly set out in this Certificate of Entry.

Liability for Loss of or Damage to Fixed and Floating Objects (including docks, jetties etc.) in accordance with rule 25 vii and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Pollution in accordance with Rule 25 vi and/save as may be more particularly set out in this Certificate of Entry.

Liabilities in respect of Wreck Removal in accordance with Rule 25 xi and/save as may be more particularly set out in this Certificate of Entry.

Subject to the Rules and the Member's terms of entry this vessel is covered for trading to Arctic Waters.

Warranties

Vessel carrying non-persistent oil cargoes only, or held covered at terms and conditions to be agreed.

Trading between 15th June and 30th November annually, and to be laid-up at a safe port with less than 1/4 crew onboard for the remainder of the time

Trading Canadian waters only

Deductibles

US\$5,235 - from all other cargo claims, each single voyage.

US\$4,000 - from all other claims, any one accident or occurrence.

Other Conditions

Sanctions Clause



STEAMSHIP MUTUAL

It is a condition of this insurance that no coverage will be provided and no entries will be accepted in respect of:

1. Vessels owned, managed, operated or chartered by a party (who need not be a Member or prospective Member of the Club); and/or
2. Vessels;

designated under any legislation, regulation or order of any State or International Organisation which howsoever exposes those vessels and/or the Club and/or the Member entering such vessels and/or any other Member of the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever.

If, notwithstanding this condition,

(a) a vessel, in relation to which cover has been provided, or the entry of which has been accepted by the Club (whether or not a certificate of entry has been issued) ; or

(b) such vessel's owner, manager, operator or charterer, (whether or not a Member of the Club)

is or becomes so designated, the entry of that vessel and/or the coverage provided to the Member, shall cease forthwith and no claims, liabilities, costs or expenses shall be paid by or recoverable from the Club in relation thereto.

In the event that any vessel entered (whether or not a certificate of entry has been issued), or a vessel in relation to which cover has been provided, is employed on any voyage, in any trade, or for the carriage of cargo in breach of any legislation, regulation or order of any State or International Organisation which howsoever exposes the Club to the risk of being or becoming subject to any sanction, prohibition or adverse action whatsoever, the insurance of that vessel and/or the coverage provided to the Member shall cease forthwith and no claims, liabilities, costs or expenses in relation thereto, and arising after the date of such cessation, shall be recoverable hereunder. Save that at any time after such cessation, if the Directors in their absolute discretion so determine, that vessel's entry in the Club or the coverage in relation to that vessel, may be reinstated on such terms and conditions and from such date and time as the Directors or the Managers direct.

Crew Clauses

CANADIAN COMPENSATION EXCLUSION CLAUSE

Excluding any and all liability to crew and/or others employed on or about the vessel under any and all Workmens' Compensation Acts or equivalent legislation applicable under Canadian Federal or Provincial Law

Premium

Cancelling Returns only.



STEAMSHIP MUTUAL

Additional Parties

Joint Members

The cover afforded to:

1. Woodward Oil Ltd (Other)
2. Labrador Leasing Ltd (Operator)
3. Labrador Motors Ltd (Operator)
4. Woodward Ltd (Other)
5. Arctic Services Ltd (Other)

as Joint Member shall extend only to risks, liabilities, costs and expenses arising out of operations and/or activities customarily carried on by or at the risk and responsibility of shipowners and which are within the scope of the cover provided under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry.

The conduct of any one Joint Member which is sufficient to bar that Joint Member's right of recovery under the terms, conditions and exceptions provided by the Rules and by this Certificate of Entry shall bar absolutely the rights of recovery of all Joint Members thereunder.

All Joint Members shall be jointly and severally liable to pay contributions due to the Club in respect of this entry, and the receipt by any one Joint Member of any sums payable by the Club in respect of this entry shall be sufficient discharge of the Club for the same.

There shall be no recovery out of the funds of the Club in respect of any liability, costs and expenses arising out of or as a result of any claim, dispute or difference between any Joint Members, affiliates and/or any others insured to any extent under one entry.

Affiliated Companies Clause

It is noted that cover has been extended as follows, subject to the terms of Rule 9 (ii):

Should a claim in respect whereof a Member named in this Certificate of Entry is insured by the Association be made or enforced through an Affiliated, Associated or Subsidiary Company of such Member, the Association shall if so requested by the Member indemnify such Company against any loss which as a consequence thereof such Company shall have incurred in that capacity provided always that nothing herein contained shall be construed as extending to any amount which would not have been recoverable from the Association by the Member had such claim been made or enforced against him. Once the Association has made such indemnification it shall not be under any further liability and shall not make any further payment to any person or Company whatsoever, including the Member, in respect of that claim.

Conduct of any one of the parties insured under this entry which is sufficient to bar the insured's rights hereunder shall bar the rights of recovery of all the said insured.

Addenda

War Risk Extension Clause

- 1) Cover excluded under Rule 21 is hereby reinstated subject to the terms set out in this



STEAMSHIP MUTUAL

Certificate of Entry and any Endorsement thereto, and to the following conditions.

2) This special cover shall be subject to an excess of either:

- a) the "proper value" of the entered ship as defined in the Note to Rule 25 xv, (which, for the purpose of this War Risk Extension only, shall be deemed not to exceed US\$100 million), or
- b) the amount recoverable in respect of the claim under any other policy of insurance, whether of war risks or otherwise,

whichever shall be the greater, save that such excess shall not apply where the entry of the ship is solely in the name of or on behalf of a Charterer other than a Charterer by Demise or Bareboat Charterer, provided that the Directors may authorise the payment, in whole or in part, of any claim or part of a claim which falls within such excess, if in their discretion and without having to give any reasons for their decision they decide that the Owner should recover from the Club.

3) Subject to the exception set out below, the limit applying to this special cover shall be US\$500 million, any one event each vessel or any limit set out elsewhere in this Certificate, whichever shall be the lesser.

4) All perils included in the special cover shall be subject to the following:

Chemical, Biological, Bio-chemical, Electromagnetic Weapons and Computer Virus Clause:

In no case shall this insurance cover loss damage liability or expense directly or indirectly caused by or contributed to by or arising from

- a) any chemical, biological, bio-chemical or electromagnetic weapon;
- b) the use or operation, as a means for inflicting harm, of any computer virus.

5) At any time or times before, or at the commencement of, or during the currency of any Policy Year of the Club, the Directors may in their discretion determine that any ports, places, countries, zones or areas (whether of land or sea) be excluded from the insurance provided by this P&I war risks cover. Save as otherwise provided by the Directors, this P&I war risks cover shall cease in respect of such ports, places, countries, zones or areas at midnight on the seventh day following the issue to the Members of notice of such determination in accordance with the terms of the cover provided pursuant to Rule 21 of the Club's Rules. Unless and to the extent that the Directors in their discretion otherwise decide there shall be no recovery from the Club under this P&I war risks cover in respect of any claim howsoever arising out of any event, accident or occurrence within the said area after such date.

6) Whether or not notice has been given under Clause (5) above, this P&I war risks cover shall terminate automatically:

i) upon the outbreak of war (whether there be a declaration of war or not) between any of the following countries:

United Kingdom, United States of America, France, the Russian Federation, the People's Republic of China and this insurance excludes loss, damage, liability or expense arising from such outbreak of war;

ii) in respect of any vessel, in connection with which cover is granted hereunder, in the event of such vessel being requisitioned either for title or use and this insurance excludes loss, damage,



STEAMSHIP MUTUAL

liability or expense arising from such requisition.

7) Notwithstanding any other term or condition of this insurance, the Directors may in their discretion cancel this special cover giving 7 days' notice to the Members (such cancellation becoming effective on the expiry of 7 days from midnight of the day on which notice of cancellation is issued by the Club and the Directors may at any time after the issue of notice of such cancellation resolve to reinstate special cover pursuant to the proviso to the terms of the cover issued pursuant to Rule 21 on such terms and conditions and subject to such limit as the Directors in their discretion may determine.

8) When either a Demise, Time, Voyage, Space or Slot Charterer and/or the Owner of the Entered Ship are separately insured for losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of any other Association which participates in the Pooling Agreement and General Excess Loss Reinsurance Contract, the aggregate of claims in respect of such losses, liabilities, or the costs and expenses incidental thereto covered under Rule 21 of the Club and/or the equivalent Rule of such other Association(s), shall be limited to the amount set out in the Certificate of Entry in respect of any one ship, any one incident or occurrence. If such claims exceed this limit, the liability of the Club in respect of each Certificate of Entry shall be limited to that proportion of the limit that claims recoverable from the Club under that Certificate bear to the aggregate of the said claims recoverable from the Club and from such other Association(s), if any.

9) Cover for acts of terrorism as defined in the U.S. Terrorism Risk Insurance Act of 2002 (TRIA) is included hereunder, subject to the conditions set out above, the estimated cost of this element of coverage being US0.25 cents per entered gross ton.

10) The Club shall not provide insurance hereunder for any losses, liabilities, costs or expenses if the provision of such insurance would create a liability for the (Insured Owner) under the Tanker Oil Pollution Indemnification Agreement 2006 to contribute to the IOPC Supplementary Fund.

11) Sanctions Clause - Excluding coverage for liabilities, costs and expenses to the extent that the payment of any claim or the provision of any benefit in respect of those liabilities, costs and expenses would expose the Club and/or their reinsurers hereunder to any sanction, prohibition or restriction under United Nations Resolutions or the trade or economic sanctions, laws or regulations of the European Union, United Kingdom or United States of America.

Bio-Chem Clause

1.1 Subject to the terms and conditions and exclusions set out herein, cover is extended to include the liability of the Member:

(a) To pay damages, compensation or expenses in consequence of the personal injury to or illness or death of any seaman (including diversion expenses, repatriation and substitute expense and shipwreck unemployment indemnity),

(b) For the legal costs and expenses incurred solely for the purpose of avoiding or minimising any liability or risk insured by an Association (other than under the Omnibus Rule)

1.2 Where such liability is not recoverable under either:

(a) cover provided by the Club for such liabilities, costs, losses and expenses as would be covered under the Rules but for the exclusion of war risks in Rule 21, or

(b) Any underlying war risk policies covering the same risks,

1.3 Solely by reason of the operation of an exclusion of liabilities, costs, losses and expenses



STEAMSHIP MUTUAL

directly or indirectly caused by or contributed to by or arising from :

(a) Any chemical, biological, bio-chemical or electromagnetic weapon
(b) the use or operation, as a means for inflicting harm, of any computer, computer system, computer software program, malicious code, computer virus or process or any other electronic system,

1.4 Other than liabilities, costs, losses and expenses arising from:

(i) Explosives or the methods of the detonation or attachment thereof

(ii) The use of the entered ship or its cargo as a means for inflicting harm, unless such cargo is a chemical or bio-chemical weapon.

(iii) the use of any computer, computer system or computer software program or any other electronic system in the launch and/or guidance system and/or firing mechanism of any weapon or missile.

2. Excluded Areas

2.1 The Directors may in their discretion decide that there shall be no recovery in respect of any liabilities, costs, losses and expenses directly or indirectly caused by or contributed to by or arising out of any event, accident or occurrence within such ports, places, zones or areas, or during such period as they may specify.

2.2 At any time or times before, or at the commencement of, or during the Policy Year, the Club may by notice to the Member change, vary, extend, add to or otherwise alter the ports, places, countries, zones and periods specified in Clause 2.1 from a date and time specified by the Club not being less than 24 hours from midnight on the day the notice is given to the Member.

3. Cancellation

Cover hereunder may by notice to the Member be cancelled by the Club from a date and time specified by the Club, not being less than 24 hours from midnight on the day notice of cancellation is given to the Member.

4. Limit of Liability

4.1 Subject to Clause 4.2 the limit of liability of the Club under this extension of cover in respect of all claims shall be in the aggregate US\$30 million each ship any one accident or occurrence or series thereof arising from any one event.

4.2 In the event that there is more than one entry by any person for Bio-Chem cover as provided herein in respect of the same ship with the Club and/or any other insurer which participates in the Pooling Agreement or General Excess Loss Reinsurance Contract, the aggregate recovery in respect of all liabilities, costs, losses and expenses arising under such entries shall not exceed the amount stipulated in Clause 4.1 and the liability of the Club under each such entry shall be limited to such proportion of that amount as the claims arising under that entry bear to the aggregate of all such claims recoverable from the Club and any such other insurer.

5. Deductible

The deductible shall be the deductible applicable to the relevant cover set out in the Certificate of Entry.

6. Law and Practice

This clause is subject to English law and practice.

Association:

The Steamship Mutual Underwriting Association (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295-4502 Fax: (441) 292-8787



STEAMSHIP MUTUAL

Managers:

Steamship Mutual Management (Bermuda) Limited
Washington Mall 1, PO Box HM 447, Hamilton HM BX, Bermuda
Tel: (441) 295 4502 Fax: (441) 292 8787

Managers' London Representative:

Steamship Insurance Management Services Limited
Authorised and Regulated by the United Kingdom Financial Services Authority
Aquatical House, 39 Bell Lane, London E1 7LU
Tel: 020 7247 5490 Website: www.simsl.com
Registered No: 3855693 England



Heather J. Cooper



BAKER LAKE AREA OPERATIONAL PROCESSES

To further support safe operations in the Baker Lake area between Woodward and Atlantic Towing, the following information and procedures will be adopted starting in the 2013 season.

1.0 COMMUNICATION PROTOCOL

Daily e-mail sent out by each vessel to all vessels by 8:00am. Distribution of e-mail would include all ATL, Woodward and Desgagnes vessels in the area.

E-mail to include:

- Current position
- ETA thru narrows
- Communication equipment status

Long Distance Communication

- Primary – satellite phone
- Secondary – Sat-C

Short Distance Communication

- VHF communication – channel 16
-

2.0 ATL COMMUNICATION INFORMATION

Atlantic Beech

- E-mail: 43252810@stratosmobile.net
- Cellular: (902) 229-3904
- Satellite: 011-8707-6481-1379

Atlantic Teak

- E-mail: 432521310@stratosmobile.net
- Cellular: (506) 343-4539
- Satellite: 011-8707-6487-5881

ATL VHF working channel is 69

WOODWARD COMMUNICATION INFORMATION

Dorsch

- E-mail: 431699913@stratosmobile.net
- Cellular: 1-709-727-6027
- Satellite: 1-613-980-6750

Nanny

- E-mail: 43169764@statosmobile.net
- Cellular: 1-709-690-4025
- Satellite: 1-613-855-6114

Alsterstern

- E-mail: 431605510@statosmobile.net
- Cellular: 1-709-541-0861
- Satellite: 1-613-855-4412

Havelstern

- E-mail: 431605711@statosmobile.net
- Cellular: 1-709-541-0083
- Satellite: 1-613-855-6115

Travestern

- E-mail: 431600532@statosmobile.net
- Cellular: 1-709-541-2029
- Satellite: 1-613-855-6121

WOODWARD VHF working channel is 10

DESGAGNES TRANSARCTIK INC.

Sedna Desgaganes

- E-mail: captain.sedna@desgagnes.com
- Cellular: (581) 998-3961
- Satellite: (418) 907-1134

Zelada Desgaganes

- E-mail: captain.zelada@desgagnes.com
- Cellular: (581) 998-6295
- Satellite: (418) 241-6175

Master Claude A. Desgagnes

- E-mail: captain.claudea@desgagnes.com
- Cellular: (418) 802-8596
- Satellite: (418) 907-8409

Master Rosaire A. Desgaganes

- E-mail: captain.rosairea@desgagnes.com
- Cellular: (418) 254-2355
- Satellite: (514) 907-5719

3.0 RULES OF THE WATER WAYS

Note: Outbound refers to Tanker and/ or Tug & Barge leaving Baker Lake for Helicopter Island

Inbound refers to Tanker and/or Tug & Barge leaving Helicopter Island for Baker Lake

Helicopter Island to Baker Lake

Inbound ATL Tug will contact outbound Woodward Tanker by e-mail to get its transit time thru the narrows . Tug and barge will depart Helicopter Island 3 and ½ hours prior to the transit time of the Tanker. It takes 3 hours for the Tug and Barge to reach the narrows from Helicopter Island. This allows plenty of time for all 4 vessels to transit the narrows. A couple of minutes before entering

Inbound ATL Tug and Barge **WILL ALWAYS** depart Helicopter Island prior to inbound Woodward Tanker. Inbound Woodward Tanker **WILL ALWAYS** follow inbound ATL Tug and Barge until to entrance of Baker Lake (no passing). Inbound ATL Tug and Barge and inbound Woodward Tanker will communicate on VHF channel 16 and should give a “security call” on channel 16 before entering the channel (satellite used as back up). All vessels (inbound and outbound) will use VHF channel 16 for communication (satellite used as back up).

Inbound ATL Tug and Barge will pass thru the narrows first, followed by the inbound Woodward Tanker. Outbound Woodward Tanker will pass thru the narrows next, followed by the outbound ATL Tug and Barge.

Baker Lake to Helicopter

Outbound Woodward Tanker will depart for the narrows. When reaching the narrows, outbound Woodward Tanker **WILL NEVER** proceed until inbound traffic has cleared the narrows. Outbound Woodward Tanker will hold position above the narrows just south of Bannerman Island.

Outbound ATL Tug and Barge will depart for the narrows. When reaching the narrows, outbound ATL Tug and Barge **WILL NEVER** proceed until inbound traffic has cleared the narrows. Outbound ATL Tug and Barge will hold position above the narrows just south of Bannerman Island.

Once inbound vessel traffic has cleared the narrows, the outbound Woodward Tanker will proceed thru the narrows first. The outbound ATL Tug and Barge **WILL ALWAYS** proceed thru the narrows after the outbound Woodward Tanker. All vessels (inbound and outbound) will use VHF channel 16 for communication (satellite used as back up).

FUEL HOSE POSITIONING

The fuel hose from the Woodward Tanker will be connected to the far side of the vessel away from the spud barge. The fuel hose will lay directly to shore, where a support structure will guide the fuel hose along the shore line until it mates with the shore manifold. This eliminates the risk of the ATL Tug and Barge coming into contact with the fuel hose while departing/ arriving at the spud barge. Also, a tender will be near the cargo hose with a line in order to move the hose away from the tug and barge.

In case of foul weather, where the tug and barge must cast off in a hurry, pumping operations will be suspended for a very short period of time, while the tug and barge depart.



Entry into Confined Waters

Vessel: _____
Channel/Pass/Port: _____
Date Completed: _____

Have the passage plan details been checked?

Item	Initials	Comments
Intended track verified for navigational hazards		
Paper chart track and ECS track are identical		
UKC maintained within Standing orders factoring in draft, squat and rise of tide. If this is not possible, prior clearance has been obtained from the Marine Superintendent in accordance with company policy.		
"No-Go" areas and abort positions are clearly marked on chart		
Index lines checked and characteristics of shoreline considered for radar errors		
Course alterations are within the maneuverability characteristics of the vessel including allowances for drift and wheel over delays		
The passage plan that includes this confined waters transit has been approved by the Master		

Prior to entering confined waters, have the following been prepared and checked?

Item	Initials	Comments
Call to E/R to confirm Engineer is on watch in the E/R and all systems are functioning normally		
Hand steering is engaged and both steering gear motors are running		
Thrusters are on, tested and control is on the bridge		
Primary pitch control is fully functional and on the bridge		
Sounder is switched on, recording, and the print out is signed by the OOW indicating the time, location and the direction of travel through the confined waters. If a printer is not fitted, a note to the same effect should be placed in the bell book.		
Speed log is switched on and functional		
Tide and current conditions have been checked and are suitable for the passage		
An up-to-date ice chart is available for the region and conditions are suitable for the passage		
Visibility conditions are suitable for the passage		
The Master has been informed of the upcoming passage and has assigned him/herself or the Chief Officer to the bridge during the passage		
A watchman has been placed on the bow and anchors have been prepared for immediate let-go. If not, Master must initial the line below, otherwise cross out the statement below.		
I do not feel a watchman on the bow is necessary for this passage.		
Master's Initials:		
If a watchman has been placed on the bow, a communication system has been established and tested.		
Immediately prior to entering the channel, a SECURITE call has been made to alert traffic in the vicinity.		

Notes, other precautions taken, or information about when precautions noted above must be enforced or may be relaxed

Signatures:

Watch Officer: _____ Signature: _____
Master or C/O: _____ Signature: _____



Monthly Safety Meeting Minutes

Date: _____
Time Started: _____
Vessel: _____

Purpose of Meeting

1. Review and discuss the response to the previous meetings and assign any action requested as part of a Corrective Action Plan.
2. Review and discuss any Memos, Classification Society Circulars, or amendments to the company's Safety Management System that have been implemented since the previous meeting.
3. Make general reminders and comments to the crew about safety and safety procedures on board. (ex: wear PPE, watch ice, snow on deck, reminder about crane safety)
4. Discuss incidents, injuries, accidents, and near-misses that have occurred since the previous meeting and propose corrective action to prevent reoccurrence.
5. Crew to raise and discuss new safety concerns onboard the vessel, keeping the focus on specific safety risks, potential hazards, and best safety practices, not general complaints.

Attendance (names)

Agenda

1. Minutes of previous meeting reviewed by vessel's crew.
2. Read and discuss company response to previous meeting.
3. Discuss outstanding items carried forward from previous meetings and safety items that have been resolved.
4. Review company memos, Class circulars, changes to Safety Management System, and make general safety reminders for crew.
5. Discuss risk assessments, injuries, accidents, near-misses and action to prevent reoccurrence.
6. Discuss new safety issues raised by vessel personnel.

Minutes of Previous Meeting

Minutes of previous meeting reviewed by vessel's crew.
Company response read and discussed.

Minutes of Current Meeting

Outstanding Safety Items From Previous Meetings

List items that were previously reported, but have not been closed yet. Indicate with a Yes or No if an additional response is requested from the office on the issue.

#	Safety Item	Latest Status	Response Requested? (Y/N)
1			
2			

Monthly Safety Meeting Minutes

Resolved Safety Items From Previous Meetings

List items that were previously reported, and have been resolved. Discuss the resolution and any changes in policy that have resulted.

#	Safety Item	Resolution
1		
2		

Review of Memos, Circulars, and SMS Amendments

List the item that is being discussed and any comments from the crew about how it applies to company vessels, changes to policy that may be needed to address the issue, or related concerns.

Item Discussed	Comments

Safety Reminders

List any reminders give to crew regarding safety onboard and applicable comments.

Item Discussed	Comments

Injuries, Accidents, Near-misses

List any incidents that have occurred since the previous meeting including a detailed description, and the findings of any follow-up investigation conducted. The office will follow-up on each item listed, so any suggested action to prevent reoccurrence would be helpful in improving safety policy. If the incident listed is an injury, accident or significant near-miss, please ensure the appropriate report paperwork has also been filed.

#	Incident Description	Investigation Findings	Suggested Action
1			
2			

Monthly Safety Meeting Minutes

New Safety Items Raised

List new safety items raised by the crew keeping the list focused on legitimate safety items. Non-safety related issues should be deferred to general discussion at the end of the meeting. The Master should comment on issues raised to determine if the issue can be resolved onboard. Indicate with a Yes or No if a response is requested from the office on the issue.

#	Safety Issue	Master's Comments	Response Requested? (Yes/No)
1			
2			
3			
4			

Other Comments

Meeting adjourned at:

Signatures

Safety Officer: _____

Master: _____

Appendix D

NWT/NU Spill Report Form



NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE

TEL: (867) 920-8130

FAX: (867) 873-6924

EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR		REPORT TIME		☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	REPORT NUMBER _____
	B OCCURRENCE DATE: MONTH – DAY – YEAR		B OCCURRENCE TIME			
C	LAND USE PERMIT NUMBER (IF APPLICABLE)			WATER LICENCE NUMBER (IF APPLICABLE)		
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION				REGION	
					☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN	
E	LATITUDE			LONGITUDE		
	DEGREES	MINUTES	SECONDS	DEGREES	MINUTES	SECONDS
F	RESPONSIBLE PARTY OR VESSEL NAME		RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION			
G	ANY CONTRACTOR INVOLVED		CONTRACTOR ADDRESS OR OFFICE LOCATION			
H	PRODUCT SPILLED		QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES		U.N. NUMBER	
	SECOND PRODUCT SPILLED (IF APPLICABLE)		QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES		U.N. NUMBER	
I	SPILL SOURCE		SPILL CAUSE		AREA OF CONTAMINATION IN SQUARE METRES	
J	FACTORS AFFECTING SPILL OR RECOVERY		DESCRIBE ANY ASSISTANCE REQUIRED		HAZARDS TO PERSONS, PROPERTY OR EQUIPMENT	
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS					
L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE	
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE	

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY		POSITION		EMPLOYER		LOCATION CALLED		REPORT LINE NUMBER	
			STATION OPERATOR				YELLOWKNIFE, NT		(867) 920-8130	
LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC					SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN			FILE STATUS ☐ OPEN ☐ CLOSED		
AGENCY		CONTACT NAME			CONTACT TIME		REMARKS			
LEAD AGENCY										
FIRST SUPPORT AGENCY										
SECOND SUPPORT AGENCY										
THIRD SUPPORT AGENCY										

Appendix E

General Response Procedures for Spilled Chemical Substances

Explosives

E.1 Ammonium Nitrate

E.2 Ammonium Nitrate Fuel Oil (ANFO)

E.1 Ammonium Nitrate

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank camp.

The first step against prevention of potential spills and association hazards is the application of proper storage procedures for bulk Ammonium Nitrate, including the following:

- Good housekeeping of the storage facility will prevent spilling and or contamination of materials;
- Ammonium nitrate should be stored away from combustible materials and fuels, as well as other blasting accessories (i.e. boosters, delays, detonating cords and detonators);
- The storage facility should be well ventilated;
- Proper signage restricting the use/exposure of ammonium nitrate to ignition sources should be posted (e.g. no hot work, smoking or vehicle maintenance); and
- The storage facility should be locked at all times with only authorized personnel allowed access.

The following is a general spill response procedure for ammonium nitrate. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required. AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For an ammonium nitrate spill (solid):

- 1) Isolate and evacuate the spill area;
- 2) Contact your Supervisor who will then contact the On-Scene Coordinator and coordinate appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 3) Put on appropriate personal protective equipment. For an ammonium nitrate spill this includes:
 - a) Gloves **as recommended by the MSDS or glove manufacturer;**
 - b) Protective eyeglasses or chemical safety goggles or face shield **as recommended by the MSDS;**
 - c) Lab coat, coveralls or TyvekTM coveralls **as recommended by the MSDS; and**
 - d) Half mask air-purifying respirator with cartridges and/filters **as recommended by the MSDS or respirator manufacturer;**
- 4) Ventilate (open windows/doors to outdoors) closed spaces before entering;
- 5) Remove all sources of heat and ignition (no smoking, flares, sparks or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.) from spill area;
- 6) For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using suitable absorbent materials, soil or other appropriate barrier;
- 7) Vacuum or sweep the spill residue using non-metal, non-sparking tools and place the residue in a labelled,

plastic, container (plastic pail with lid or double heavy duty plastic bags) for re-use or off-site disposal at a licensed disposal facility;

*Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines**.*

Note: Minimize dust generation during the operation.

- 8) Remove and bag personal protective equipment for cleaning and disposal at a licensed facility. Thoroughly wash potential skin contact locations after handling.

E.2 Ammonium Nitrate Fuel Oil (ANFO)

Currently no ANFO is stored at the site. ANFO is fabricated as required, with ammonium nitrate and fuel oil. In the event that ANFO would be stored at the camp, AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project. Proper handling and disposal of ANFO is an important first step in mitigating against spills and associated hazards.

The proper storage procedures are as follows:

- ANFO should only be used under the supervision of authorized trained personnel;
- ANFO should be kept away from heat, sparks, and flames, as well as initiating explosives, oxidizing agents, combustibles, and other sources of heat;
- Containers should be protected from physical damage and in dry, well ventilated conditions;
- Transportation to the Mine site will be in accordance with Section 14 of the *Mines Act* and Regulations and the *Transportation of Dangerous Goods Act*. Transport vehicles will be in sound mechanical condition and equipped with proper safety equipment. Loaded vehicles will not be left unattended and only authorized personnel will be responsible for the security of the explosives under their control; and
- Explosives that have been identified as deteriorated or damaged will need to be disposed of or destroyed. The appropriate method of disposal or destruction and subsequent course of action will be determined by authorized personnel or the explosive supplier.

The following is a general spill response procedure for ammonium nitrate fuel oil – ANFO. The following procedure does not apply to emulsions or other explosives. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required. AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For an ANFO spill (solid):

- 1) Isolate and evacuate the spill area;
- 2) Immediately extinguish any open flames and remove ignition sources (no smoking, flares, sparks in immediate area) IF SAFE TO DO SO. **Fires involving large quantities of ANFO should not be fought;**
- 3) Contact the On-Scene Coordinator who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 4) Put on appropriate personal protective equipment. For an ANFO spill this includes:
 - a): Gloves **as recommended by the MSDS or glove manufacturer;**
 - b) Protective eyeglasses or chemical safety goggles or face shield **as recommended by the MSDS;**
 - c) Lab coat, coveralls or TyvekTM coveralls **as recommended by the MSDS;**
 - d) Shoe covers or rubber boots;
 - e) Half mask air-purifying respirator with cartridges and/filters **as recommended by the MSDS or respirator manufacturer;**

- 5) If the spill has occurred outdoors, stay upwind and avoid low lying areas. Ventilate (open windows/doors to outdoors) closed spaces before entering. Ensure adequate explosion proof ventilation for clean-up;
- 6) Remove all sources of heat and ignition (no smoking, flares, sparks or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.) from spill area;
- 7) Do not operate radio transmitters within 100 m of electric detonators;
- 8) For spill on land, protect the spill area from storm water runoff by constructing a ditch or dike using suitable absorbent materials, soil or other appropriate barrier. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;
- 9) Collect, sweep or shovel spilled material and the other contaminated material/soil using non-metallic, spark-proof tools and place residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility;

*Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines**.*

Note: The drums/containers/residues are to be stored in ventilated areas away from incompatible materials for eventual off-site disposal at a licensed disposal facility.

- 10) Remove and bag personal protective equipment for cleaning or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated leather articles including shoes that cannot be decontaminated.

Appendix F

General Response Procedures for Spilled Chemical Substances

F.1 Compressed Gases

E.1 Compressed Gases

AEM commits to review, modify and approve as required to establish this procedure as appropriate for Meadowbank Gold Project.

The following is a general spill response procedure for compressed gases. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required. AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a compressed (inert and flammable) gas leak:

- 1) IF SAFE TO DO SO and it will stop the gas leak, turn off cylinder valve;
- 2) If the leak cannot be stopped by closing the cylinder valve, and it is **an inert atmospheric gas** (e.g. nitrogen, carbon dioxide, etc.) isolate and evacuate the affected area. If the leak is a **flammable gas** and the leak is outside of a ventilated building enclosure that will contain the gas, immediately activate the fire alarm system and evacuate the area/building;
- 3) Contact the On-Scene Coordinator who will assemble spill response team members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 4) If possible and safety permits, adjust leaking cylinder so that gas escapes rather than liquid;
- 5) If possible and safety permits, eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area) and turn off electrical equipment;
- 6) If the spill has occurred outdoors, stay upwind and avoid low lying areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, then it may also be necessary to have it shut-down. Allow vapours to ventilate outdoors by opening windows and doors to the exterior; and
- 7) Isolate area until gas has dispersed. On-Scene Coordinator to verify safe conditions.

Appendix G

General Response Procedures for Spilled Chemical Substances

G.1 Flammable and Combustible Liquids

G.1 Flammable and Combustible Liquids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project. The following is a general spill response procedure for flammable or combustible liquids, particularly petroleum hydrocarbon products. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a spill of flammable or combustible petroleum hydrocarbon product (liquid):

- 1) Isolate and evacuate the spill area;
- 2) Immediately extinguish any open flames and remove ignition sources (no smoking, flares, sparks in immediate area) IF SAFE TO DO SO;
- 3) Stop leak and contain spill (**see Step 9**) IF SAFE TO DO SO;
- 4) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 5) Put on appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
 - a) Gloves **as recommended by the MSDS or glove manufacturer**;
 - b) Splash goggles or face shield;
 - c) Shoe covers or rubber boots;
 - d). Lab coat or TyvekTM coveralls; and
 - e) Half mask air-purifying respirator with **organic vapour or combination** cartridges, or **as otherwise recommended by the MSDS or respirator manufacturer**.
- 6) If the spilled has occurred outdoors, stay upwind and avoid low lying areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, then it may also be necessary to have it shut-down;
- 7) Ventilate (open windows/doors to outdoors) closed spaces before entering. Ensure adequate explosion-proof ventilation for clean-up. A vapour suppressing foam or water spray may be used to reduce vapours;
- 8) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area) and combustible materials (wood, paper, oil, etc.) within the spilled area;
- 9) Contain spill by using spill absorbent, spill pads or pillows, soil or snow to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. If possible, compact soil or snow dikes, and place plastic tarps over the dike and at its foot to allow the product to pool on the plastic for easy recovery;

Note: Do not use paper towels to absorb spill as this increases the rate of evaporation and vapour

concentration in the air.

Note: Do not flush with water into drainage areas or ditches as this will spread spill.

Note: Snow works well as a natural absorbent to collect and contain spilled petroleum hydrocarbons. However, its use in containing a spill will result in a water-contaminant mixture that may be more difficult to manage. It is important to scrape up the contaminated snow and ice as soon as possible.

- 10) Carefully cover the spill area with spill absorbent, spill pads, soil or snow, starting at the outside and working inward. Do not touch or walk through spilled material;
- 11) Sweep up or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags). For larger spills to land, excavate impacted absorbent material and soil, place in lined and bermed temporary storage area or directly into sealed drums/containers;

Note: The drums/containers/residues are to be stored in ventilated areas away from incompatible materials for eventual treatment at on-site landfarm or off-site disposal at a licensed disposal facility. Electrically ground all containers and transporting equipment.

Note: Larger pools of product may be pumped into empty storage tanks or drums.

- 12) If spill is indoors, mop the affected area using detergent and water. Dispose of this water to drums for eventual off-site disposal at a licensed disposal facility. Spills to land may require further excavation or remediation of contaminated soil until acceptable soil quality is achieved. The On- Scene Coordinator and/or Environmental Superintendent will assess this requirement;
- 13) For spills to water, immediately limit the area of the spill on water using absorbent pads and booms and similar materials to capture small spills on water. Deploy and slowly draw in absorbent booms to encircle and absorb the spilled product. Recover larger spills on water with floating skimmers and pumps, as required, and discharge recovered product to drums or tanks;

Note: Petroleum hydrocarbons are generally hydrophobic, and as such, do not readily dissolve in water. They typically tend to float on the water's surface. Absorbent booms are often relied on to recover hydrocarbons that escape land containment and enter water.

Note: Antifreeze sinks and mixes with water. If released to water, attempt to isolate/confine the spill by damming or diverting the spill. Pump contaminated water to tanks or drums.

- 14) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated leather articles, (including shoes) that cannot be decontaminated.

Appendix H

General Response Procedures for Spilled Chemical Substances

Oxidizing Substances

H.1 Liquids

H.2 Solids

H.1 Liquids

AEM commits to review, modify and approve as required and to establish this procedure as appropriate for use at the Meadowbank Gold Project. The following is a general spill response procedure for liquid oxidizer compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a liquid oxidizer spill:

- 1) Isolate and evacuate the spill area;
- 2) Stop leak and contain spill (**see Step 8**) IF SAFE TO DO SO;
- 3) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 4) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
 - a) Gloves **as recommended by the MSDS or glove manufacturer**;
 - b) Splash goggles or face shield;
 - c). Shoe covers or rubber boots;
 - d) Lab coat, coveralls or TyvekTM coveralls **as recommended by the MSDS**; and
 - e) Half mask air-purifying respirator with cartridges and/or filters **as recommended by the MSDS or respirator manufacturer**.
- 5) Ventilate closed spaces before entering. Ensure adequate explosion-proof ventilation for clean-up;
- 6) Remove and/or moisten with water any combustible material (wood, paper, oil, etc.) affected by the spill;
- 7) Use water spray to reduce vapours or divert vapour cloud drift, if required;
- 8) Contain spill by using non-combustible spill absorbent, soil or snow to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate;

*Note: Flushing area with flooding quantities of water may also be appropriate assuming this does not make clean up and waste management more difficult– **refer to the MSDS.***
- 9) Carefully cover the spill area with spill absorbent, soil or snow, starting at the outside and working inward. Use non-combustible absorbent. Do not touch or walk through spilled material.
- 10) Sweep up or shovel the spill residue using non-metal, non-sparking tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for off- site disposal at a licensed disposal facility;

- 11) For indoor spills, mop the affected area using detergent and water. Flushing area with flooding quantities of water may also be appropriate – **refer to the MSDS**. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate. Spills to land may require further excavation or remediation of contaminated soil until acceptable soil quality is achieved. The On- Scene Coordinator and/or Environmental Superintendent will assess this requirement; and
- 12) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

H.2 Solids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project.

The following is a general spill response procedure for solid oxidizer compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a solid oxidizer spill:

- 1) Isolate and evacuate the spill area;
- 2) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 3) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
 - a) **Gloves as recommended by the MSDS or glove manufacturer;**
 - b) Safety glasses or goggles;
 - c) Lab coat; and
 - d) Half mask air-purifying respirator with **N95 or greater protection** particulate filter or **as recommended by the MSDS or respirator manufacturer.**
- 4) Remove all sources of heat and ignition (no smoking, flares, sparks or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.) from spill area;
- 5) For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using suitable non-combustible absorbent materials, soil or other appropriate barrier. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;
- 6) Vacuum, sweep or shovel the spill residue using non-metal, non-sparking tools and place the residue into a labelled, plastic, container (plastic pail with lid or double heavy duty plastic bags) for re- use or off-site disposal at a licensed disposal facility;

*Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines.***

Note: Minimize dust generation.

- 7) If there is still oxidizer residue left in the spill area, neutralize with appropriate agent **as recommended by the MSDS**, or for spills to land continue to excavate until no visible spilled solid remains. Use non-combustible spill absorbent or soil to absorb the neutralized residue. Place in suitable drums/containers for disposal to a licensed facility;
- 8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary

sewer, process stream or waste drums as appropriate; and

- 9) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

Appendix I

General Response Procedures for Spilled Chemical Substances

Poisonous and Toxic Substances

I.1 Sodium Cyanide

I.1 Sodium Cyanide

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project. The following is a general spill response procedure for solid Sodium Cyanide.

AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a Sodium Cyanide (solid) spill:

- 1) Isolate and evacuate the spill area;
- 2) Contact the On-Scene Coordinator who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 3) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
 - a) Impermeable Gloves **as recommended by the MSDS or glove manufacturer;**
 - b) TyChem; and
 - c) SCBA – Self Contained Breathing Apparatus
 - d) Rubber Boots

Note: For worker safety, maintain readily accessible supply of cyanide response kits on site.

- 4) Ventilate area of spill or leak;
- 5) Avoid exposure to acids, water or weak alkalis which can react to form toxic hydrogen cyanide (HCN) gas.
- 6) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using absorbent materials, soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent subsequent runoff. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;
- 7) Shovel the spilled material into labelled drums, containers or plastic bags for re-use or off-site disposal at a licensed disposal facility.

*Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines.***

Note: Minimize dust generation.

- 8) If there is still spilled sodium cyanide residue left in the spill area, neutralize with appropriate agent **as recommended by the MSDS** (sodium or calcium hypochlorite solution), or for spills to land continue to excavate until no visible spilled solid remains. Use suitable spill absorbent or soil to absorb the neutralized residue. Place in suitable drums/containers for disposal to a licensed facility. Collect material and place in a closed container for recovery or disposal;

IMPORTANT: It is strictly prohibited to add any chemicals or neutralizing solutions to a Sodium Cyanide Spill near a drainage system, or near or in a water body.

- 9) For indoor spills, mop the affected area using detergent and water. Dispose of this water to waste

drums/containers for disposal to a licensed facility; and

- 10) Remove and bag personal protective equipment for disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

Appendix J

General Response Procedures for Spilled Chemical Substances

Corrosive Substances

J.1 Acids, Liquids

J.2 Acids, Solids

J.3 Bases/Alkali, Liquids

J.4 Bases/Alkali, Solids

Response to Spilled Chemicals

IMPORTANT: *It is strictly prohibited to add any chemicals or neutralizing solutions to a Spilled Chemicals near a drainage system, or near or in a water body.*

1.1 Acids, Liquids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project.

The following is a general spill response procedure for liquid acid compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required. AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a liquid acid spill:

- 1) Isolate & evacuate the spill area;
- 2) Stop leak and contain spill (**see Step 8 below**) IF SAFE TO DO SO;
- 3) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 4) Put on appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
 - a) Gloves **as recommended by the MSDS or glove manufacturer**;
 - b) Splash goggles or face shield;
 - c) Shoe covers or rubber boots;
 - d) Lab coat or TyvekTM coveralls; and
 - e) Half mask air-purifying respirator with **acid gas or combination** cartridges, or **as otherwise recommended by the MSDS or respirator manufacturer**.
- 5) If the spill has occurred outdoors, stay upwind and stay out of low areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, then it may also be necessary to have it shut-down;
- 6) Ventilate (open windows/doors to outdoors) closed spaces before entering;
- 7) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area);
- 8) Contain spill by using spill absorbent, spill pads or pillows, or dry soil to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. Ideally, use spill absorbent that contains a mild neutralizing agent **as recommended by the MSDS**;

*Note: Many acids, particularly concentrated acids react violently in the presence of water. Do not flush spill area with water unless the **MSDS** indicates acceptable.*

Note: Nitric Acid reacts violently and explosively with organic chemicals and organic material such as wood, cotton and paper; therefore, do not use organic absorbent material on Nitric acid.

Note: Hydrofluoric acid will fume during neutralization. Provide adequate ventilation and approach from upwind. Neutralize carefully with sodium bicarbonate, soda ash or lime. Use water spray to disperse the gas/vapour if required. Remove all sources of ignition.

- 9) Carefully cover the spill area with spill absorbent, spill pads or dry soil, starting at the outside and working inward. If practical, neutralize spill using **MSDS-recommended** or commercially available neutralizers. Use pH indicator paper to determine if spill is neutralized (pH 7);

Note: Use caution as neutralization reactions generate heat.

- 10) Sweep or shovel the neutralized spill residue using non-metal, non-sparking tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility;
- 11) Check the pH of the spill area. If it is less than pH 6, then further neutralize with a dilute solution of a suitable reagent **as identified on the MSDS** or for spill to land continue to excavate contaminated soil;
- 12) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate;
- 13) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated; and
- 14) After the spill has been cleaned up, the area should be free of vapours. However, if personnel note odours or irritation, isolate the spill area; re-clean the area as per **Steps 11 and 12** or wait at least **1 hour** before re-entering or until considered safe by the On-Scene Coordinator or Environmental Superintendent.

J.2 Acids, Solids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use on the Meadowbank Gold Project.

The following is a general spill response procedure for solid acid compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a solid acid spill:

- 1) Isolate and evacuate the spill area;
- 2) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 3) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
 - a) **Gloves as recommended by the MSDS or glove manufacturer;**
 - b) Safety glasses or goggles;
 - c) Lab coat; and
 - d) Half mask air-purifying respirator with **N95 or greater protection** particulate filter, or **as otherwise recommended by the MSDS or respirator manufacturer.**
- 4) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using absorbent materials, dry soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent reaction and/or subsequent runoff. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;
- 5) If necessary to minimize dust production, slightly moisten the solid. Use water, or if the material is water reactive, another inert liquid **as recommended by the MSDS;**
- 6) Sweep up or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for reuse or off-site disposal at a licensed disposal facility;

*Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines.***

- 7) Remaining solid acid residue may be neutralized using a dilute solution of appropriate agent **as recommended by the MSDS** (e.g. sodium bicarbonate - baking soda), or for spills to land continue to excavate until no visible spilled solid remains. Check the pH of the spill area; the final pH should be between pH 6 and 10. Use spill absorbent, spill pads or dry soil to absorb the neutralized residue;

Note: Use caution as neutralization reactions generate heat.

- 8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate; and
- 9) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

J.3 Bases/Alkali Liquids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank exploration camp.

The following is a general spill response procedure for liquid alkali or base compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a liquid alkali or base spill:

- 1) Isolate & evacuate the spill area;
- 2) Stop leak and contain spill (**see Step 8**) IF SAFE TO DO SO;
- 3) Contact the On-Scene Coordinator who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 4) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
 - a) Gloves **as recommended by the MSDS or glove manufacturer**;
 - b) Splash goggles or face shield;
 - c) Shoe covers or rubber boots;
 - d) Lab coat or Tyvek™ coveralls; and
 - e) Half mask air-purifying respirator with cartridges/filters **as recommended by the MSDS or respirator manufacturer**.
- 5) If the spill has occurred outdoors, stay upwind and stay out of low areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, then it may also be necessary to have it shut-down;
- 6) Ventilate (open/windows to outdoors) closed spaces before entering;
- 7) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area) and combustible materials (wood, paper, oil, etc.);
- 8) Contain spill by using spill absorbent, spill pads or pillows, or dry soil to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. Ideally, use spill absorbent that contains a mild neutralizing agent **as recommended by MSDS**;

Note: Use caution as neutralization reactions generate heat.

- 9) Carefully cover the spill area with spill absorbent, spill pads or dry soil, starting at the outside and working inward. If practical, neutralize spill using MSDS-recommended or commercially available neutralizers. Use

pH indicator paper to determine if spill is neutralized (pH 7);

Note: Use caution as neutralization reactions generate heat.

- 10) Sweep or shovel the neutralized spill residue using non-metal, non-sparking tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility;
- 11) Check the pH of the spill area. If it is greater than pH 10, then further neutralize with a dilute solution of a suitable reagent **as identified on the MSDS**, or for spill to land continue to excavate contaminated soil;
- 12) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate;
- 13) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated; and
- 14) After the spill has been cleaned up, the area should be free of vapours. However, if personnel note odours or irritation, isolate the spill area; re-clean as per **Steps 11 and 12** or wait at least **1 hour** before re-entering or until it is considered to be safe by the On-Scene Coordinator or Environmental Superintendent.

J.4 Bases/Alkali Solids

AEM commits to review, modify and approve as required to establish this procedure as appropriate for use at the Meadowbank Gold Project.

The following is a general spill response procedure for solid alkali or base compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

AEM commits to review and test, and if necessary, modify and update this spill response procedure on an annual basis.

For a solid alkali or base spill:

- 1) Isolate and evacuate the spill area;
- 2) Contact the On-Scene Coordinator who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken;
- 3) Put on the appropriate personal protective equipment. Depending on the scale of the spill and properties of the spilled substance, this can include:
 - a) **Gloves as recommended by the MSDS or glove manufacturer;**
 - b) Safety glasses or goggles;
 - c) Lab coat; and
 - d) Half mask air-purifying respirator with **N95 or greater protection** particulate filter or **as recommended by the MSDS or respirator manufacturer.**
- 4) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from storm water runoff by constructing a ditch or dike using absorbent materials, dry soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent reaction and/or subsequent runoff. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination;
- 5) If necessary to minimize dust production, slightly moisten the solid. Use water, or if the material is water reactive, another inert liquid **as recommended by the MSDS;**

Note: Do not use water to flush bases in powdered form, such as calcium oxide (lime), as this material is not very soluble.
- 6) Sweep or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled, plastic, waste container (plastic pail with lid or double heavy duty plastic bags) for offsite disposal at a licensed disposal facility;

*Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and **clearly label the container per WHMIS Guidelines.***
- 7) Remaining solid alkali or base residue may be neutralized using a dilute solution of appropriate acid. Check the pH of the spill area; the final pH should be between pH 6 and 10. Use spill absorbent, spill pads or dry soil to absorb the neutralized residue;

- 8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate; and
- 9) Remove and bag personal protective equipment for cleaning, informing laundry personnel of contaminant hazards, or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

Appendix K

Agnico Eagle Spill Response Training Records

Group Training Report



Course Name: Emergency Planning and Spill Response Awareness

Trainer's Name: Trever Miller

Date: Jan. 15/2013

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours		Total Hours	Code
					TRG.	ASS.		
	1	Jeffrey Pratt	AEM		☐	☐	10	
	2	Fanny Laporte	AEM		☐	☐	10	
	3	RICHARD JACKSON	AEM		☐	☐	10	
	4	Tom Thomson	AEM		☐	☐	10	
	5	MAURICE BARRIEN	AEM		☐	☐	10	
	6	DAVID ALEXANDER	AEM		☐	☐	10	
	7	Martin Theriault	AEM		☐	☐	10	
	8				☐	☐		
	9				☐	☐		
	10				☐	☐		

COMMENTS:

Trainer's signature:

Date: January 15, 2013

Codes:

1. AEM Permit
2. Restrictive Permit
3. Temporary Permit
4. Training Completed
5. Training Not Completed
6. Fail

Assessment Codes:

- A+: Very Good
A: Good
B: Average
C: Below Average

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

Km 23 - Bridge 3

1. List the **issues** linked to this scenario:

Response Time + Moving Equipment/Resources to the Area
Light + Temperature
Fish Bearing Stream
Speed of Containment/Cut off Point
Vast Contaminated area - Type of Contaminate
* Safety of Personnel, Communications, Environment,
Equipment



2. What resources are required?

Baker Lake Contractor / Peters Exp.
Baker Lake Command Center, Camp, at Spill Location
Ert Personal + Relieve
Emergency Trailer - Environmental
Emergency C-Cons / Roll offs
Lighting / Generators
Transportation
Safety officer(s)
AEM Personal from Baker Lake
Mapping of Area

3. What are the initial spill response steps and what does your ICS look like?

3rd Control / Crisis Centre
On Site Commander
Baker Lake
Logistic, Planning, Finance

i) Review ERP + Spill Contingency Plan
Prepare J.H.A on Spill

Establish Safety Zones - Hot, Warm, Cold

4. What is your oil spill containment and recovery strategy?

Shut off / Stop Spill - Identify Source

Contain Spill - Trench & Baffle (POE)

Maritime Booms & Absorbents

Estimate Direction of spill & find a cut off points

By Using 10-30-4 - Protect Shoreline and diverting flow

* Pre plan - Plan it now

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Vacuum Pump, Absorbents, Oil/Water Separator

- Vegetated / Rocky Shorelines - Excavate cont Soil

- Sample & Monitored until we have clearance from DFO, ENV Canada

- Do a quick wash & leave it for Bio remediation

6. What are some **safety** issues?

~~Drinking Water~~ Drinking Water - Baker Lake

Temperature + H+S of Response Team
LEL's
water + Ice

7. How do you manage your **waste**?

Quatrex, 45 Gallons, oil/water separator

Contaminated Soil pad

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Additional
Same as #3 - Notify Proper Personal / Authorities
DFO, EC, Baker Lake Res.

Fanny Laporte.

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- 45 000 Litres KM 23
- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
 - **Spill** - occurred 22:00 hrs on March 20, 2013
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KM 23.

1. List the **issues** linked to this scenario:

- Contamination Communication issue
- Back to land / water contamination / wildlife.
To Whitefish Lake (Fishing major site for inv.)
 - Time of day and distance from camp.
 - March → still snow – could be cold.
 - Accident → Health & Safety (Driver) and the Responder
 - Acid → add another safety issue ↓ less.
 - Baker Lake water intake
 - Public relation case / inform the lobby appropriate person Community



2. What resources are required?

* 60 people ↓

- Labor → with incident Command Plan / everybody ✓
has a task in the organization / ERT Team.
- Command center trailer & facilities close to site ✓
↳ could be a container, heated
- decontamination area.
- Machinery → loader → Truck → Shovel. ✓
- Disposal and containing material DRUMS / 45 Gall
(benzene - secondary material) Vacuum - emergency trailer
with supply.
- Towerlight → because it is right ✓
helicopter for next morning. Zodiac empty tanker.

3. What are the initial spill response steps and what does your ICS look like?

- Info. ①
- Command ICS:
- MSDS Sheets - Planning - Logistic
 - JHA
 - S.R.P spill response plan. / ERP. / SRP /
- ② Find resources / General Briefing.
- ③ Logistic and reassess at all change (F.L.R.A.)
- ↳ operations.
 - Isolation
 - Contain
 - Recovery - Remediate
 - Wildlife
 - Waste management
 - Sampling.

Level 3 SPILL
Emergeng

Because it
is night and
impact can
be
disastrous



4. What is your oil spill containment and recovery strategy?

- ① DA → Make the environment safe for me and my Team - Gas det for - PPE
- ② Stop the leak
- ③ dig a ~~ditch~~ trench to protect the water (shore)
- ④ evaluate where the contaminant are
→ wind → slope → current.
- ⑤ Instal maritime barriers to contain the biggest part of the oil.
- ⑥ Snow barrier if needed.
- ⑦ cut all entries to other ponds and rivers
- ⑧ Vacuum the contaminant and dispose the waste adequately.
- ⑨ transport what is still in the tanker to another container

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- Tundra / Rock ✓ trenches / bell hole.
- Inspect the shore / contain with maritime barrier.
- Monitoring often and sample ✓
- When melting / sample and vacuum if needed.
- let nature take over.
- if too much → excavate the shore ✓ and remove contaminant. and dispose

6. What are some safety issues?

Under the ice. → leave it.

→ LEL / Fire / toxic Gases.

→ Water / ice / cold for response team and equipment.

→ darkness → uneven Ground / strain ankle

7. How do you manage your waste?

45 Gall.

used Fuel → sent back south to appropriate place

used absorbant supply → ship down south in Quadrex material → Land farm brought to

Clean and rinse - PPE

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

see # 4 ~~answer~~ answer. ✓

→ cut the Hamlet Water intake. ✓

inform additional Authorities.

Skimming Vessels

Boats. V V J



Jeff Pratt

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the issues linked to this scenario:

- 90km from mine
 - Dark out
 - Very Cold
 - Vicinity to lake
- low tide will suck out



2. What **resources** are required?

- Personnel
- Command center both on site & Baker Lake
- Lightening
- Amenities for personnel
- Spill Response Equipment
- Transportation

3. What are the **initial spill response steps** and what does your ICS look like?

- Alert ERT and immobilize
- Alert ICS
- ICS - Review of Spill Contingency - Planning for mobilization
- ERT Captain would assess situation and report incident command

4. What is your oil spill containment and recovery **strategy**?

- ~~Cont.~~ Stop the release - Plug hole or build berm.
- Contain release - Do Not Let Enter Lake
 - Place boom along ~~mouth~~ deltas from the tributaries.
 - Have to create ice road to down stream collection point.
 - ~~Use~~ Extract contaminant from down stream boom point.*

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- Create Hot, Warm, Cold Zones
- Rocky Sandy Substrate
- Leave to summer Volatilize

6. What are some **safety** issues?

- No light
- Cold Weather
- PPE for Chemicals

7. How do you manage your **waste**?

- Quatrex bags
- Totes for liquid Contaminants

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
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- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the issues linked to this scenario:

- BL water intake
- impact to the land / to the water
- Going towards white hills lake (fishing lake)
- Distance from camp / time of event / Weather ~~at the~~
- H/S for the driver and responder + possible acid reaction
- Spreading of cont.
- Wildlife (fish)
- Public relationship (what have the appropriate person)
- Dispersion
- communication, Road Access



2. What resources are required?

- Equipment : Boat, Maritime Barrier, Shovel, truck, Quadrex
waste disposal, secondary containment, Spot (toward light)
Vacuum (Emergency trailer)

Decontamination unit, Commandement unit

- Personnel : Labour, ERT, IC, public relationship

helicopter

3. What are the initial spill response steps and what does your ICS look like?

Planning { MSDS sheet, JHA, ERP, SRP,

Logist. { General Briefing
Find resource and equipment and make them available

Operation → Field Level Risk Assessment

↳ Isolation - contain - recovery ~~at~~ Wildlife - Waste Management
sampling

Reassess between field and Management by IC.

4. What is your oil spill containment and recovery strategy?

Make sure everything is safe, gas detector, PPE ect.

~~WASH IT~~ Plug the hole / Stop the leak

Dig a ditch ^{trench} close to the shore

Evaluate the location of the contaminate in the water

Install maritime barrier to enclose ^{isolate} the leaking shore

Cut all entries to other channels

Vacuum the accumulate diesel / transfer the diesel
left in the tanker

Adequately dispose the waste

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

inspect the shore, keep the maritime barrier containing the fuel close to shore, monitor and sample if needed, vacuum, let nature take over

If too much contaminant keep coming from the underground, dig everything

6. What are some safety issues?

- LEL / fire / toxic gases
- WATER / ICE
- cold weather
- heavy equipment
- Uneven soil, darkness (strain ankle)

7. How do you manage your waste?

- used fuel send back south to appropriate location
- Absorbant stuff used ^(quadvex) burned or ship down south
- Contaminated soil send to landfarm
- Rinse all the PPE

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

See question #4

R. Jackson

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

23

24

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the issues linked to this scenario:

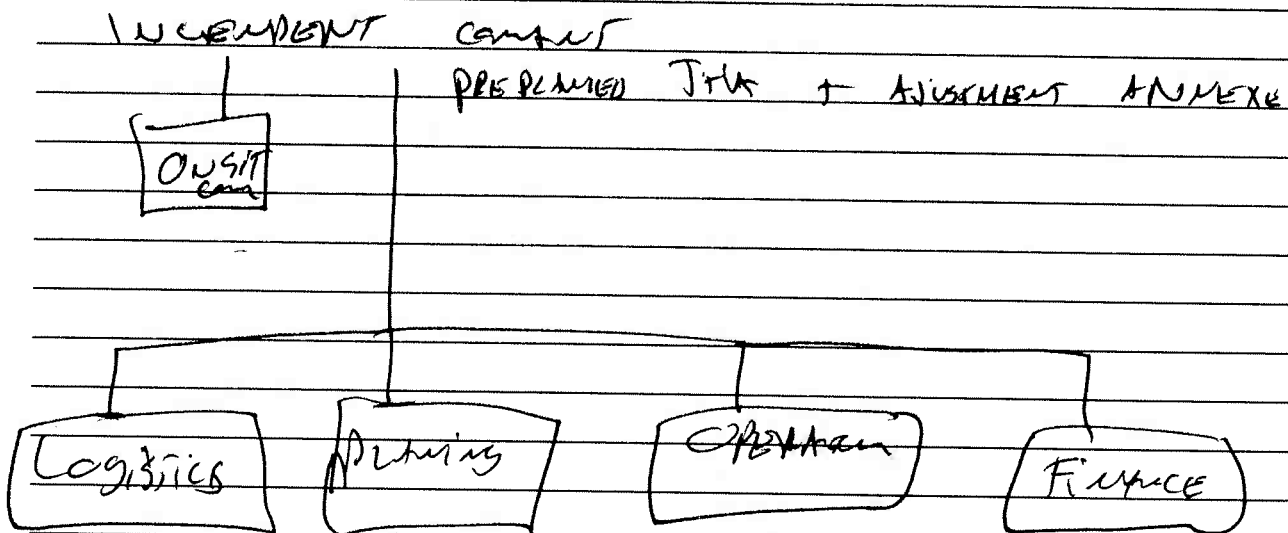
- RESPONSE TIME
- MOVING RESOURCES + EQUIP
- LIGHT FINDER
- FISH BREWING
- SPEED OF CONTAINMENT
- VAST CONTAMINATED AREA
-



2. What resources are required?

- BACS + PETER EXPORTING HEAVY EQUIPMENT
- ERT PERSONNEL + RELIEF PERSONNEL
- COMMAND CENTER ON SITE + AT CAMP
- EMERGENCY SEA CANS ROLLOFF PLOT
- LIGHTING GENERATORS
- INFORMATION + SAFETY OFFICER
- MAPPING OF THE AREA

3. What are the initial spill response steps and what does your ICS look like?



R1

4. What is your oil spill containment and recovery strategy?

CONTAIN SPILL (STOP SPILL AT THE SOURCE)
PREVENT FURTHER ENTRY/ TRAP/ BELL HOLE
ESTIMATE DIRECTION OF SPILL MARITIME ROUTING
FIND COORDINATES
By using 10/20/40 RULE DIRECT FLOW TO AND
PROTECT SENSITIVE LINE

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- VACUUM PUMP
- PADS
- SORBENTS
-

6. What are some **safety** issues?

LET
COLD TO
LOW VOLTAGE
CONTAMINATION
FIRE
WATER OVER RUN

7. How do you manage your **waste**?

QUANTON ROCK
45 GAL DRUMS
OIL WASTE SEPARATION
CAR MAINTENANCE SOIL PADS

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

D. ALEXANDER

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the **issues** linked to this scenario:

Water infiltration 90km away
Sound alarm Pitch DARK
Extreme cold EMERGEN
Set-up block before river enters INTO BAKER LAKE
Low tide when it comes will make it worse



2. What **resources** are required?

~~ERT RESPONSE - ALERT BAKER LAKE FIRE DEPT.~~
COMMAND CENTRE AT MEADOW + BAKER
LIGHTING
WARM-UP FOR STAFF
SPILL RESPONSE EQUIP.
TRANSPORT FROM MINE
50-60 people / h/d off at MB

3. What are the **initial spill response steps** and what does your ICS look like?

~~ALERT ERT~~ ALERT ERT, INCL. ENVIRO, MINE SUPER,
H+S SUPER, SITE SERVICES MR
REVIEW CONTINGENCY PLAN, PLANNING FOR MOBILIZATION
ERT CAPTAIN - WITH ENVIRO, WOULD ASSES REPORT
BACK TO THE ICS

4. What is your oil spill containment and recovery strategy?

Stop ~~contain~~ SPILL CONTAIN from entry into LAKE.

→ CLOSURE THE HOLE IN TRUCK OR BUILD BERM
→ CREW ASSIGNED.

- INSTALL BERM ALONG THE DELTA MOUTH OF THE RIVER JUST BEFORE IT ENTERS THE LAKE
- MAKE ICE ROAD TO DOWNSTREAM COLLECTION POINT
- WITH VACUUM TRUCK
- ESTABLISH ZONES

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

ROCKY, SANDY SUBSTRATE, WAIT TIL SUMMER
VALITISE.
ZONE OFF.

6. What are some **safety** issues?

- PITCH DARK - Need
- Cold weather
- PROPER PPE

7. How do you manage your **waste**?

- VACUUM TRUCK

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

CEMULDSE BOOMS

M. BARIBANU

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the **issues** linked to this scenario:

- 90 kms from site
- Pitch dark, Very cold.
- Sanitary to Lake.
- ⇒ Set up on site operational Post.
- ⇒ Low tide will draw water away.
- ⇒



2. What resources are required?

- Manpower - 6
- Boat, Light tower, amenity.
- Baler lake free dirt.
- Personnel transportation.
- Mean of communication.
- Small loader, Vacuum Truck.

3. What are the initial spill response steps and what does your ICS look like?

- Set up ICS.
- H&S, Environmental, HR, Site Services, General Services, spill.
- Review emergency contingency plan.
- Plan mobilization. → ERT Captain assess situation and Report, →

4. What is your oil spill containment and recovery **strategy**?

Stop the Release, prevent further entry
- shut off flow, Build Barrier,
→ Block off.

Make sure lead to collection Pond;

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Rocky Sand Monitor leave till
Summer.

6. What are some **safety** issues?

- Measure ice thickness,
 - wear proper PPE,
 - lightning,
 - cold weather,
 - wind
- assess zoning

7. How do you manage your **waste**?

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Group Training Report



Course Name:

Trainer's Name:

Date:

2013-01-16

Agnico-Eagle Mines Ltd.
Meadowbank Division

M		Name	Company	Signature	Hours		Total Hours	Code
					TRG.	ASS.		
	1	Jamie Kataluk	AEM	<i>Jamie Kataluk</i>	☐	☐	10	
	2	Robin Alard	AEM	<i>Robin Alard</i>	☐	☐	10	
	3	Dave Holmstrom	AEM,	<i>Dave Holmstrom</i>	☐	☐		
	4	ALAIN GENESSE	A-E-M	<i>Alain Genesse</i>	☐	☐		
	5	Stéphane Larose	AEM	<i>Stéphane Larose</i>	☐	☐		
	6	LUC BLANCHETTE	FGL	<i>Luc Blanchette</i>	☐	☐		
	7				☐	☐		
	8				☐	☐		
	9				☐	☐		
	10				☐	☐		

COMMENTS:

Trainer's signature: _____

Date: _____

Codes:

1. AEM Permit
2. Restrictive Permit
3. Temporary Permit
4. Training Completed
5. Training Not Completed
6. Fail

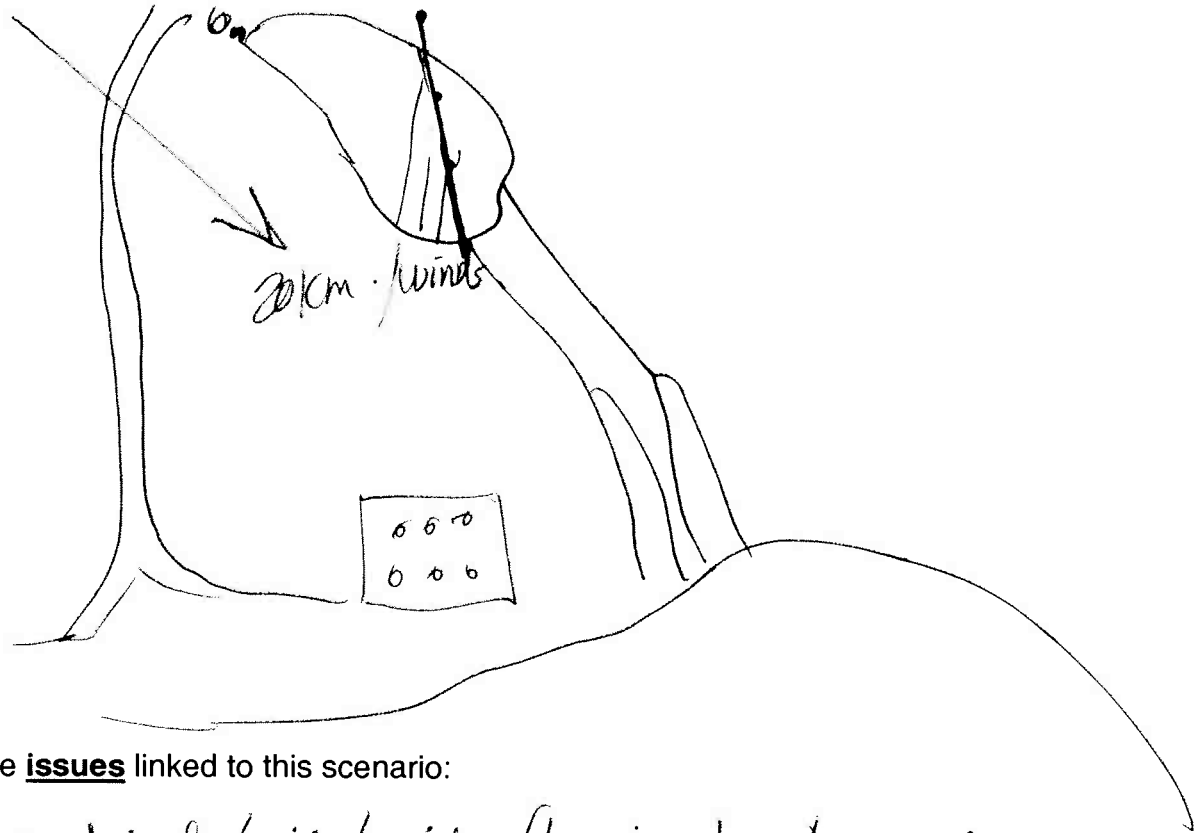
Assessment Codes:

- A+: Very Good
A : Good
B : Average
C : Below Average

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
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- **Lake** – winds from the North West at 20 km/hr. Tide is high.



1. List the **issues** linked to this scenario:

- 45 m³ diesel/oil/acid flowing to the river heading to Baker Lake. (15 km away)
- Give less than 3 hours to react.
- Contain the spill before the lake (Before to 2 rivers)
- Secure and take care of the driver.

2. What **resources** are required?

- Helicopter to have look on the scene (Speed of the spill)
- 1 team at the scene (accident) to contain the spill at the source
- 1 team further down to stop the flow before the lake.
- Boats / maritime barrier / boom, etc... light plan
- ERT Team in case of fire.
- empty tanker to pump in.
- Good communication
- MSDS → Proper PPE

3. What are the **initial spill response steps** and what does your ICS look like?

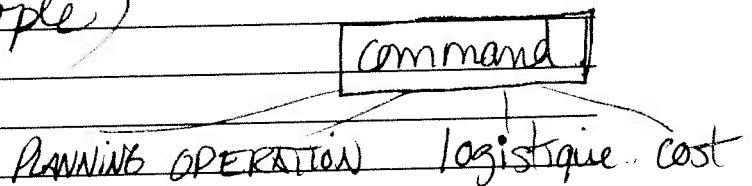
- Scene survey (analyse) (inspection)

- Make the plan (planning)

- Decision (delegate people)

- execution

- Call proper authority



Safety first!!!

4. What is your oil spill containment and recovery **strategy**?

- Install barrier before the rivers (less contamination)
- Recover the fuel/oil (Skimmer)

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- Assess the shoreline situation and ask trained people to evaluate if we need to clean and what we have to do.
- Flush
- Is it transferable?

6. What are some **safety** issues?

- Risk of fire
- Falling into water / ice
- poor visibility at night.
- Hypothermia
- Hot water.
- PPE (:

7. How do you manage your **waste**?

- Bring to the proper facility disposal (ENV. DEPT.)
(QUATREX BAGS)

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

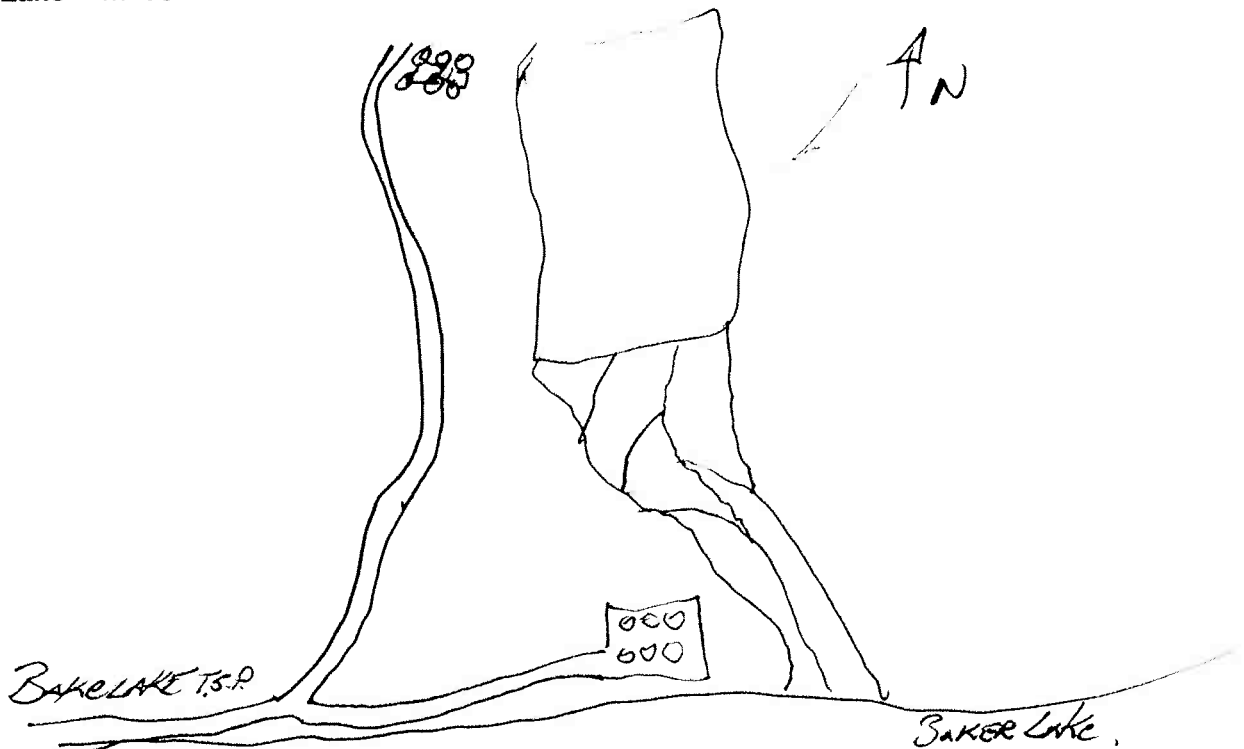
- Protect the water intake of the town.
- Do whatever it takes at all cost.
- Inform community

Dave Holmstrom.

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
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- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.



1. List the issues linked to this scenario:

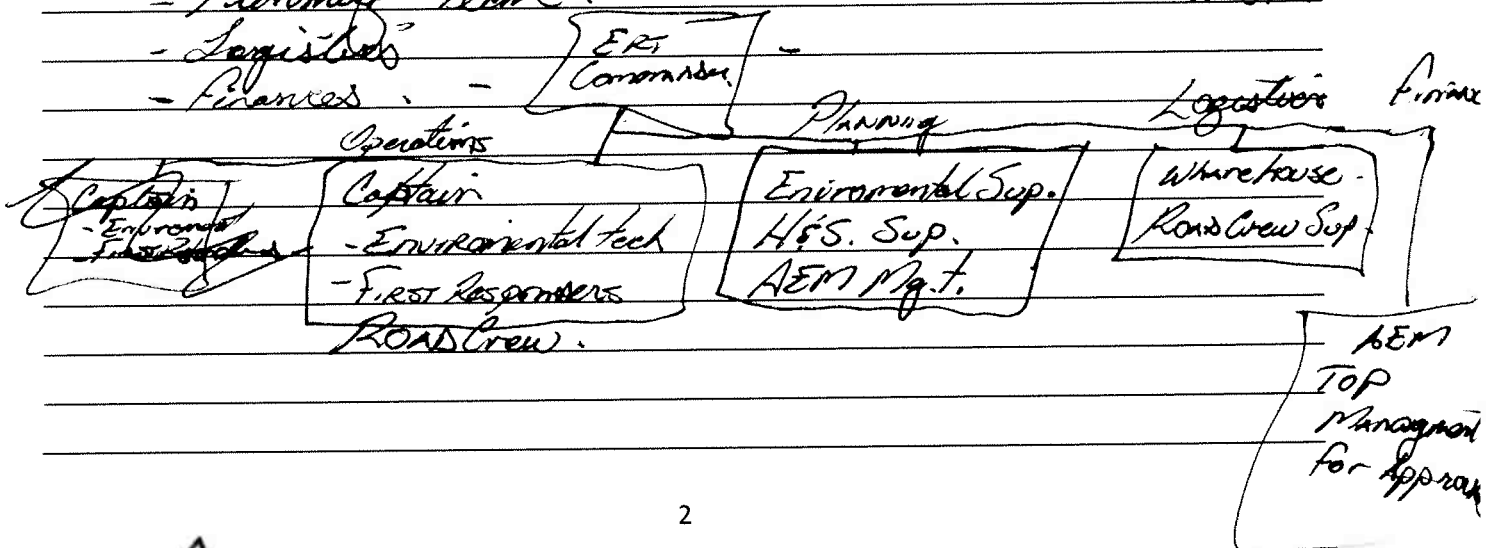
- Potential Risk to Baker Lake portable drinking water.
- Fast moving water (FRESHET). High travel rate / ICE,
- Potential impact to spawning grounds.
- IS IT STOPPED? - TRUCK Rollover *** Contained
- What are the sensitive areas.
- Time Frame / Braided channel extends shoreline
- L.E.H.?
- Road Traffic / Security

2. What resources are required?

- pump trucks - helicopter, - boat
- personal facilities - food, PPE, Bathroom - B
- personal - cleanup, communication, H&S, Environmental.
- stop & containment resources - booms, pumps, earth
- ~~stop~~ - ~~stop~~ ~~containment~~ resources - booms, pumps, earth
- ERP ~~Plan~~ Spill contingency Plan, OPEP, JHA.
- WHMIS,
- Level 1, for first 6 hours Level 2 After.
- TIER 3 response, initially

3. What are the initial spill response steps and what does your ICS look like?

- Call appropriate personnel.
- Evaluate Spill - Immediate danger threat level.
- ~~Identify~~ Identify Incident Command Team - With ERP
 - Operations personnel.
 - Planning Team.
 - Logistics
 - Finance
- Spill response plan
- JHA



4. What is your oil spill containment and recovery strategy?

- STOP Source

- Based on Evaluation = contain Establish Booms for River Containment
 - Recover land based spills using
 - haul truck, hoe, loader if flat
 - create ditch pump oil from there.
 - Water containment - skimmer cleanup.
 - pump from bottom of V, U, S, Boom.
 - Install booms at 90°/30° of 4.
 - install proper bell hole pump from there.

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

Shoreline types.

Rock
Tundra, Creeches.

Using SCAT.

Identified shoreline types - rock - nothing
- Tundra - Abrasives
* and natural recovery
- is it transferable.

6. What are some **safety** issues?

- LEL, Benzine,
- Tired personnel.
- recovery of truck
- water & ice operations - ~~PEP~~? Assessment.
- other road traffic.
- Possibility of community water supply
- Wild Animals.

7. How do you manage your **waste**?

Hazmat / Quasrex / TOTES / DRUMS / Soil / PAH
Soil tanks, Incinerate.

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

- U-Boom
- V-Boom.
- S-Boom.
- Corral it.
- Install Booms @ P.O.E.

Robin ALARD

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

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- **Lake** – winds from the North West at 20 km/hr. Tide is high.

1. List the issues linked to this scenario:

Flow in River.	Safety Barrier
→ close Baker Lake - Potential	
→ Ice → Flow Erosion	LEL ISSUE
→ Potential Impact to Wildlife	
Stop possible or not +	
Sensitive Area	High Flow.
TIME FRAME	
+ Surface for Braided.	
Rock runs.	



2. What **resources** are required?

→ Pump truck / Machinery
Personal facilities: Food / PPE / Rest
HR
Spill - Stop / contain ment resources / Lights
Helicopter
Communication
H/S
Environment Dept / Rep.
Documentation (ERP / Spill / OPEP) - JHA / BOAT
WHMIS

TIER III / →

3. What are the **initial spill response steps** and what does your ICS look like?

Evaluate / call
→ STOP if possible / Safety ERP / Spill RP /
immediate Payer

→ ICS

→ SET - OCC

O	P	C	F
Capt.	Env	Wash	Management
Task	~~Wash~~	P/L	
Responders	H/S		
Salvage			
Load			

4. What is your oil spill containment and recovery strategy?

- Prevent from going to WATER.
- Brown for containment.
- Recover Truck / DITCH / VAC TRUCK
HOE - IF POSSIBLE

→ WATER CONTAINMENTS - Bottom / End.
→ collect. Sludge

Protect Shore line

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

SCAT.
Rocks / Organic Matter -

→ No SHEEN / Small. minimal.

Tool - Nothing
eg → Shovel / m Machine

TRANSFER

6. What are some safety issues?

Tired

Recovery of truck

ON WATER/ICE OPERATION/ assessment.

↳

FAST WATER

DRINKING WATER.

7. How do you manage your waste?

HAZMAT / QUADREX / TOTES / DRUMS
GSP

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

✓ Boom

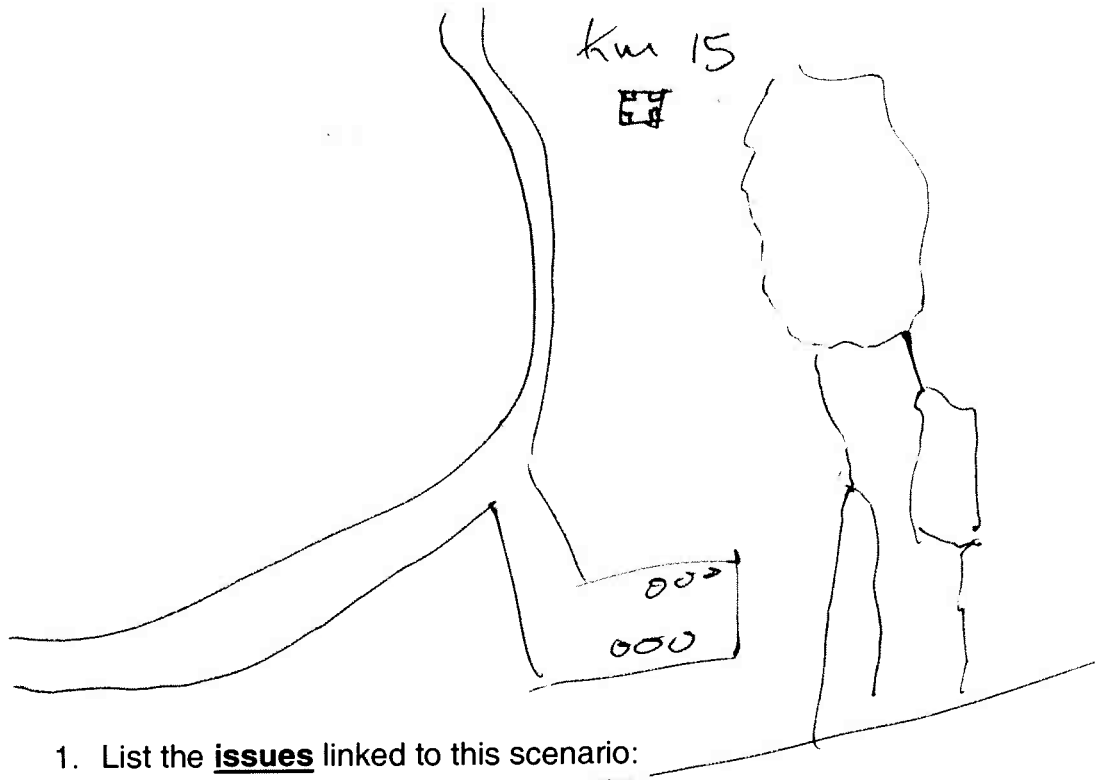
✓ Boom

✓ Boom.

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on ^{June} March 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.



1. List the issues linked to this scenario:

- POSSIBLE CONTAMINATION OF COMMUNITIES WATER SUPPLY
- FRESHET WILL MAKE IT HARDER TO COLLECT CONTAMINANTS.
- BRAIDED CHANNELS INCREASE THE CHANCES OF MORE CONTAMINATED AREA
- MAY DISTURB SPAWNING AREAS → FISH
- TIDES WILL INCREASE THE CONTAMINATION OF SOIL.
- SHORT TIME FRAME
- SAFETY OF THE DRIVER
- LEL'S
- OTHER ROAD USERS .

2. What resources are required?

- HEAVY EQUIPMENTS TO BUILD TRENCHES
- ENOUGH MATERIAL TO DO ENTIRE CLEANUP. (LAND & RIVER)
- PROPER PPE TO PROVIDE TO ALL PERSONEL
- ENOUGH MATERIAL TO DISPOSE CONTAMINATED MATERIAL (TOTES, SEALED DRUMS)
- ADEQUATE MATERIAL TO BRING CONTAMINATED MATERIAL TO WINE SITE.
- SAFETY MONITORING DEVICE BEFORE STARTING ANY CLEANUP.
- PROPER COMMUNICATION.
- MSDS.
- MATERIAL TO MOVE THE TRUCK.
- H&S AND ENVIRONNEMENT PERSONNEL.
-

3. What are the initial spill response steps and what does your ICS look like?

- CODE 1 RADIO CALLED
- IC INFORMS TEAM OF SITUATION AND DOES HEADCOUNT BEFORE DEPLOYING TEAM
- COMMAND CENTRE SET UP - INCLUDE MANAGEMENT TO ASSISTS IN DECISION
- MONITOR AND DEVELOPE A SAFETY ZONE IN THE SPILL AREA.
- IDENTIFY HAZARDS.

COMMAND

4. What is your oil spill containment and recovery strategy?

- PREVENT FURTHER ENTRY.
- BUILD TRENCHES OF BARRIERS TO AVOID THE SPREADING OF THE SPILL.
- PLACE BOOMS INSIDE BARRIERS TO PICK UP CONTAMINANTS
- ONCE BOOMS ARE FULL - REPLACE WITH NEW ONES. PLACE CONTAMINATED BOOMS IN PROPER CONTAINERS.
- SEND QUADREX BAGS TO MINE SITE AND PLACED INSIDE SEACHANS, PROPERLY LABELLED
- WATER → PLACE MARITIME BARRIER INSIDE LAKE.
- PLACE BOOMS OR ABSORBENTS ON SHORE TO PROTECT SOIL ALSO ALONG MARITIME BARRIERS.

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- ASSES THE SHORELINE.
- FLUSH THE SHORELINE
- STOP THE CLEANING WHEN CONTAMINANTS IS NOT TRANSFERABLE.

6. What are some safety issues?

- TIREDNESS OF THE CREW

- LEL'S

- REMOVAL OF THE TRUCK

- WORK ON ICE AND NEAR FAST WATER.

- WILDLIFE

7. How do you manage your waste?

- PUT IT INTO DRUMS OR TOTES TO BURN IT OR
STORE IT — A MINE SITE.

- IF IT HITS THE WATER, SET UP A V, J OR U Boom.

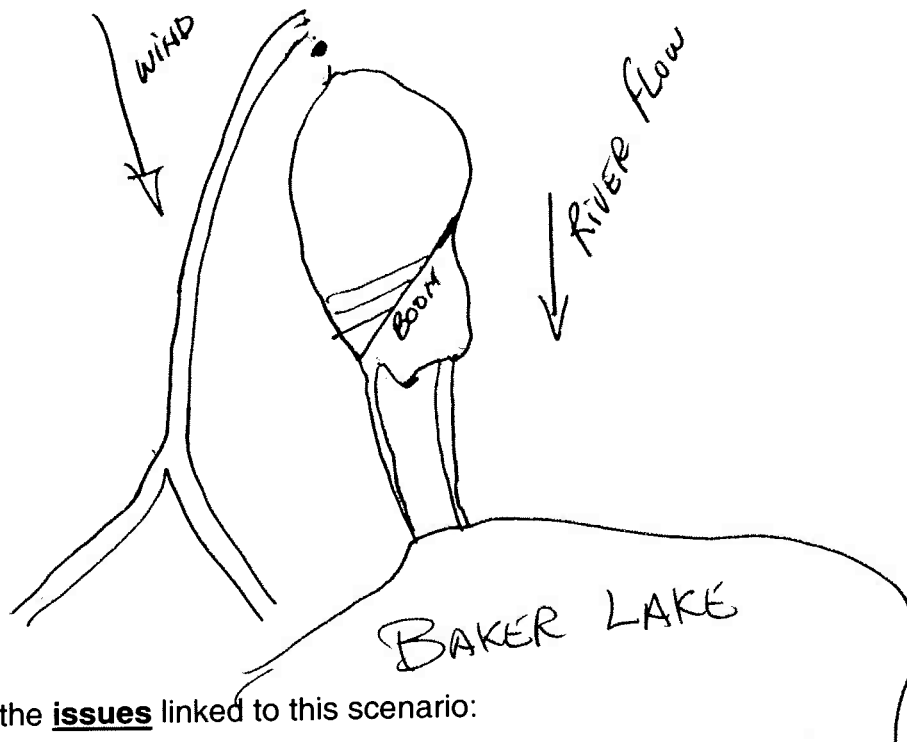
8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

SET UP A V, J OR U Boom.

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on ~~March~~^{June} 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.



1. List the issues linked to this scenario:

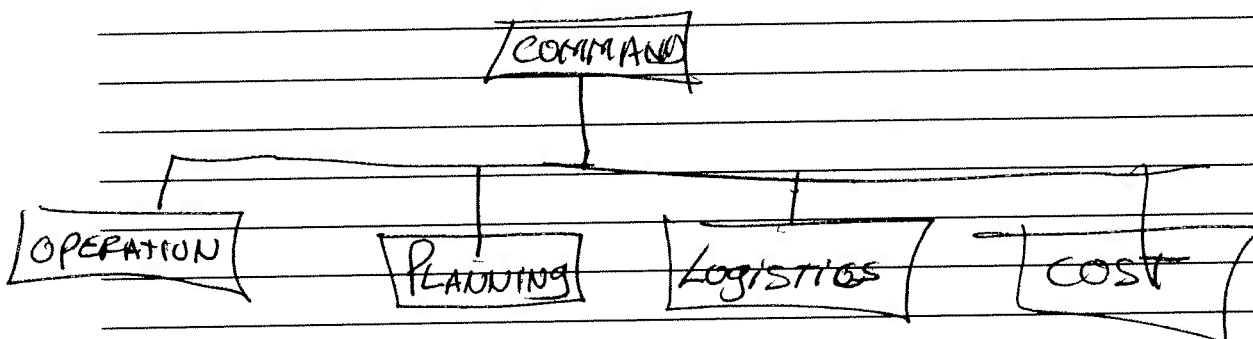
- DIESEL FLOWING INTO THE RIVER, HEADING TO BAKER LAKE (15 KM AWAY) giving us LESS THAN 3 HRS TO CONTAIN THE SPILL BEFORE IT GETS TO THE LAKE.
- ISOLATE THE VEHICLE.
- MAKE SURE THE DRIVER IS OK.

2. What resources are required?

- HELICOPTER TO ASSESS THE SPILL ON THE RIVER AND THE ACTUAL SPEED OF THE SPILL.
- A TEAM OF RESPONDERS AT THE ACCIDENT TO CONTAIN THE SPILL AT THE SOURCE.
- ANOTHER TEAM FURTHER DOWN STREAM BEFORE THE LAKE TO PREVENT ANY SPILL INTO THE LAKE
- NEED BOATS, MARITIME BARRIERS, SKIMERS, LIGHT PLANTS
- E.R.T. TEAM IN CASE OF FIRE
- M/T TANKER TRUCK TO PUMP THE REST OF THE LOAD
- M.S.D.S. - P.P.E.

3. What are the initial spill response steps and what does your ICS look like?

- ANALYZE THE SCENE, DELEGATE PEOPLE
- MAKE A PLAN, MAKE A DECISION, TAKE ACTION
- CALL PROPER AUTHORITY ~~IN CASE OF~~
- SAFETY



4. What is your oil spill containment and recovery strategy?

- INSTALL BOOM ACROSS THE RIVER (POND) BEFORE IT GETS INTO THE 2 RIVERS (CREEK) AND THE BIG LAKE

FABRICATE A BERM

10-30-4 BARRIER

5. What is your strategy for shoreline cleanup operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

- ASSESS THE SHORELINE SITUATION, ASK TRAINED PEOPLE TO EVALUATE IF WE NEED TO CLEAN, IF YES WHAT IS THE BEST WAY TO DO IT. (ANY FRAGILE SYSTEM)

- IS IT TRANSFERABLE? YES OR NO

6. What are some safety issues?

- RISK OF FIRE
- FALLING INTO WATER
- DEALING WITH POOR VISIBILITY (DARK AT NIGHT)
- WATER & ICE
- POTABILITY

7. How do you manage your waste?

- BRING TO THE PROPER DISPOSAL FACILITY.

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

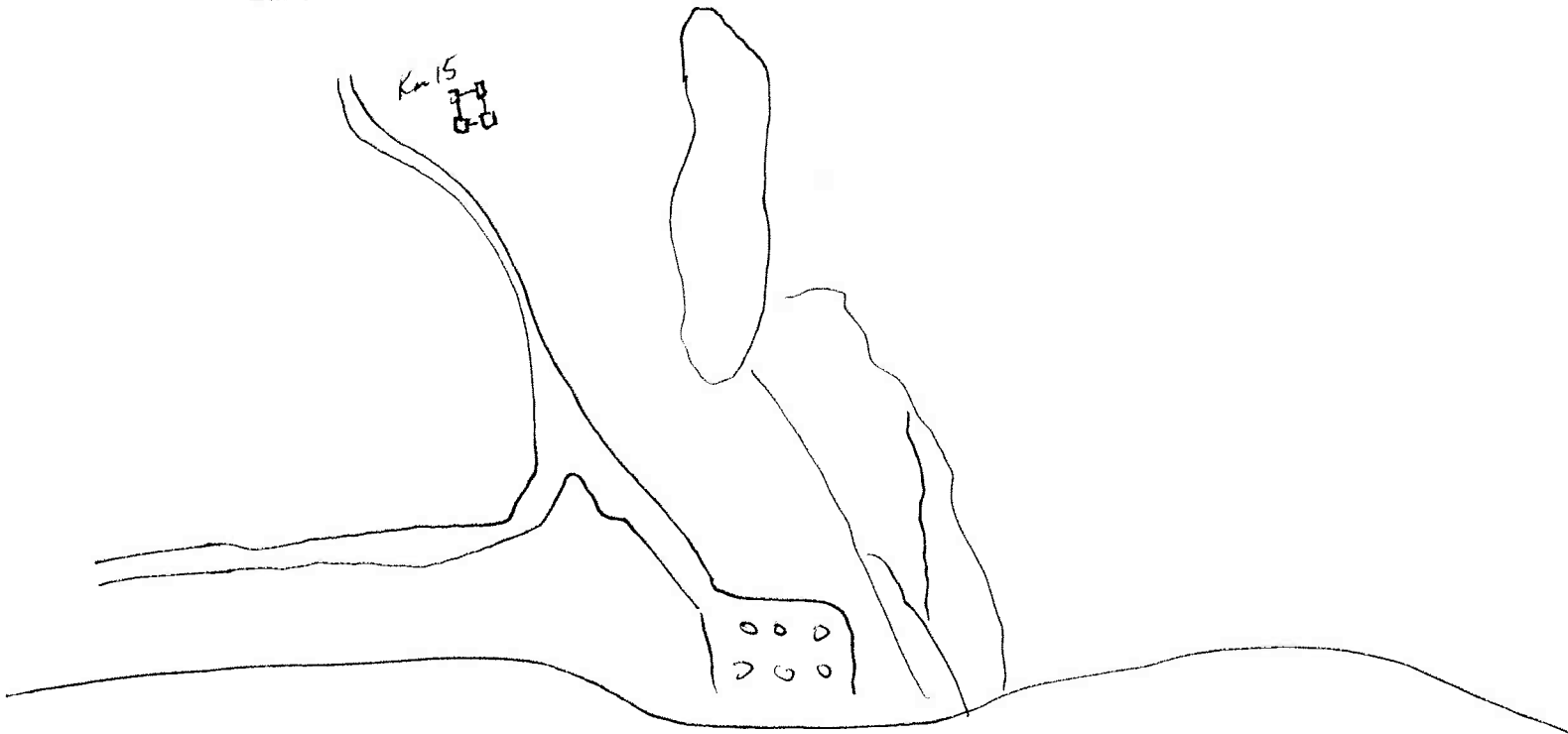
- PROTECT THE WATER INTAKE FOR THE TOWN
- DO WHATEVER IT TAKES AT ALL COST.
- INFORM THE COMMUNITY.

- U-BOOM, V-BOOM, J-BOOM

SWAT OILSPILL ISSUES WORKSHOP

Situation Analysis – Truck Rollover *considered Tier 3 incident*

- **Incident** - 45 m³ diesel spills/plus oil/acid – Originates on Land, flows into the River
- **Spill** - occurred 22:00 hrs on ~~March~~^{June} 20, 2013
- **River** – water flow, 5 km/hr, braided channels; approx 15 km to Baker Lake
- **Lake** – winds from the North West at 20 km/hr. Tide is high.



1. List the **issues** linked to this scenario:

possible contamination of community's water supply
freshet will make it harder to collect contaminants
braided channels - increases chances of more contamination area
may disturb spawning areas - fish
tides will increase contamination of soil
response time
other road users

2. What **resources** are required?

heavy equipment to build trenches (COMMS) ERP
enough material to do entire clean up
proper PPE for all ~~person~~ personnel
enough material to dispose contaminated material - totes, sealed drums
adequate equipment to bring contaminated material to mine site
safety monitoring devices before starting any clean up

3. What are the **initial spill response steps** and what does your ICS look like?

- Code 1 on radio called - safety
- IC informs team of situation and does a head count before deploying team
- command centre setup - include management to assist in decisions
- ~~develop~~ develop a safety zone in spill area

4. What is your oil spill containment and recovery **strategy**?

- had - build bell holes or barriers to avoid spreading of contaminants*
- place booms inside barriers to pick up contaminants*
- once booms are full, replace with new ones - place contaminated booms into Quattroex bags*
- send Quattroex bags to mine site and placed inside seacans - properly labelled*

water - place maritime barrier inside lake
place booms along shore to protect soil - also along maritime barrier collect

5. What is your strategy for shoreline **cleanup** operations; if using SCAT what are the forecasted shoreline types, what is your treatment options for each type and what is your end point criteria

6. What are some **safety** issues?

LEL

fatigue

water and ice

removal of truck

other road users

fast water

wildlife

7. How do you manage your **waste**?

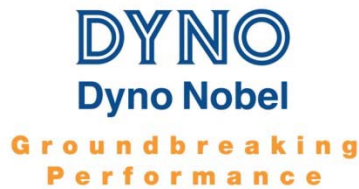
place contaminated material - rags, booms - inside Quattroex bags

send bags to mine site - placed into Seacans

8. If it were to make it to the lake what is your containment, recovery, cleanup and general overall response?

Appendix L

Dyno Nobel Emergency Response Plan



EMERGENCY RESPONSE PLAN



Meadowbank Mine Site.

Magazine, Plant and Work Sites

This Emergency Response Plan (ERP) addresses incidents and potential incidents involving the manufacturing, handling and storage of explosives and related products in Dyno Nobel Canada Inc.' magazines, plants and worksites. This ERP has been developed for Dyno Nobel Canada Inc. and all of its wholly-owned subsidiaries (DNX Drilling). Actions detailed within this plan are compulsory, under the approval and authorization of DNCI's Regional Operations Managers.

"This document, as presented on Dyno Nobel's database, is a controlled document and represents the version currently in effect. All printed copies are uncontrolled documents and may not be current".

Note: Information provided within this document may be privileged and is not intended for general distribution.

Publication/Amendment

<u>Date</u>	<u>Changes To Prior Edition</u>	<u>Pg.</u>
15 Oct 03	New document	All
26 Apr 04	Amendment # 1 Renumbering of Appendices 6 - 13 Miscellaneous Typos & Amendment Dates	App. 7 - 14 All
17 March 08	Amendment #2 Updated Contact information Addition of definitions Included Calling and responding emergency procedures Addition Duties of Key personnel Addition of response to Natural disasters Addition of visitor and contractors access control - Replaced the Appendices and renumbering Included a Emergency Report form Addition of Nitric acid, Aluminum and Diethylene glycol and CFE Addition of alternate methods of communication Addition of Reportable Substance list Miscellaneous Typos & Amendment Dates	All
August 18, 2010	Amendment #3 Updated Scope and ERP Outline Added Sign-off sheet for Annual Fire Department Review Added Appendix for Employee Training sign-off Updated Reporting Incidents Flowchart Updated procedure for Raw Material Truck Spills Updated Bomb Threat Checklist	
February 14, 2011	Amendment #4 Updated site contacts Updated site evacuation & Muster locations	
July 14, 2011	Amendment #5 Updated site contacts Updated site evacuation & muster loaction (Map drawn) Site specific emergency procedures	

Table of Contents

Section	Topic	Pg.
1.0	Scope	4
2.0	Related Documents	4
3.0	ERP Outline	4
4.0	Preparation and Planning	6
5.0	Training	7
6.0	Emergency Procedures and Lines of Authority	8
6.1	Duties Of Key Personnel	8
Table 6-1	Flow Chart	9
6.2	Fire & Explosives	13
Table 6-2	Fire Fighting Information	15
Table 6-3	Control Measures	16
Table 6-4	Evacuation Distances	18
6.3	Environmental Releases	19
Table 6-5	Environmental Release Procedures	20
6.4	Security	21
6.5	Bomb Threat	21
Table 6-6	Bomb Threat – Conversation Guidelines	21
6.6	Lines of Authority	22
7.0	Notification and Reporting	23
Table 7-1	Reportable Substances Quantity List	25
8.0	Decontamination	27
9.0	Work Site Closure / Shut Down	27
10.0	Response to Natural Disaster Preventive Measures	28
11.0	Work Site Start Up	29

Work Site Phone Numbers and Magazine / Plant Details

- Appendix 1 DNCI Emergency report form
- Appendix 2 DNCI Corporate Contacts
- Appendix 3 ERA Contact List
- Appendix 4 Management and Site Contact list
- Appendix 5 Site Information
- Appendix 6 Bomb Threat Checklist
- Appendix 7 New/Transferred Employee or Annual Refresher Form
- Appendix 8 Annual Fire Department Review Form
- Appendix 9 TDG Regualtion Class Quantity Emission Limit
- Appendix 10 Evacuation/Muster locations

1.0 SCOPE

This document provides a Work Site Emergency Response Plan covering fire/explosion, spills, security breach, bomb threat, evacuation and prescribed actions that employees must take to ensure employee and public safety in the event of an emergency. The general reference to DNCI's "Work Sites" throughout this document includes magazines, plants and miscellaneous work locations.

The Emergency Response Plan appearing on Dyno Nobel Canada Inc.' database is a controlled document. Uncontrolled copies of this ERP are provided to customers and associates who own the land on which DNCI's worksite is located, plus applicable municipal and regulatory authorities. As well, uncontrolled copies are issued to all Company employees and are placed in all central offices and Company delivery vehicles.

2.0 RELATED DOCUMENTS

The following documents also relate to emergency situations that can arise and should be held at each Work Site:

- Federal, Provincial and Municipal regulations, standards and guidelines
- Corporate Policies plus HSE Management System Standards & Procedures
- Standard Operating Procedures (SOP's)
- Dyno Nobel General and Specialized Work Rules
- Material Safety Data Sheets
- Prime Contractor's / Customer's ERP
- Transportation ERAP #2-1037
- Crisis Communication Plan

3.0 ERP OUTLINE

3.1 The following materials are covered by this ERP:

Fuel Oil
ATF Hydraulic Fluid
Ammonium Nitrate Prills and Solution
Sodium Nitrite
Sodium Thiocyanate
ANFO
Emulsion
Packaged Explosives
Detonators
Diethylene glycol

3.2 The following situations are addressed in this ERP:

- Fire / Explosion
- Storage Tank Failure
- Spills from Product Delivery Trucks
- Spills from Raw Material Delivery Trucks
- Process Spills
- Shut down due to weather, floods, lightning, fires, explosions and other threats to the security and operation of DNCI's facilities, equipment and material.
- Bomb Threats
- Quantities of spills and reportable to Dyno Nobel and authorities

3.3 This ERP covers:

Preparation	Reporting
Training	Waste Disposal Permits
Lines of Authority	Containment
Notification	Inspection
Decontamination	Maintenance

3.4 The following definitions apply to this plan:

DNCI Corporate contact : A DNCI corporate employee who is assigned to receive Emergency Calls at all times from the answering service.

ER Advisor: Emergency Response Advisor (ERA), who will normally be the applicable General Manager, Area Manager, or Technical Advisor who will liaise with First Responders.

OSC: (DNCI) On Scene Coordinator, the Senior DNCI employee at an incident site who manages and controls DNCI resources in support of First Responders and incident recovery.

ERT: Emergency Response Team, DNCI personnel dispatched to an incident site to assist First Responders and conduct incident recovery under the direction of the OSC.

4.0 PREPARATION AND PLANNING

- 4.1 In order to provide competent emergency response at Dyno Nobel Canada Inc. magazines, plants and worksites, first responders (local fire departments and mine rescue personnel) must be thoroughly briefed on an annual basis of the potential hazards involved in a Dyno Nobel Canada Inc. worksite fire. To this end, Work Site Supervisors must take fire department plus mine safety and security representatives on an annual magazine/plant tour to view:

Explosives Storage Areas	Evacuation (Meeting) Area
Bulk Emulsion Equipment	Communications Equipment
ANFO Blending Area	Facility Layout
Fire Fighting Equipment Sites	(Waste) Burn Facilities

A record of each explosives worksite tour and the names of the first responder representatives attending are to be documented and kept on file.

Annual Fire Department Review Form (Appendix 9)

- 4.2 All DNCI employees shall review this ERP on an annual basis and participate in ERP drills / exercises when scheduled.
- 4.3 All worksite accidents involving fire, explosion, reportable spills/emissions, breaches of security and bomb threats are to be reported to applicable authorities and senior management. As per incident reporting procedure
- 4.4 Spill procedures for each of the materials listed in section 3.1 are outlined in Table 6-3. All procedures specify: Method of Cleanup, Method of Disposal and Protective Clothing. Based on the procedures presented in Table 6-3, worksite supervisors must ensure that adequate clean-up equipment and materials are readily available and in good condition.
- 4.5 Worksite information for each of DNCI's facilities is contained in the attached appendices. The ERP is revised whenever significant changes are made.
- 4.6 Current Material Safety Data Sheets (MSDS) are to be kept at each Work Site for all hazardous materials that are stored and handled at the Work Site. Copies of current product MSDS' are also made available to customers and landowners. Obsolete MSDS' will be replaced as new ones are issued.

- 4.7 Each Work Site will hold and maintain in good repair, appropriate fire fighting and spill control equipment for potential emergencies. Fire extinguishers, hoses and other fire fighting equipment are to be visually inspected on a monthly basis to ensure Magazine, Plant, Work Site and delivery vehicle readiness.

5.0 TRAINING

- 5.1 All employees will complete training on the contents of this Plan during their “new hire” orientation and review the plan annually.
- 5.2 A trained person is considered to have reviewed all related documents (Section 2.0), to have been instructed on the use of related equipment and procedures, and to have discussed with their Supervisor or trainer, questions and issues of concern.
- 5.3 Training records, including certificates for training completed, are to be kept onsite in the Employee’s Training Record.
- 5.4 The Magazine, Plant or Work Site Supervisor/Manager will certify their employees as having received training by signing the training form. In signing the training form, the Supervisor / Manager will have satisfied themselves that trained employees are able to:
- Recognize fire and explosive hazards for the materials and processes to which they are exposed /involved with;
 - Competently use Fire Fighting / Fire Protection Equipment (Note: employees should receive refresher training in the use of fire extinguishers at least every three years)
 - Competently use applicable personal protective equipment (PPE) when handling hazardous substances;
 - Recognize and be familiar with substances which become hazardous wastes when spilled; and
 - Follow SOP’s and use established work practices to minimize the potential for fires, explosions, environmental releases and other accidents.
 - Worksite Managers / Supervisors will ensure that all contractors receive a worksite orientation before commencing work or being left unaccompanied in the worksite. Following the orientation process, the contractors will be required to sign off on the Contractor Checklist acknowledging training in the applicable areas including the site emergency response plan.

- All Plant & Magazine sites will have in place, a continuous (24 hour) access control system to control the entrance, presence and exit of visitor and contractors and their equipment and materials
- Employees must be trained on Reportable Quantities to the Government in the unlikely event of a spill.
- All employees are aware of evacuation routes, muster point location, and all-clear notice procedure.
- New/Transferred employee or Annual Refresher sign-off form located in Appendix 8

6.0 EMERGENCY PROCEDURES AND LINES OF AUTHORITY

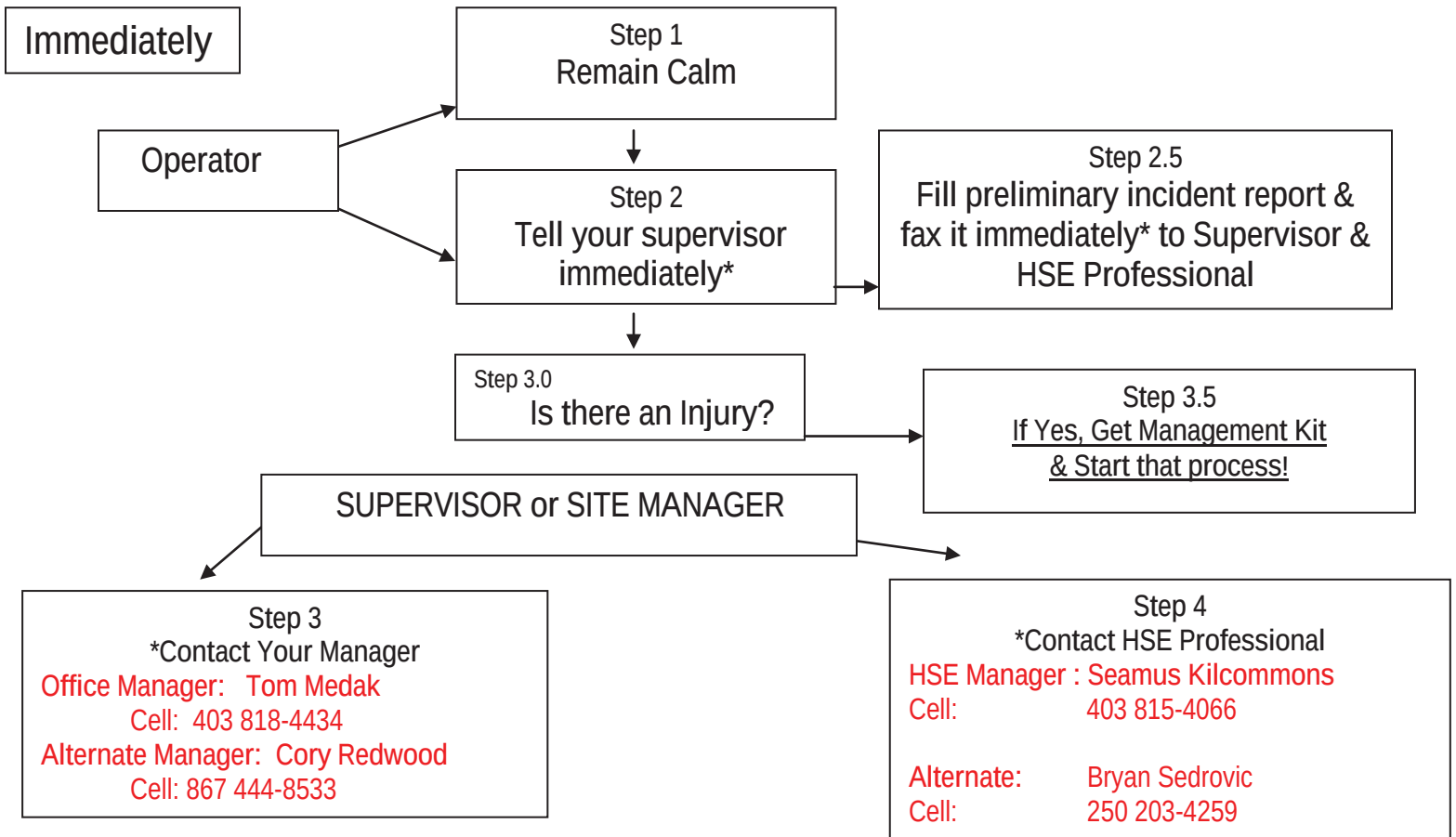
6.1 GENERAL

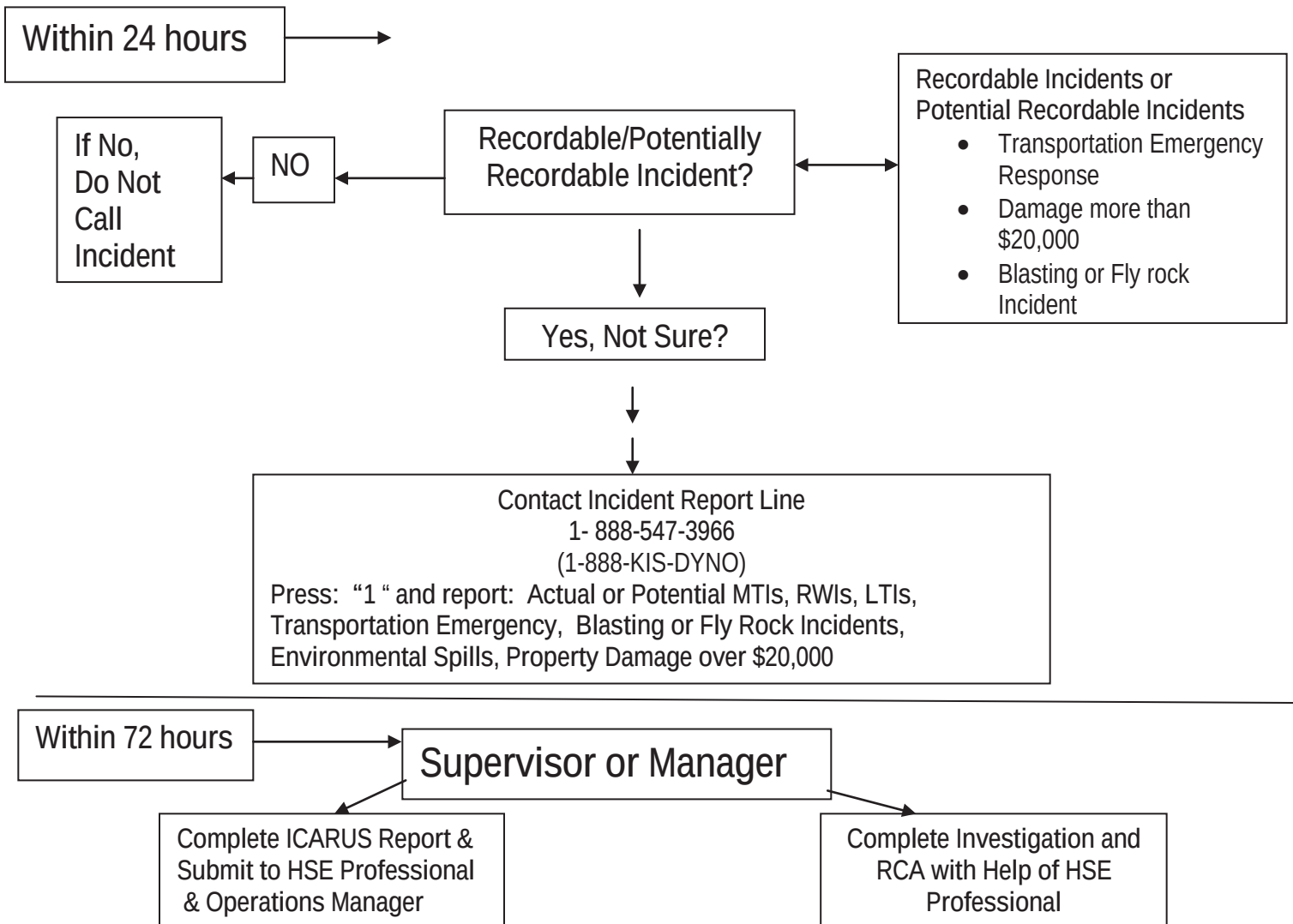
Reporting Incidents Flow Chart (Following page)

Table 6-1
Emergency Response Flow Chart

Reporting Incidents

Property Loss/Fly Rock/Environmental Spill/Injury





SITE SUPERVISOR/DELAGATE
EXPERIENCING EMERGENCY / POTENTIAL EMERGENCY

- **CALL FOR EMERGENCY ASSISTANCE**

In the event of an emergency, accidental release or imminent accidental release involving explosives, eliminate potential sources of detonation where possible (eg. turn off the ignition of a vehicle), call **6911** (or the local emergency number) for immediate assistance, **call the site Supervisor/Area Manager** and initiate the site's Emergency Response Plan. If normal phone systems are down other methods of communication can include two way radios, satellite phones, pager, e mail and vehicle satellite tracking systems.

- **WARN PUBLIC WITHIN EVACUATION DISTANCES IF RISK OF DETONATION**

Should there be explosive detonations, or the risk of detonations due to the presence of fire or other detonating factors, advise the First Responders (or anyone within the immediate vicinity if First Responders are not at the scene) of the risk and applicable safety distances per Table 6-4, page 17 (liaise with Emergency Response Advisor (ERA) if time permits). Help organize perimeter guards to prevent people from entering the evacuation zone.

Note: See ERP, page 17 Table 6-4 for Evacuation Procedures.

- **ASSIST LOCAL AUTHORITIES**

Assist First Responders and Local Authorities in eliminating the emergency situation, and liaise with DNCI's On-Call Employee / ERA until relieved by the Company's Emergency Response Team (ERT).

TO RESPOND TO AN EMERGENCY CALL

DNCI Corporate contact instructions:

Upon receiving a call for emergency response assistance, keep a log of all subsequent communications and actions, and do the following:

1. Immediately obtain the name and callback number of the caller, in case the telephone line is lost.
2. Obtain information as fully and accurately as possible following the emergency report form (see appendix 1).
3. Call an ER Advisor for the applicable Region (see appendix 2) and report the emergency situation. In turn, the ER Advisor will phone the emergency scene caller, establish ongoing contact, assess the emergency, determine what Company resources and/or contracted emergency response services are required and organize an Emergency Response Team - ERT to proceed to the emergency scene if required.

4. Assist the Emergency Response Advisor (ERA).
5. Liaise with Company Executive / Senior Managers.

Emergency Response Advisor (ERA) instructions:

1. Call the Branch/Plant Supervisor nearest the emergency scene plus territorial & federal authorities (see applicable appendix to Annex D) to advise them of the situation and the need for an emergency response.
2. Designate, assemble and dispatch an Emergency Response Team (ERT), made up of Groups 1 & 2 personnel (see ERAP pg. 16 and Annex D) under the leadership of an On Scene Coordinator (OSC), if required.
3. Authorize the dispatching of additional resources, communications, transportation and contracted services as necessary.
4. Contact and instruct the designated Emergency Response Team (ERT) to proceed to the emergency scene with the required vehicles and equipment.
5. Liaise with the Person in Charge of the Emergency) and/or Local Authorities to obtain a situation update.
6. Advise Local Authorities as appropriate, regarding the properties, hazards and handling procedures for the explosives involved in the emergency. In particular, advise the Local Authorities of appropriate evacuation distances per Table 6-4 pg. 17.
7. Continue to consult with the Local Authorities as appropriate, plus the Company's On-Scene Coordinator (OSC), to stabilize and eliminate the emergency.
8. Refer to **Regional Manager** *(Tom Medak, Willard Pierce, Dale Bodnarchuk or Francois Lambert)* for any media requests in accordance to the Crisis Communication Plan (CCP). Media contacts shall be through Regional Manager designated for the area.
9. Contact the explosives supplier and / or transporter (if other than DNCI) to advise them of the emergency and to request their assistance if/as required.

ON-SCENE CO-ORDINATOR (OSC)

- The On-Scene Coordinator (OSC) is the Company's representative and local authority in charge of all company actions and resources at the emergency scene. Once the OSC arrives at the emergency scene, the ERA will transfer communication with First Responders/Local Authorities to the OSC. In turn, the OSC will liaise with the ER Advisor as required. Throughout the Company's emergency response, the OSC will ensure that First Responders and Company personnel (employees and contractors) observe all safety and regulatory standards and procedures.
- The OSC may revise / adjust the composition of the Emergency Response Team (ERT) and supporting resources as required. The OSC may, in consultation with the ER Advisor, contract commercial services to assist in addressing and resolving the emergency situation.
- The OSC will oversee the Company's local involvement with emergency services, government (municipal & provincial) and public interests until the emergency is fully resolved. Post-emergency activities (clean-up, restoration, etc.) under the direction of the Environment Manager may be delegated to an appropriate Branch, Plant or Area Manager. **EMERGENCY RESPONSE TEAM (ERT)**
- Selected emergency response personnel will take their direction to assemble and proceed to the emergency scene from the ERA or their representative. Team members will immediately report to the On-Scene-Coordinator.
- The primary role of the ERT is to provide a competent and trained / certified workforce plus specialized equipment and material to assist First Responders / Local Authorities in the stabilizing and elimination of an 'explosives emergency', and to retrieve / recover, repack and remove to safe and secure storage, non-detonated explosives.
- While at the emergency scene, ERT members will take their direction from the Company's OSC and remain available until released by the OSC.

NOTE:

ONLY INDIVIDUALS WHO HAVE RECEIVED TRAINING AS REQUIRED UNDER THE TRANSPORTATION OF DANGEROUS GOODS (CLEAR LANGUAGE) REGULATIONS, OR WHO ARE WORKING UNDER THE DIRECT AND CONTINUOUS SUPERVISION OF AN EMPLOYEE WHO HAS BEEN TRAINED FOR CLASS 1 DANGEROUS GOODS UNDER TDG, MAY PARTICIPATE IN SITE CLEAN-UP ACTIVITIES SUCH AS PICKING UP, REPACKAGING AND TRANSPORTING EXPLOSIVE MATERIAL.

6.1.1 In any emergency the Work Site Supervisor/Manager or their delegate must take certain actions, including the following:

- Call local fire/emergency authorities (at mine sites, also call Mine Fire, Safety and Security if different and give relevant information).
- Account for all employees and visitors. Arrange for Rescue of anyone who may be trapped, without endangering oneself or others.
- Notify Dyno Nobel Canada Inc. ERA's so that necessary arrangements can be made for technical / administrative support, including accident reporting and investigation plus continued/alternate production. The following information should be provided and refer to appendix 1:

What Occurred	Time of Occurrence
Action Taken	People Contacted
Status of Situation	Anticipated Follow-up

6.2 **FIRE & EXPLOSIVES**

6.2.1. There are three categories of fire that may involve explosives:

I. Fires Directly Involving Class 1 Explosives and Blasting Agents

- **DO NOT FIGHT THE FIRE.** Instruct all fire fighters on the scene not to fight fire with explosives.
- Shut off power at main breakers if possible. At mine sites, call Mine Security or Fire/Rescue. At all other DNCI locations call local Fire/Rescue personnel.
- Evacuate all personnel from the Work Site to the safe meeting place as outlined in the Work Site Appendix.
- Set up a communications base at the meeting place and guard
- against anyone entering the area.

II. **Fires Involving Components For Manufacture of Blasting Agents**

Bulk blasting agents may be in the form of emulsion or ANFO. ANFO is a mixture of prilled ammonium nitrate and fuel oil.

Under conditions of large mass, intense heat, confined dust / vapor buildup, and the right mixture combination of the basic ingredients, emulsion and ANFO will explode. The probability of explosion with

ammonium nitrate (AN) alone is very small, but increases when under intense heat and confinement. Table 6-1 includes recommended fire fighting procedures for each of these substances.

III. Fires Involving Dyno Nobel Canada Inc. Trucks

In cases where the Dyno Nobel Canada Inc. delivery trucks are in a building that is on fire, if there is no explosives and safe to do so, may be moved provided access to the truck and exit from the building is not barred by flames or smoke, with available fire extinguishers with caution only if the fire is small and not in the storage compartment.

Fires on re-pump or other bulk explosive delivery vehicles shall not be fought if the fire involves the explosives compartment. Fire fighting measures should be taken immediately to prevent any fire such as a tire, electrical or cab fire from reaching the explosives compartment.

Fires on other transport vehicles may be fought with caution. Fires that cannot be controlled sufficiently to avoid involvement of the vehicle's fuel compartment shall be left and personnel evacuated to a safe distance.

- 6.2.2.** When a fire is small and does not involve any explosive agents, it may be fought with plant extinguishing equipment. If the fire is widespread and intense, all personnel, including visitors and contractors should be evacuated to the meeting area outside the main gate.

Table 6 - 2
FIRE FIGHTING INFORMATION

MATERIAL	RECOMMENDED FIRE-FIGHTING METHODS	SPECIAL CONSIDERATION
Ammonium Nitrate Prill – Odorless white to light tan crystalline solid	Use flooding amounts of water in early stages of fire. Keep upwind. AN is an oxidizing agent which supports combustion and is an explosive hazard if heated under confinement that allows high-pressure buildup. Ensure good ventilation and remove combustible materials if it can be safely done. Evacuate to designated area if fire cannot be controlled.	Toxic oxides of nitrogen are given off during combustion. Fire fighters require self-contained positive pressure breathing apparatus. Avoid contaminating with organic materials. Many powdered metals such as Al, Sb, Si, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, Sn, Zn and brass react violently and explosively with fused AN below 200°C Sensitivity to detonation increases when heated.
Ammonium Nitrate Solution- Colorless/Odourless Liquid – white paste like solid when cooled	Use flooding amounts of water in early stages of fire. Cool containing vessels with flooding quantities of water until after fire is out	Material will not burn, but thermal decomposition may result in flammable/toxic gases being formed. These products are nitrogen oxides and ammonia. (NO,NO ₂ NH ₃). Product may form explosive mixtures when contaminated and comes in contact with organic materials. Explosive when exposed to heat or flame under confinement. Avoid temperatures over 210°C (410°F) A self contained breathing apparatus should be used to avoid inhalation of toxic fumes
Sodium Thiocyanate – White solid - odourless	Use extinguishing media most appropriate for the surrounding fire	Wear self contained breathing apparatus – MSHA/NIOSH approved or equivalent, and full protective gear. During a fire, irritating or highly toxic gases may be generated by thermal decomposition or combustion.
Sodium Nitrite – Oxydizing agent - white to light yellow crystals- faint odour	Flammability class – not regulated. Flood with water only – Isolate materials not involved in the fire and cool containers with flooding quantities of water until well after the fire is out.	Self contained apparatus should be worn in a fire involving Sodium Nitrite. Thermal decomposition will cause reddish brown nitrogen oxides to be released.
Fuel Oil (No. 2 diesel) Dyed or pale yellow liquid with petroleum odor; and/or ATF Fluid	Use water spray to cool fire-exposed surfaces and to protect personnel. Shut off fuel from fire. Use foam, dry chemical or water spray to extinguish fire. Avoid spraying water directly into storage container due to danger of boil-over.	Avoid strong oxidizing agents.

Explosive emulsions, ANFO, packaged explosives and firing devices.	Fire involving explosive materials must never be fought. Evacuate the incident scene. Do not confine (ventilate to prevent / reduce pressure build-up if safe to do so).	Explosion hazard.
Enviro CFE	Dry chemical, foam, water spray (fog). Use water spray to cool exposed surfaces and containers	OIL FLOATS ON WATER. Do not use direct or heavy water stream to fight fire. Use organic vapour respirator or self-contained breathing apparatus to fight fire.

**Table 6 - 3
CONTROL MEASURES FOR FIRE**

MATERIAL	RECOMMENDED FIRE-FIGHTING METHODS	SPECIAL CONSIDERATION
Diethylene glycol	Small fire: type ABC dry chemical or CO ₂ fire extinguisher. Large fire: water fog.	Keep away from oxidizers (nitrates and perchlorate). Explosion hazard if heated under confinement.

EVACUATION PROCEDURES

Advise the first emergency responders at the scene (police or fire) of the need to evacuate using the guidance in the Emergency Response Plan. Employees at the scene should assist local emergency services to the best of their ability to accomplish this. For incidents within a worksite such as a mine, quarry or construction operation, in most cases access is radio controlled. The quickest way of alerting people, therefore, is by site radio. Clearly state your location, situation and call for assistance in evacuating the area.

DO NOT FIGHT EXPLOSIVES FIRES. EVACUATE THE AREA AND LET THE FIRE BURN ITSELF OUT.

THE MINIMUM EVACUATION DISTANCE IS AS OUTLINED IN TABLE 6-4 (Pg. 17) FOR ALL DIRECTIONS (which is based on a higher traffic / risk / population density within the area, without benefit of protective features such as berms and hills. **(Transport Canada requires 1,600 meters for situations that involve high-risk surroundings)** upon determining actual quantity of explosives refer to Table 6-4 as per ERD quantity of distances.

Table 6 - 4
EVACUATION DISTANCES
Based On Amount of Explosives Present

<u>Explosive Quantity</u>		<u>Metric Distance</u>		<u>English Distance</u>
250 kg		70 Meters		230 Feet
500 kg		100 Meters		320 Feet
1,000 kg		150 Meters		500 Feet
2,000 kg		240 Meters		800 Feet
5,000 kg		400 Meters		1,300 Feet
7,000 kg		450 Meters		1,450 Feet
10,000 kg		480 Meters		1,550 Feet
20,000 kg		700 Meters		2,300 Feet
40,000 kg		800 Meters		2,640 Feet
60,000 kg		870 Meters		2,860 Feet
80,000 kg		960 Meters		3,150 Feet
100,000 kg		1040 Meters		3,420 Feet
120,000 kg		1100 Meters		3,610 Feet
>120,000 kg		1600 Meters		5,250 Feet

6.3 ENVIRONMENTAL RELEASES

6.3.1 Procedure For Fuel Oil Storage Tank Failure

- Assess the magnitude of the leak.
- If the leak is slow and the source can be determined, take the appropriate action to prevent further leakage.
- Transfer fuel from storage tank into drums if necessary.
- Collect spilled material, including contaminated soil, with absorbent pads or inert solid absorbent and store in drums labeled for disposal.
- If the leak is large and further leakage cannot be prevented, allow the dyke to fill. Transfer to drums, label for reuse or disposal, and store.
- Inspect empty tank to identify failure/cause of leak and repair tank.

6.3.2 **Procedure For Raw Material Truck Spills**

- Identify the material involved, assess the magnitude of the spill or leak and assist the driver to take appropriate action to stop the leak, taking care to prevent run off and/or entry into any water course or drainage system near the spill site.
- For AN prill, shovel spilled material into drums, label for reuse or disposal, and store. Use a non-sparking shovel to transfer spilled material into lined drums.
- For spilled fuel, contain by dyking with earth. Collect spilled fuel with absorbent pads or solid inert absorbent, transfer into drums, label and store for disposal.
- Remove contaminated soil for disposal in conformance with Environment Canada standards.

6.3.3 **Procedure For Process Spills**

- Identify the material involved and assess the magnitude of the spill or leak, taking care to prevent run off and/or entry into any watercourse or drainage system near the spill site.
- For AN prill, shovel spilled material into drums, label for reuse or disposal, and store.
- For spilled fuel, contain by dyking with earth. Collect with absorbent pads or solid inert absorbent, transfer into drums, label, and store for disposal.
- In the case of leaking bags of ANFO, sweep or shovel the spilled material into a clean drum or other suitable container, label for reuse or disposal, and store.
- Remove contaminated soil for disposal in conformance with Environment Canada standards.
- Have any process equipment (pumps, process lines, parts, gauges, etc.) involved in a leak or spill inspected and repaired or replaced. Re-inspect and test if necessary after repair is affected.

6.3.4 Procedure For Emulsion Tank Failure

- Assess the magnitude of the leak.
- If the leak is slow and the source can be determined, take the appropriate action to prevent further leakage.
- Transfer remaining emulsion from leaking storage tank into another storage tank, a tanker trailer if available, or into drums as necessary.
- Collect spilled material using double diaphragm pump(s) and store in labeled drums for reuse or disposal at the mine.
- If the leak is large and further leakage cannot be prevented, allow the room to fill. Transfer to drums, label for reuse or disposal, and store.
- Inspect empty tank to identify failure/cause of leak and repair or replace the tank

6.3.5 Procedure For Fire

- In the event of a raw material or product fire, take care to protect all persons from exposure to smoke and gaseous emissions from the fire.
- Potential toxic gaseous emissions from fires involving explosive materials include:

Oxides of Nitrogen
Carbon Monoxide
Cyanide Gas

- All fires must be reported to local authorities and Mine Site Security as soon as possible.
- Self contained breathing apparatus is required for fighting a fire in the plant.
- Follow procedures outlined above for any spills and leaks resulting from fire when it is safe to do so

Table 6 - 5
ENVIRONMENTAL RELEASE PROCEDURES

MATERIAL	SPILL AND LEAK PROCEDURES	WASTE DISPOSAL
Ammonium Nitrate Prill (odorless white to light tan crystalline solid)	Remove source of heat and ignition. Sweep or shovel spill into a clean, non-combustible container. Wash remaining trace residues with water. Wear rubber gloves and safety glasses to minimize contact with skin and eyes.	Re-use if possible or give it to a farmer as a fertilizer. If not possible, dispose of as-is in approved. Remove as much as possible the spilled material as a solid.
Ammonium Nitrate Solution- Colorless/Odourless Liquid – white paste like solid when cooled	Small spill - Dike and contain spilled material. Ensure spilled material does not enter sewers, wells or water courses. Allow to solidify. Use appropriate tools to place in container for disposal. Larger spill - Dike and contain spilled material. Ensure spilled material does not enter sewers, wells or water courses. Notify downstream water users. Allow to solidify. Use appropriate tools to place in container for disposal.	Call for assistance for disposal. Ensure disposal complies with regulatory requirements and regulations.
Fuel Oil (dyed or pale yellow liquid with petroleum odor)	Eliminate any source of ignition. Prevent spills from entering watercourses or drainage systems. Contain with sand or earth. Recover with pump or inert absorbent material into clean container. Wear safety glasses and rubber gloves to prevent contact with the eyes and skin.	Dispose of recovered material in approved landfill or other waste disposal facility.
ANFO (Ammonium Nitrate Fuel Oil)	This material is an explosive. Remove all sources of heat and ignition. Transfer into clean plastic container with a plastic shovel. Label drums. Wear rubber gloves.	Recycle product, if possible. If not practical, explode it inside a borehole or burn it in an authorized burning ground.
Emulsion	This product is a blasting agent. Remove all sources of heat and ignition. Prevent spills from entering watercourses or drainage systems. If large amount of emulsion is involved, contain spill with earth or sand found locally. Recover spilled material with a diaphragm pump. Use of a diaphragm pump also requires an air compressor. Limitation of the pump suction is approximately 2.5 meters, pump discharge is approximately 8 meters. Use a screening device on pump suction hose. Out of area spills will require taking two pumps and extra hose. Transfer the product into a tanker trailer or clean 200 liter drums. If small amount of emulsion is involved, transfer material into a clean plastic container with a plastic shovel. Label tanker trailer or drums. Wear rubber gloves and rubber boots.	Recycle product, if possible. If not practical, explode it inside a borehole or if large amount is involved, demulsify it with liquid detergent.

Enviro CFE	Eliminate any source of ignition. Prevent spills from entering watercourses or drainage systems. Contain with sand or earth. Recover with pump or inert absorbent material into clean container. Wear safety glasses and rubber gloves to prevent contact with the eyes and skin.	Dispose of recovered material in approved landfill or other waste disposal facility.
Sodium Thiocyanate – White solid - odourless	Ensure adequate ventilation whe handling Sodium Thiocyanate. Keep containers closed when not in use. Wear appropriate PPE – eye protection, gloves and appropriate clothing to prevent skin exposure.	Vacuum or sweep up material and place into a suitable disposal container. Avoid run off into storm sewers and ditches which lead to waterways. Not regulated as a hazardous material. Chemical waste generators must consult appropriate hazardous waste regulations to ensure complete and accurate classification.
Sodium Nitrite – Oxydizing agent - white to light yellow crystals- faint odour	In the event of a spill or leak, contact the vendor (403-263-8660) for advice. Wear respirator, protective clothing and gloves. Vacuuming is the recommended method to clean up spills. Do not sweep or use compressed air for clean up. Recover spilled material on non-combustible material, such as vermiculite. Use non-sparking tools and place in covered containers for disposal. Any recovered material mau be used for it's intended purpose , depending on contamination.	Dispose of the waste material at an approved hazardous waste treatment/disposal facility.
Acetic Acid – Colourless liquid with a pungent odour	Wear appropriate PPE – evacuate downind areas as required to prevent exposure and to allow fumes and vapours to dissipate. Prevent entry into sewers or streams. Dike if needed. Eliminate all sources of ignition. Neutralize the residue with sodium carbonate or crushed limestone. Absorb win an inert dry material and place in an appropriate container for disposal. Flush area with water to remove trace residue.	Waste disposal must be done in accordance with provincial and federal regulations. Empty containers must be recycled or disposed of through an approved waste management facility.

6.4 SECURITY

6.4.1. In the event of a breach of security at a Dyno Nobel Canada Inc. Work Site, a call is to be made to the RCMP / local Police Department at the discretion of the Supervisor/Manager, or their delegate. In the case of a breach of security, Dyno Nobel Canada Inc.' HSE, Regulatory Affairs and Executive / Senior Management shall also be informed immediately and provided with the same information as outlined in Section 6.1

- 6.4.2. Any person(s) apprehended during the course of a serious security breach shall be detained until the Police arrive (note: employees are not to put themselves at undue risk by attempting to apprehend or restrain a potentially violent person).

6.5 BOMB THREAT

- 6.5.1. The safety of employees and the public is of primary concern. A person receiving a bomb threat over the telephone should attempt to remain calm and keep the caller talking by asking the questions listed in Table 6-6 (ERP pg. 20). Recording (writing) as much information about the caller and their comments is also very important for future reference. If possible, alert a co-worker to the situation while talking to the caller.
- 6.5.2. The police / mine security should be advised of the bomb threat as soon as possible. Unless there is good reason to the contrary, all personnel should evacuate the Work Site and await the arrival of the police / first responders at the designated meeting area. Suspicious objects should be reported but not tampered with and other people should be prevented from entering the Work Site until the local authority has authorized a return to the Work Site. Employees should be prepared to assist local authorities in their search / inspection of the Work Site as necessary.

Table 6 - 6
CONVERSATION GUIDELINES IN THE EVENT OF RECEIVING
A BOMB THREAT
See Appendix 7

6.6 LINES OF AUTHORITY

- 6.6.1 Based upon the information available at the time of the incident, the Work Site Supervisor/Manager, in consultation with others (such as DNCI Senior Management, Mine/local authorities and/or Dyno Nobel advisors), will evaluate the incident and proceed with appropriate steps to implement this ERP. A decision on when to return to the scene of a serious incident will be made in like fashion, subject to approval by public authorities overseeing the incident.

- 6.6.2 The Work Site Supervisor/Manager will have overall responsibility for the implementation of this ERP and the supervision of all Company activities. Public authorities and the site owner have ultimate authority regarding the resumption of normal production activities.

7.0 NOTIFICATION AND REPORTING

- 7.1 Any incident that activates this ERP shall be documented on the DYNO Incident (Cintellate) Report. The Corporate Emergency Response Advisor must also be notified and in turn will advise the:

HSE Manager
Area Manager

Vice President Operations

It is the responsibility of the HSE Manager or his delegate to report the incident to DYNO's HSE Management Team. A major incident involving a fire with emissions and/or a hazardous material spill shall be reported to a provincial Environment Officer under the direction of the Environmental Manager. Major incidents shall also be reported to the Chief Inspector, Explosives Branch, Natural Resources Canada; a Provincial/Territorial Safety Officer; and as applicable, an Emergency Measures Official.

Any incident which involves a spill at a Mine Site shall be immediately reported to the Mine Site Environmental Representative, and followed up with a copy of the incident report when complete.

7.2 Spills and Releases – Reportable and Significant Classifications

1) Determine if the spill/release is reportable

All environmental incidents are to be input into Cintellate. Reportable spills/releases are not only input into Cintellate, but the investigation and corrective action sections of Cintellate must be completed. To assist in determining if a spill/release is reportable, a listing of common materials with assigned reportable quantities is referenced (see Appendix 5, Reportable Substance List). The reportable quantities utilize the most stringent "reportable quantity" in Canada. Even if the spill/released material is recovered, the media impacted by the spill/release may be reportable to authorities (e.g., a portion of a spill reaching a source of drinking water or wetland). In addition, a spill/release is reportable if the amount equals or exceeds the Dyno Nobel Default Threshold.

2) Determine if the spill/release is significant

- Significant spills/releases are disclosed in the company's annual report. Significant spills/releases trigger time-critical internal actions as required by the company's procedures (crisis communication, internal investigation, etc)

The following table is provided to assist in making these determinations:

Reporting of Environmental Spills

Is the spill reportable?

- Yes if above a Reportable Quantity
- Yes if oil sheen is visible or sludge/emulsion is deposited beneath water surface
- Yes if water quality standards are exceeded
- Yes if from a UST exceeding 25 gallons or result in a sheen

Is the spill significant?

- Yes if authorities implement a national contingency plan
- Yes if "sensitive" environmental features have been impacted
- Yes if neighbors are evacuated
- Yes if authorities and/or neighbors file complaints and/or demand response activities
- Yes if financial impact is >US\$100K
- Yes if media coverage is adverse.

7.3 Internal investigation reports will include:

- Name, work address, and phone number of the investigating (reporting) individual
- Identification and quantity of the released substance
- Time, duration, and location of the release
- Nature and quantity of injuries, property damage, production loss, administrative penalty and/or legal liability
- Precautions taken during the incident
- Relevant environmental conditions
- Corrective actions taken at the time of the incident
- Recommended corrective actions to prevent future occurrence

7.4 Senior Management shall be immediately informed by telephone of any major incident that requires Government notification as per Dyno Nobel's reporting procedures.

7.5 Major incidents involving explosive material shall also be reported to the Chief Inspector, Explosives Branch, and Natural Resources Canada by the applicable Regulatory Affairs Coordinator.

Table 7 - 1
REPORTABLE SUBSTANCE QUANTITY LIST

Material Released	Reportable to Authorities		Dyno Nobel Default Threshold (Proposed)
	If Recovered	If Unrecoverable/ Abandoned / Disposed	
AN Solution	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	44 Kg (100 lbs) for ammonia if released into water	45 Kg (100 lbs) for ammonia if released into water	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to aquatic ecosystem (NH3 toxic to fish)	Report if released to aquatic ecosystem (NH3 toxic to fish)	
AN Prill	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	45 Kg (100 lbs) for ammonia if released into water	45 Kg (100 lbs) for ammonia if released into water	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to aquatic ecosystem (NH3 toxic to fish)	Report if released to aquatic ecosystem (NH3 toxic to fish)	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
Sodium Nitrite	45 Kg (100 lbs)	45 Kg (100 lbs)	225 Kg (500 lbs)
	Report if released to Drinking Water (DW std at 1mg/L-N)	Report if released to Drinking Water (DW std at 1mg/L-N)	
Fuel Oil	Reportable if sheen on surface of pond, stream, etc. or sludge within such	Reportable if sheen on surface of pond, stream, etc. or sludge within such	225 Kg (500 lbs); 261 L (69 gallons)
	State Regulations - Varies from Any Amount to specific Trigger Amounts	State Regulations - Varies from All Spills to specific Trigger Amounts	
	95 L (25 gallons) from UST	96 L (25 gallons) from UST	
Mineral Oil	Reportable if sheen on surface of pond, stream, etc. or sludge within such	Reportable if sheen on surface of pond, stream, etc. or sludge within such	225 Kg (500 lbs); 261 L (69 gallons)
	State Regulations - Varies from Any Amount to specific Trigger Amounts	State Regulations - Varies from All Spills to specific Trigger Amounts	
	95 L (25 gallons) from UST	96 L (25 gallons) from UST	

Emulsifier Agents	Reportable if sheen on surface of pond, stream, etc. or sludge within such	Reportable if sheen on surface of pond, stream, etc. or sludge within such	225 Kg (500 lbs); 261 L (69 gallons)
	State Regulations - Varies from Any Amount to specific Trigger Amounts	State Regulations - Varies from All Spills to specific Trigger Amounts	
ANFO	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	45 Kg (100 lbs) for ammonia if released into water	45 Kg (100 lbs) for ammonia if released into water	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to aquatic ecosystem (NH3 toxic to fish)	Report if released to aquatic ecosystem (NH3 toxic to fish)	
	Reportable if sheen on surface of pond, stream, etc.	Reportable if sheen on surface of pond, stream, etc.	
Emulsion	Not Reportable if it can be used as a product	45 Kg (100 lbs) as released oxidizer (not media specific)	225 Kg (500 lbs)
	44 Kg (100 lbs) for ammonia if released into water	45 Kg (100 lbs) for ammonia if released into water	
	Report if released to Drinking Water (DW std at 10mg/L-N)	Report if released to Drinking Water (DW std at 10mg/L-N)	
	Report if released to aquatic ecosystem (NH3 toxic to fish)	Report if released to aquatic ecosystem (NH3 toxic to fish)	
	Reportable if sheen on surface of pond, stream, etc. or sludge within such	Reportable if sheen on surface of pond, stream, etc. or sludge within such	
Ethylene Glycol	2250 Kg (5000 lbs)	2250 Kg (5000 lbs)	225 Kg (500 lbs)
Sodium Thiocyanate	45 Kg (100 lbs)	45 Kg (100 lbs)	225 Kg (500 lbs)
	Report if released to Drinking Water (DW std at 1mg/L-N)	Report if released to Drinking Water (DW std at 1mg/L-N)	

8.0 DECONTAMINATION

8.1 DNCI's Standard Operating Procedures and safety rules establish work practices that minimize employees' direct and indirect contact with hazardous substances.

- 8.2 Equipment, rubber boots, gloves and clothes that have been contaminated can be washed with soap and water. Wash water should be collected and disposed of in an approved manner with other contaminated material.

9.0 WORKSITE CLOSURE / SHUT DOWN

9.1 Plant Shutdown (use appropriate lock-out/tag-out procedures)

- In the event that a plant is shut down due to weather, flood, or other adverse situation, the Plant Manager / Supervisor or his delegate will ensure that all non-essential power is shut off. The Plant Manager / Supervisor will secure all valves and flow devices so as to prevent accidental opening.
- The Plant Manager / Supervisor shall determine if any raw material or raw material storage will be contaminated or at risk of fire/explosion, and take steps to move the material or isolate it from the contamination / hazard source.
- If the power and/or gas will create a dangerous situation the Plant Manager / Supervisor will cut the outside supply of power, thereby isolating all plant equipment.
- The Plant Manager / Supervisor will advise local Mine authorities of the plant shutdown and preventative actions taken.
- All sensitive documents must be secured.

9.2 Magazine Closure (use appropriate lock-out/tag-out procedures)

- In the event that a magazine is closed due to weather, flood, or other adverse situation, the Supervisor/Manager or his delegate will ensure that all non-essential power is shut off. Also, the Supervisor/Manager will ensure that all magazines and compound gates are locked before leaving the site.
- The Supervisor/Manager shall determine if any products or raw materials will be contaminated and take steps to move the material or isolate it from the contamination source.
- If power and/or gas will create a dangerous situation the Supervisor/Manager will cut the outside supply of power, thereby isolating all magazine equipment.

10. RESPONSE TO NATURAL DISASTER

Hurricanes, tornadoes, floods, slides, forest fires, and earthquakes, have the ability to damage or destroy everything in their path. Yet much of the

damage or destruction associated with such phenomena is the result of some secondary event, e.g. fallen power lines, ruptured tanks valves, pipes etc. If reasonable warning of an approaching disaster is received, efforts can be made to minimize damage by taking specific preventative measures. These measures are outlined in the following procedures.

1. Consult the Site Supervisor for guidance and proceed according to his direction.
2. If so directed, notify key personnel regarding the action being taken.
3. Collect important files, records and papers for safekeeping.
4. Open main electrical breaker to cut off all power to the site. (The main breaker is marked for easy identification).
5. Secure all buildings and equipment and lock the site gate.
6. Evacuate the site taking mobile equipment to safety.
7. Post Guards on site access routes to monitor the activities of unauthorized personnel.
8. A report of the incident must be submitted to the Area Manager within 24 hours.

10.1 PREVENTIVE MEASURES

10.2 Waste Disposal Permits

If nitrate waste is generated, a disposal permit must be obtained and kept up to date if the product will be disposed of off-site, or in mine tailings.

Permits to dispose of other collected waste in the event of spills or leaks (such as described in Section 6.3) must also be obtained in consultation with mine / provincial environmental representatives

10.3 Liquid Containment

All fuel / oil storage tanks must be dyked according to the provisions of Federal and/or Provincial regulations (eg. National Fire Code, Environmental Protection Act), or have a double-walled tank.

A plan must be in place and materials on hand to create a dyke in the event of a large fuel or solution leak or spill or other emergency spill situation.

10.4 Inspection

All site emergency storage areas and equipment must be inspected monthly by qualified personnel, monthly for physical condition and serviceability, and the results recorded according to quality and safety standard operating procedures.

All recommendations/orders made by NRC Explosives Branch inspectors, Fire Marshals and insurance inspectors must be responded to and acted upon accordingly. Copies of their reports are to be forwarded to DNCI's HSE representative for the region.

10.5 **Maintenance**

All preventive and breakdown maintenance must be carried out and recorded in accordance with standard operating procedures.

**11.0 WORK SITE START UP
(Restoration of Business)**

- 11.1 Before startup, the condition prompting the shutdown / closure must be over / corrected (i.e. flood, fire, explosion or blizzard).
- 11.2 All decontamination procedures must be followed and the site cleared and cleaned of any environmental waste hazards.
- 11.3 All repairs to plant equipment involving safety shutdowns and essential operating machinery must be completed.
- 11.4 All electrical circuits, plumbing and piping must be tested.
- 11.5 The Work Site Supervisor / Manager will ensure that all lockout and tag-out procedures have been followed and signed off.
- 11.6 The Work Site Supervisor / Manager will start up the facility by turning on individual switches to the components that have been shutdown.
- 11.7 Operational checks will be done to ensure that all equipment is functioning at safe working pressures and voltage.
- 11.8 The Work Site Supervisor / Manager will give the verbal "all clear" before workers will be allowed to return to work.
- 11.9 The Work Site Supervisor / Manager or one of their delegates will cancel / remove all roadblocks, terminate evacuation activities, and notify employees to return to normal activities.

APPENDIX 1
DNCI'S EMERGENCY REPORT FORM FOR
INCIDENTS INVOLVING EXPLOSIVES

WHO IS CALLING? NAME: _____

PHONE #: _____ TIME: _____ DATE: _____

CALLER'S ORGANIZATION: _____

LOCATION OF INCIDENT: _____

WHAT IS THE EMERGENCY?

PROBLEM: (Motor Vehicle Accident, Fire, Scattered Product, Disabled Truck, etc.)

PRODUCTS INVOLVED : VISIBLE PLACARDS ? YES _____ NO _____

SHIPPING NAME(S) _____

UN NUMBER(S) _____

HAZARD CLASSIFICATION (ex: 1.1 D) : _____

QUANTITY: _____

INJURIES: _____

PROPERTY DAMAGE: _____

EXPLOSIVES VEHICLE UNIT NUMBER: _____ LICENSE NO. _____

DRIVER: _____ CARRIER: _____

WHEN DID INCIDENT OCCUR? DATE: _____ TIME: _____

WHERE IS THE EMERGENCY? (City, Town, Rural Area, Lat. & Long., Specific Directions)

ARE THERE RESIDENCES, BUSINESSES, OR OTHER PUBLIC GATHERING PLACES WITHIN
THE EVACUATION ZONE (what, where)?

WHAT ACTION HAS BEEN TAKEN TO THIS POINT IN TIME? _____

(Medical, evacuation, fire fighting, etc.)

APPENDIX 2

DNCI Corporate contact

Name	Position	Cell number
Benoit Choquette	Environmental Manager - Canada	(514) 246-6285
Nicholas Ebsworth	General Manager HSE - Canada	(514) 708-5417
Hubert Fafard	HSE Manager Eastern Canada	(418) 570-9257
Willard Pierce	Regional Manager -West	(403) 836-9029
Francois Lambert	Regional Manager –East	(514) 212-3490
Dale Bodnarchuk	Regional Manager – Central	(705) 715-6672
Seamus Kilcommons	HSE Manager Western Canada	(403) 815-4066
Brad Rhude	Sales Manager - Central	(705) 494-5171
Rick Chopp	HSE Manager – Central Canada	(705) 498-2855
Pierre Poulin	Sales Manager – Quebec/Maritimes	(418) 569-5565
Greg Brown	Sales Manager Western	(403) 512-5127
Bryan Sedrovic	HSE/ Regulatory Affairs Coordinator West	(250) 203-4259

APPENDIX 3

DNCI Emergency Response Advisors (ERA) per area

Name	Position	Cell number	Area (West, Central or East)
Tom Medak	Mgr, Bulk Emulsion Operations	(403) 818-4434	West
Ralph Olson	Operations Manager, Vancouver Island	(250) 713-8720	West
Darren Woodhead	Gregg River worksite supervisor	(780) 223-4491	West
Randy Armella	Bulk Operations Manager	(780) 865-6580	West
Cory Redwood	Manager dnx Drilling/ Joint Ventures	(867) 444 - 8533	West
Kevin S Kelly	Operations Manager - Seismic	(403) 934-0753	West
Tyrone McClean	Operations manager, Manitoba and Saskatchewan	(204) 687-0046	Central
Scott Smith	Operations Manager, Red Lake Ontario	(807) 727-7300	Central
Mike Ertel	Operation Manager - Ontario	(807) 629-9660	Central
Joss Forget	Operations Manager Northern Ontario	(705) 471- 8745	East
David Roy	Manager Plant operations	(418) 570-5604	East
Francois Lambert	Operations Manager	(514) 212-3490	East
Daniel Roy	Dyno Consult , Ste-Sophie	(514) 213-5889	East
Pierre St-George	Regulatory Affairs Canada	(613) 677 - 1051	Canada

APPENDIX 4

SITE: Meadowbank Site

MANAGEMENT AND WORK SITE CONTACT LIST

NAME	TITLE	BUSINESS PHONE	HOME PHONE	CELL PHONE
Doug Robertson	Site Supervisor	(867) 793-4610 (Option 2; option 1 ext 6804)		(867) 222-3930
Dennis Wall	Site Supervisor	(867) 793-4610 (Option 2; option 1 ext 6804)		(867) 222-3930
Site employees	All employees on shift	(867) 793-4610 (Option 2; option 1 ext 6804)		
Tom Medak	Operations Manager	(403) 723-7530		(403) 818-4434
Seamus Kilcommons	HSE Manager	(403) 236-9160 Ext 7547		(403) 815-4066

EXTERNAL CONTACT NUMBERS

ORGANIZATION/CONTACT	LOCATION	PHONE NUMBER
Mine security	Meadowbank	Ext. 6817
Local Fire; ERT	Hinton	Ext 6911
Local Ambulance	Hinton	Ext 6911
Baker Lake RCMP	Hinton	867 793-1111

APPENDIX 5

Area Office Address:

Meadowbank site
Baker Lake, NU

Type of Facility:

Emulsion Plant
AN Tote storage

Emergency Meeting Place Upon Evacuation:

As identified on site orientation forms, employees and visitors are to meet at muster point for head count. Once all persons are accounted for, all will proceed to the Muster Point located at Security Gate #1, located at junction of All Weather Road. (see map)

Emergency Equipment On Hand:

Fire Extinguishers, First Aid Kits, Fire alarm system, video monitoring,

FY 2011 drill conducted

APPENDIX 6

BOMB THREAT CHECKLIST

Exact time of call:	
Exact words of caller:	
QUESTIONS TO ASK	
1- When is bomb going to explode?	
2- Where is the bomb?	
3- What does it look like?	
4- What kind of bomb is it?	
5-What will cause it to explode?	
6- Did you place the bomb?	
7- Why?	
8- Where are you calling from?	
9- What is your address?	
10- What is your name?	
CALLER'S VOICE (circle)	
Calm	Slow
Crying	Slurred
Stutter	Deep
Loud	Broken
Giggling	Accent
Angry	Rapid
Stressed	Nasal
Lisp	Excited
Disguised	Sincere
Squeaky	Normal
If voice is familiar, whom did it sound like?	
Were there any background noises?	
Remarks:	
Person receiving call:	Telephone number call received at:
Date:	Report call immediately to:

APPENDIX 7

NEW/TRANSFERED EMPLOYEE OR ANNUAL REFRESHER FORM

HSE Employee Orientation Form To Be Completed By Supervisor (within 2 to 4 weeks of hiring)					
(Employee Surname)		(Given Names)		(Worksite) (Date of Hire)	
(Job / Position)		(RFT/ RPT/ Casual / Temp)		(End date if applic)	
<u>Show & Tell</u>					
<u>Date Completed</u>			<u>Date Completed</u>		
Tour Of Facility				Introduction To Staff	
Emergency/Fire Exits & Procedures				Workplace Hazards & Controls	
Environmental Clothing Issued				First Aid & WCB Reporting	
Overview Of Organization				Telephone Contacts	
Work Schedules				Time Sheets & Pay Periods	
Security & Key Control				E-mail & Website Access	
Expense Claims Procedures				Other:	

		<u>Documentation Given To & / or Discussed With Employee</u>		
Position Description			DYNO G & S Work Rules	
Worksite ERP, TDG ERAP & CCP			MSDS's	
Handling/Transporting Explosives			SOP's	
Employee Guidelines			Policy: HSE & Quality	
Policy: Privacy & Confidentiality			Policy: Substance Abuse	
Policy: Violence In The Workplace			Policy: Security	
Policy: Smoking In The Workplace			Performance Reviews	
Other:			Other:	
		<u>New Hire Training Completed</u>		
Customer Orientation			WHMIS	
TDG Clear Language			PPE (as applicable)	
Handling/Transporting Explosives			Fire Extinguisher	
ICARUS (Incident Reporting)			Take 5 (Hazard Assessment)	
Worksite ERP, TDG ERAP & CCP				
Supervisor (Print Name) Supervisor Signature Date				

APPENDIX 8



ANNUAL ERT VISIT REVIEW FORM

Information to be released to Emergency Services

From: Local Emergency Services

Subject: Emergency Response Plan for

_____.

The following is a copy of the Emergency Response Plan that has been prepared by Dyno Nobel Inc. Has been received from _____ operations. The ERP has been discussed and being kept on file for future reference. If questions arise, we have been given the contact information for the _____ operations staff.

On _____ the _____ of 2011, AEM ERT responder _____ attended the Dyno Nobel Meadowbank site for an annual visit and ERP review.

Signed:_____

Position:_____

Date: _____

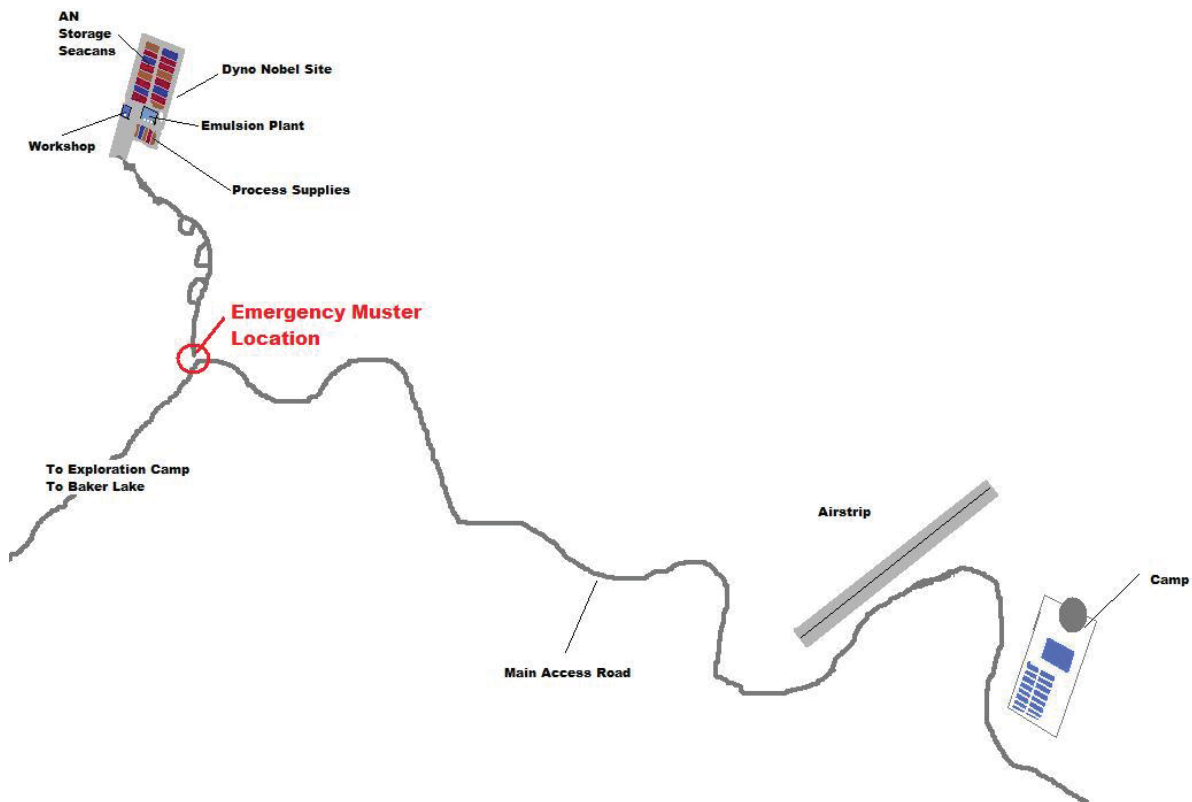
APPENDIX 9

Transportation of Dangerous Goods Regulation Class Quantity Emission Limit

1	Any quantity that could pose a danger to public safety or 50 kg
2	Any quantity that could pose a danger to public safety or any sustained release of 10 minutes or more
3	200 L
4	25 kg
5.1	50 kg or 50 L
5.2	1 kg or 1 L
6.1	5 kg or 5 L
6.2	Any quantity that could pose a danger to public safety or 1 kg or 1 L
7	Any quantity that could pose a danger to public safety. An emission level greater than the level established in section 20 of the <i>Packaging and Transport of Nuclear Substances Regulations</i>
8	5 kg or 5 L
9	25 kg or 25 L

Table identified in Section 8.1(1) of Part 8 of the Transportation of Dangerous Goods Regulation Class Quantity Emission Limit

Evacuation/ Muster location



Appendix M

MBK-ENV-0016 Spill Reporting Procedure

PROCEDURE NUMBER: **MBK-ENV-0016**

People concerned	• All Departments	Prepared by	Jeff Pratt Erika Voyer Environment Coordinator
		Authorized by	Kevin Buck Assistant Environmental Superintendent
Effective :	January 18, 2015	<i>“Safety First, Safety Last ... Safety Always!”</i> <i>“No Repeats” – Our Stepping Stone to ZERO HARM</i>	
<i>This procedure corresponds to the required minimum standard. Each and everyone also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.</i>			

Objective:

- As per Meadowbank's Water License we must have and employ a Spill Contingency Plan. The overall purpose of creating a spill contingency plan is to minimize the impacts of spills by the establishment of predetermined lines of response and plans of action. The plan has been designed to facilitate effective communication and the efficient clean-up of spills from potentially hazardous materials. The Plan also specifies the reporting of all spills on site to the Environment Department. The Plan details which spills will be reported to regulators.

Concerned departments:



ALL DEPARTMENTS

Risks/ Impacts Legend



Health & Safety



Process/quality



Costs



Environment

Definitions:

- A) A **Major spill** is defined as an accidental release of product into the environment that has the potential for adverse impacts to the receiving environment, AEM property or human health. This can include potential impacts to water, surface and groundwater, land, equipment, buildings, human health and the atmosphere.
- B) A **Minor spill** is defined as any spill that does not involve a toxic, reactive, or explosive material in a situation that does not pose a significant risk to the environment, is not human health or AEM property.

Procedure	Risks/ Impacts
1. All Spills on the Meadowbank site regardless of size, quantity, location, or time of spill are to be reported to the Environment department.	
2. Spills must be immediately reported to the Supervisor.	
3. The supervisor will determine if the spill is a major or minor spill. A) If the spill is <i>Major</i> , supervisor will call CODE 1 to dispatch (Mine, AWAR, or Control room). B) If the spill is <i>Minor</i> the supervisor will contact the Environment Department (Channel 9 or extension 6747 or 6759 Techs / 6980 or 6728 Coordinators)	
4. Whether the spill is Major or Minor the following must be verbally reported: a) Product description (diesel, hydraulic oil, sodium cyanide) b) Estimated quantity of the product c) Location of Spill d) Area contaminated (#meters x # meters) e) Cause of spill – If this is not yet know best assumption ** if photos can be taken of the spill, please submit to the environment department with spill report	
5. For a <i>Major Spill</i> the Supervisor will ensure the area stays safe until the ERT team arrives to intervene. The environment department will assist the ERT team.	

6. For a minor spill the supervisor and the Environment department will then determine the clean-up method and the location in which the contaminated material will be taken too. **Environment department may want to investigate the spill prior to clean up.	
7. A spill report will need to be completed, <i>In Full</i>, and submitted to the environment department within <u>12 hrs.</u> of the spill occurring. Thus allowing time for the environment department to determine if it needs to be reportable to the Governing bodies. <i>**Spill report is attached below or can be found here:</i> http://mymeadowbank/documentcentre/Documents/Health%20and%20Safety/2014%20-%20AEM%20Internal%20Spill%20Report%20Form_V03.pdf	
8. Spills found on site that have not been reported to the environment department will be deemed as Non-Reported spills.	

**Agnico Eagle Mines Meadowbank Project:
Internal Spill Reporting Form**

(Spills greater than the *Reportable Volume*, see *Spill Contingency Plan*, require the completion and submission of the *Nunavut Spill Report Form*)

 AGNICO EAGLE	Meadowbank Project	Spill report #.
Date and time of spill :		
Location of spill :		
First responder name :		
Company Name:		
AEM Contact:		
Nature of contaminant :		
Volume/quantity of the container / tank (L)		
Quantity spilled (L) :		
Cause of the spill :		
Contaminant collected by :		
Follow-up done by :		
Actions taken :		
Report completed by:		Date :
Incident investigation recommended : YES ☐ NO ☐		
Government agency notified : YES ☐ NO ☐		
Date of notification to government agency :		
Date of report : Signature of environmental personnel : 		

WATER QUALITY AND FLOW MONITORING PLAN, VERSION 5, MARCH 2016



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:

Agnico Eagle Mines Limited - Meadowbank Division

Approved by:


Kevin Buck – Environment Superintendent - Nunavut

Table of Contents

SECTION 1.	INTRODUCTION	1
SECTION 2.	OVERVIEW	2
2.1	OVERVIEW OF SITE WATER MANAGEMENT PLAN	2
2.2	MONITORING PROGRAMS.....	2
2.2.1	Compliance Monitoring Program (CM)	2
2.2.2	Event Monitoring Program (EM)	2
2.3	OVERVIEW OF MINE DEVELOPMENT SCHEDULE	3
2.3.1	Pre-development and Construction Phase.....	3
2.3.2	Early Operations Phase.....	3
2.3.3	Late Operations Phase.....	4
2.3.4	Closure Phase	4
2.3.5	Post Closure Phase	4
SECTION 3.	MONITORING PROGRAM	11
3.1	COMPLIANCE MONITORING PROGRAM.....	11
3.1.1	General Sampling and Analysis Program.....	11
3.1.2	Compliance Monitoring Stations and Discharge Criteria	17
3.2	EVENT MONITORING	26
3.2.1	Portage Rock Storage Facility Seepage.....	26
3.2.2	Assay Road Seepage	26
3.3	ADAPTIVE MANAGEMENT PROGRAM.....	27
3.3.1	Adaptive Management Program for Regulated Discharge	27
3.3.2	Adaptive Management Program for Non-Regulated Discharge	30
SECTION 4.	FLOW VOLUMES	33
SECTION 5.	REPORTING	35
5.1	ANNUAL REPORTING	35
5.2	EXCEEDANCE REPORTING.....	35

LIST OF TABLES

Table 2-1: Staged Development of the Meadowbank Mine Facilities	10
Table 3-1: Monitoring Program.....	12
Table 3-2: Monitoring Parameters	15
Table 3-3: Summary of Sampling Requirements for each Analyte.....	16
Table 3-4: TSS Criteria at CM Stations ST-DC and ST-DD	18
Table 3-5: Effluent Criteria at CM Station ST-DD.....	18
Table 3-6: TSS Criteria for All Surface Runoff during the Construction of Any Facility	18
Table 3-11: Seepage Observations and Characterization	25
Table 3-12: Action Plan for Regulated Discharge	28
Table 4-1: Intervals of pumping for Surface Water at the Meadowbank Project, Mine Operation Period	34

LIST OF FIGURES

Figure 2-1: Early operations Phase	5
Figure 2-2: Late Operations Phase.....	6
Figure 2-3: Closure Phase	7
Figure 2-4: Post-Closure Phase	8
Figure 2-5: Baker Lake Site Facilities.....	9
Figure 3-1: Logic Diagram for Regulated Discharge.....	29
Figure 3-2: Logic Diagram for Non-Regulated Discharge	32

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

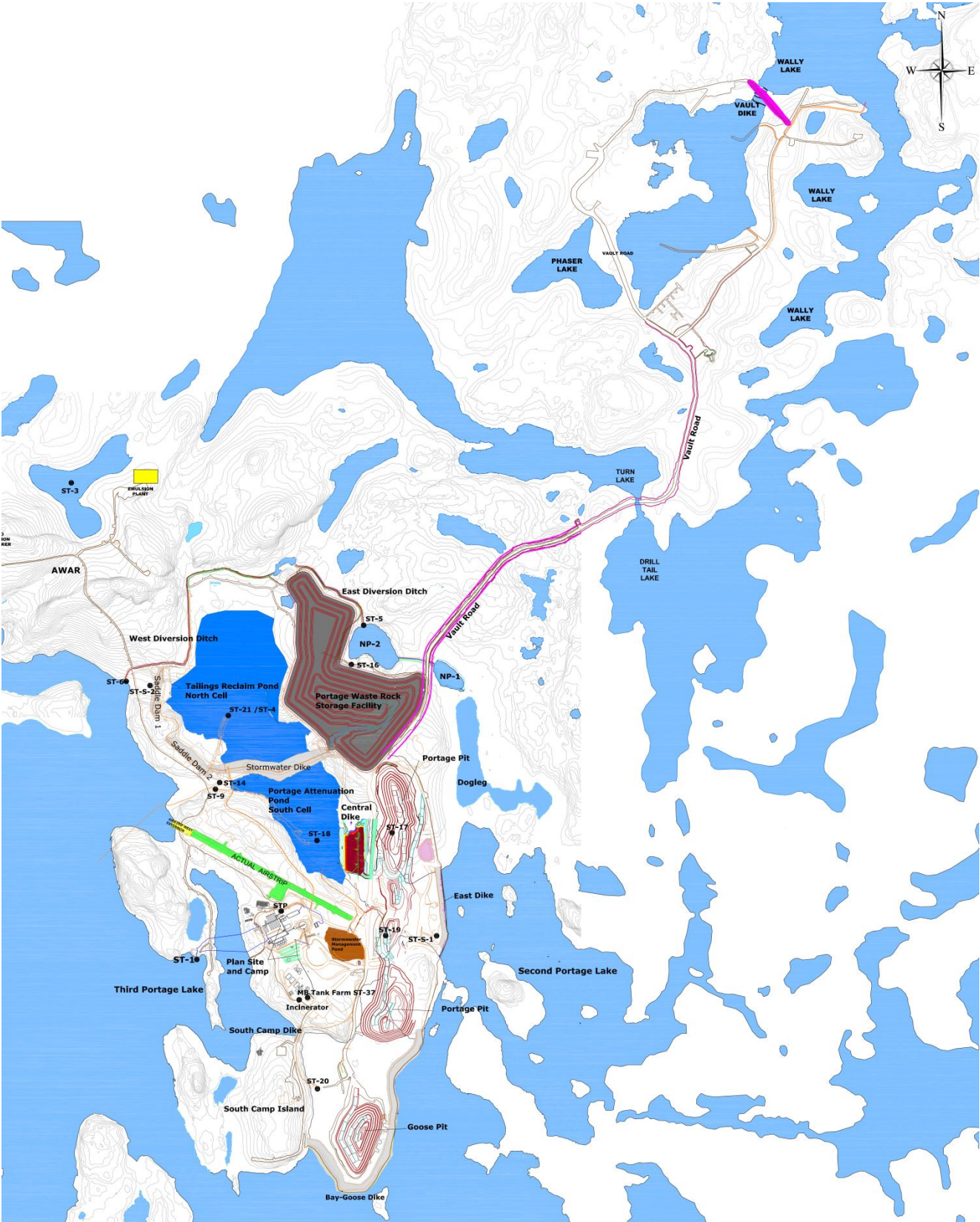


Figure 2-2: Late Operations Phase

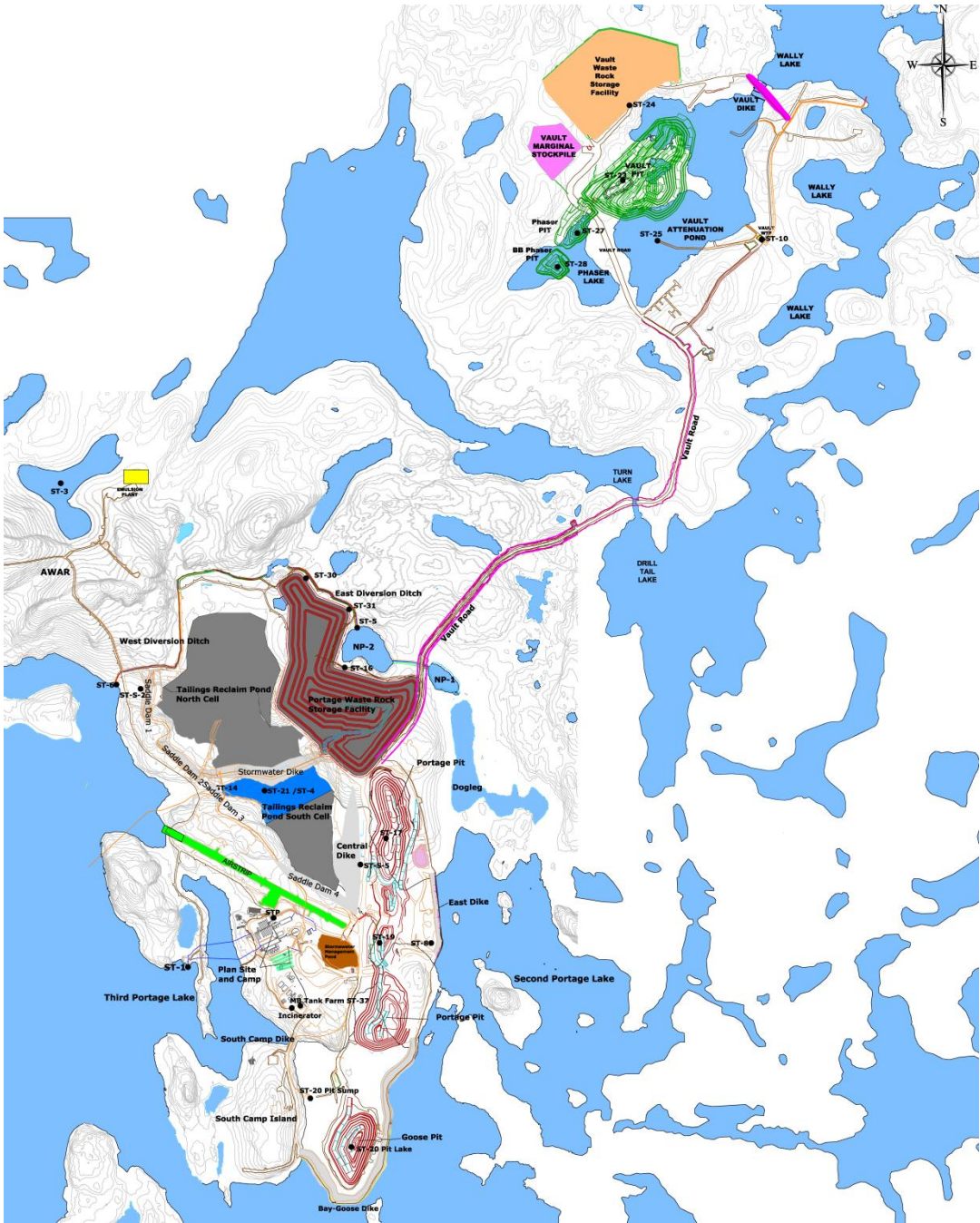


Figure 2-3: Closure Phase

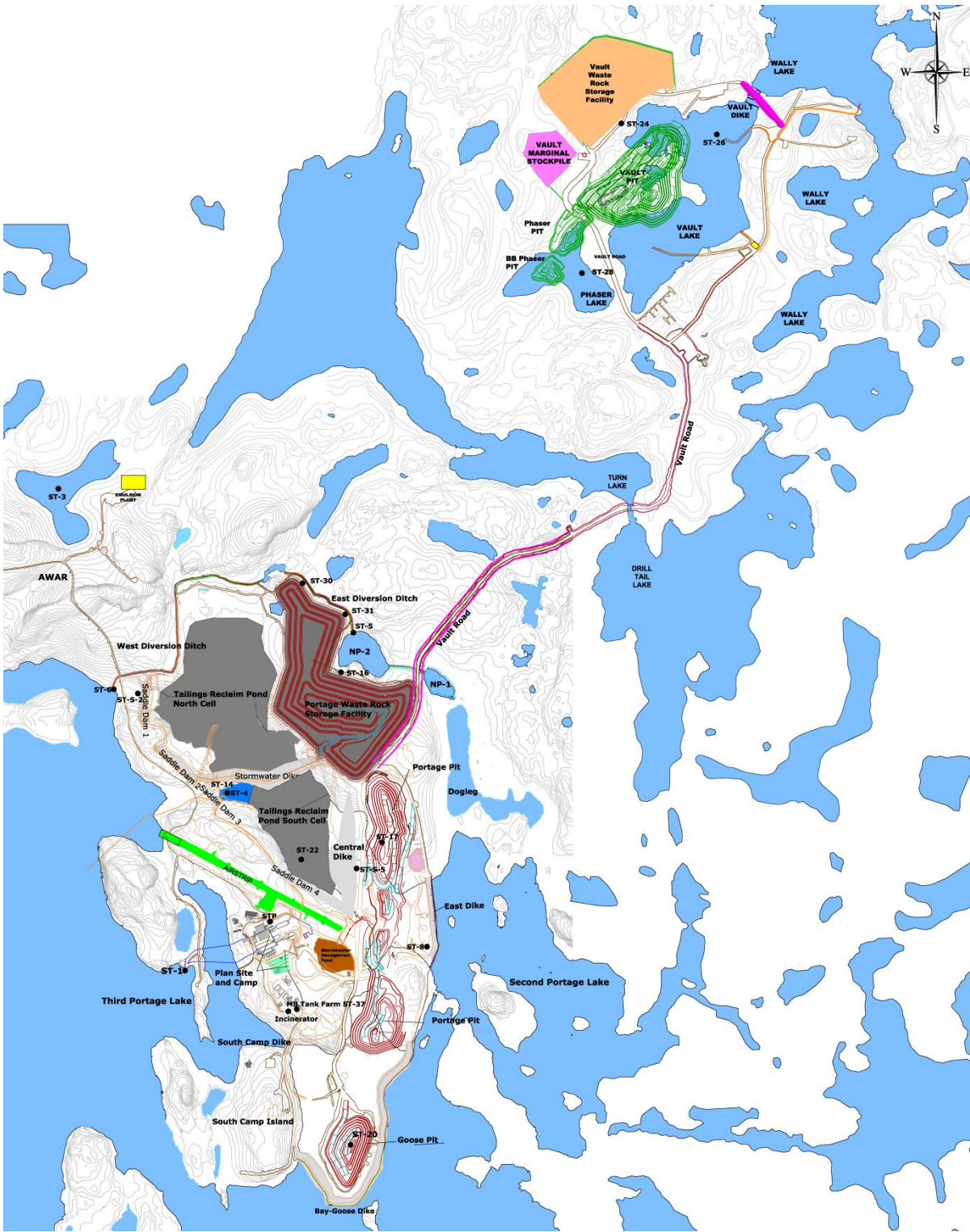


Figure 2-4: Post-Closure Phase

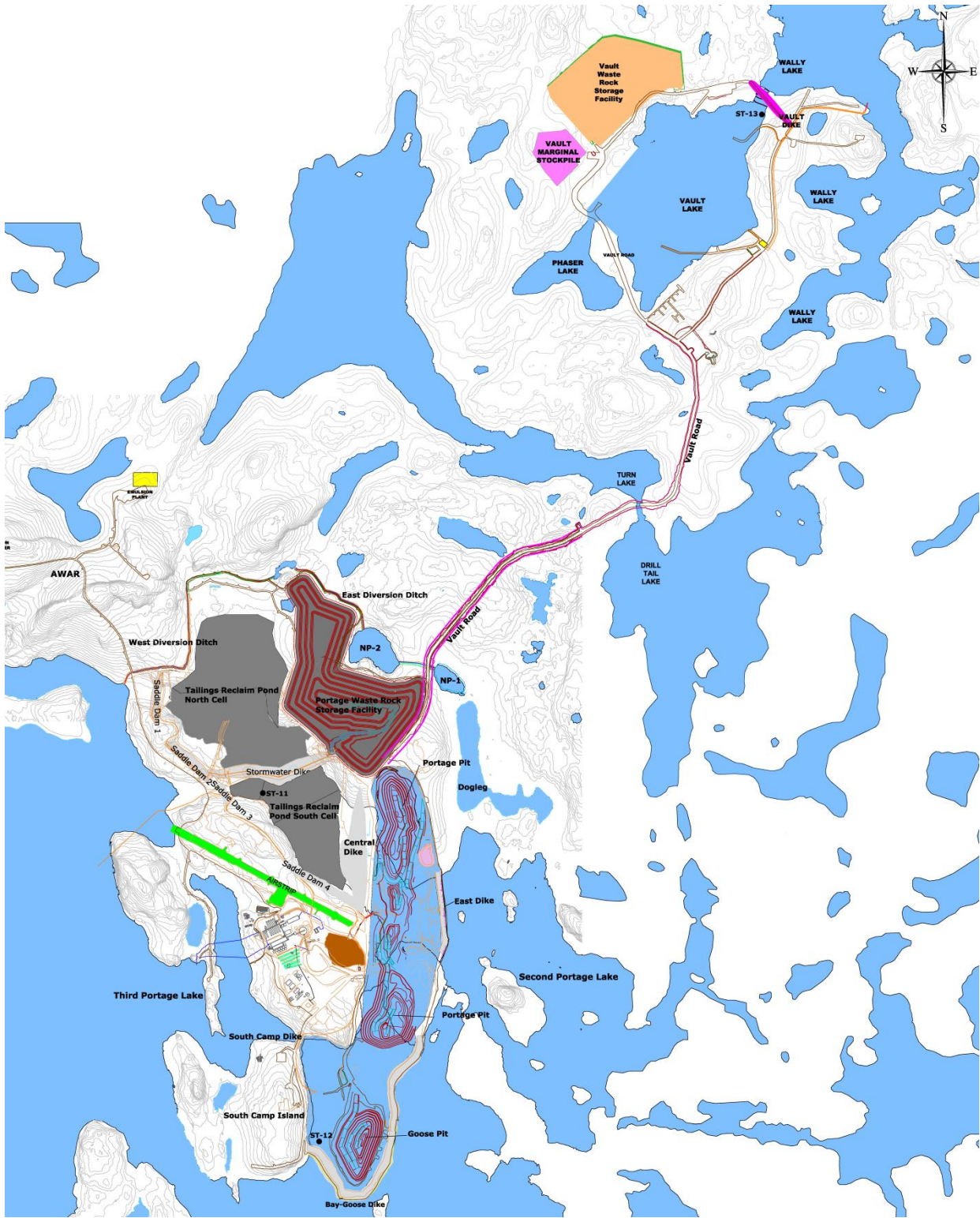


Figure 2-5: Baker Lake Site Facilities

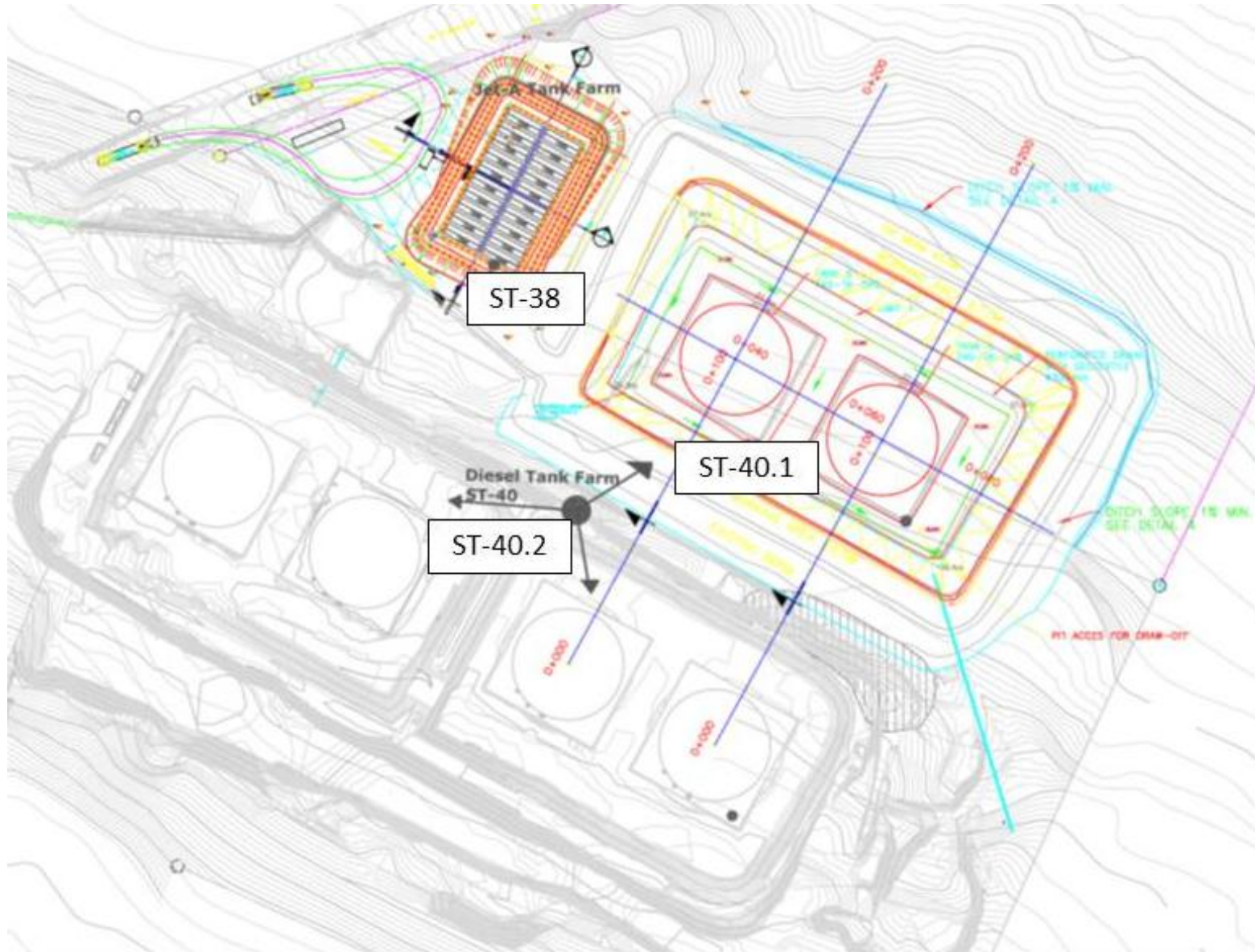


Table 2-1: Staged Development of the Meadowbank Mine Facilities

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

Water Quality and Flow Monitoring Plan

Version 5; March 2016

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

Water Quality and Flow Monitoring Plan
Version 5; March 2016

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 ₂ SO 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 ₂ SO 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 ₂ SO ₄	28 days
Total kjeldahl nitrogen	250	250 mL, glass or plastic, filled to the top	4°C, H ₂ SO 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 ₂ SO ₄	28 days
Total organic carbon	125	250 mL glass	4°C, H ₂ SO ₄	28 days
Dissolved organic carbon	125	250 mL glass	4°C, H ₂ SO 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

Mine Site

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. 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:

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 *Aquatic 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:

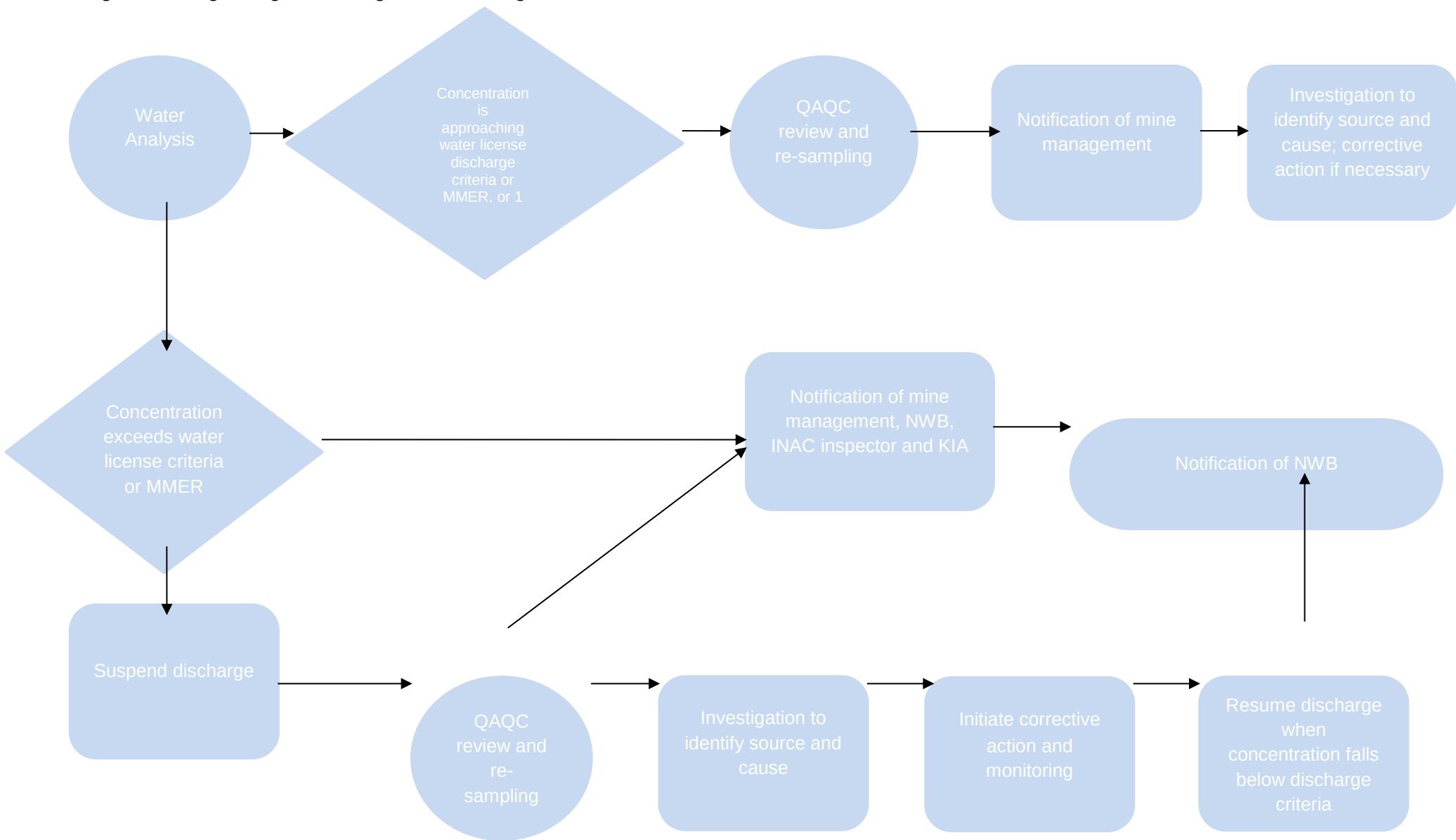
- Best management practices for sediment and erosion control would be employed to reduce TSS concentrations, ie flow control, sedimentation basin construction, etc;
- Addition of a coagulant for the reduction of TSS in pond water;
- Use of geotextile or reamouring of banks to filter and reduce TSS in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

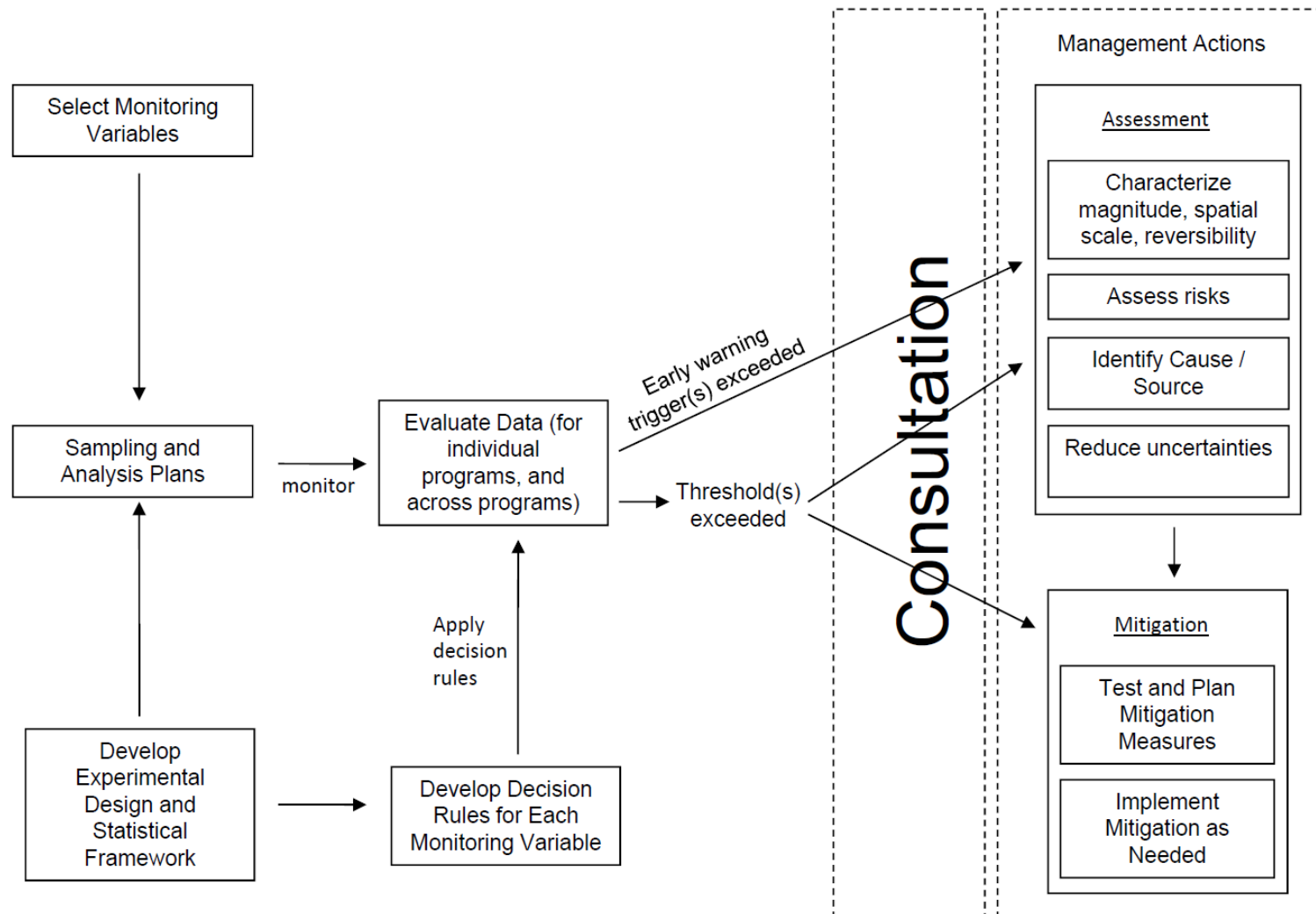
Nevertheless, there are two general classes of management actions – those aimed at further assessment and those aimed at mitigation. In general, exceedance of early warning triggers will trigger further assessment, which may then lead to mitigation, whereas exceedances of thresholds could possibly lead 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 be 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.

INCINERATOR WASTE MANAGEMENT PLAN, VERSION 6, MARCH 2016



MEADOWBANK GOLD PROJECT

Incinerator Waste Management Plan

In Accordance with Water License 2AM-MEA1525

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 6
March 2016

EXECUTIVE SUMMARY

This Incinerator Waste Management Plan (IWMP) describes the performance limits, waste management protocols, operation, monitoring and record keeping requirements for the incinerator and waste oil burning furnaces. This plan was developed in support of AEM's renewal application for a Type A Water License from the Nunavut Water Board (NWB). AEM's water license 2AM-MEA1525 was renewed on July 23, 2015. This updated IWMP is a component of the Meadowbank Environmental Management System. This IWMP will be maintained by AEM to reflect the current operations at the Meadowbank Gold Project, permit requirements and regulatory setting. The IWMP will be reviewed on a regular basis and revised by AEM when necessary to ensure that the project staff, operators and regulatory bodies are kept aware of any changes to project operations. Any changes in operation/procedures are communicated to all applicable Meadowbank Departments.

The main objective of waste management relating to the primary incinerator and waste oil furnaces is to minimize the amount of solid waste to be incinerated by implementing an effective waste segregation and reuse (in the case of waste oil) program to ensure that only appropriate types of waste are incinerated. The primary objective of incineration is to eliminate materials from the landfill that could create odours, attracting wildlife to the landfill site or to the Meadowbank camp; as well as to avoid the generation of leachate caused by the decomposition of putrescible materials. The primary incinerator is a dual chamber, high-temperature incinerator and is used to dispose of solid waste from the accommodation camp, kitchen, shops, and offices that cannot be landfilled. The materials to be incinerated will be limited to putrescible waste such as paper, wood, food packaging and food waste. In addition, a number of small waste oil burning furnaces will be utilized in order to recycle used petroleum products such as heavy lubricants and engine oil. Ash produced from the incineration process will be disposed of in the on-site landfills provided it meets criteria as stated in Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities (GN, 2011). A protocol is implemented for testing incinerator ash and contingent measures for alternate disposal of ash if quality is unsuitable for landfilling.

The incinerator at Meadowbank is manufactured by Eco Waste Solutions. The incinerator is designed to ensure the emissions meet Canadian Council of Ministers of the Environment (CCME) Canada-wide Standards for Dioxin and Furans (CCME, 2000a) and the CCME Canada-wide Standards for Mercury Emissions (CCME, 2000b). In addition to the incinerator technology, the implementation of a waste management and segregation plan will further limit emissions of dioxins and furans from the incinerator. Compliance with the performance limits is confirmed by stack testing conducted once every two years (providing that the waste stream has not changed). Should an exceedance of the CCME Standards occur, AEM will change the frequency of stack testing to once per year as well as conduct an investigation related to the cause of the exceedance (thoroughly check the waste stream).

In order to demonstrate compliance with performance limits, an annual incineration management report will be prepared and submitted to the NWB (as part of the water license annual report), Government of Nunavut (GN), Environment Canada (EC), and NIRB. The quantity of materials incinerated on site during operations and a record of performance temperatures together with results from stack testing and ash monitoring, will be included within the annual report.

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. This document will supersede the Incinerator Waste Management Plan Version 5 – 2014.

DISTRIBUTION LIST

AEM – General Mine Manager

AEM – Environment Superintendent

AEM – Environmental Coordinator

AEM – Environmental Technician

AEM – Site Services Superintendent

AEM – Field Services Supervisor

AEM – Incinerator Operator

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
1	08/10/08	3 & 6	5 & 13	Revised to consider best management practices for ash
		App 1		Technical specifications for primary incinerator included
2	09/05/12	1; 3.3; 4.1	1; 7; 8	Revised to include regulatory comments
3	12/11/16			2012 Comprehensive Review
4	12/11/16	ES; 3.1, 6.1	II, 5, 13	Stack testing will be completed biennially
		5.5	12	Adjusted quantities for mass reduction
		APP III		Include Procedure for Loading Incinerator
5	14/07/21	All	All	2014 Comprehensive Review
6	16/03/31	All	All	2016 Comprehensive Review

Prepared by: Environmental Department

Approved by:



Kevin Buck
Environmental Superintendent - Nunavut

Table of Contents

SECTION 1.	INTRODUCTION	1
1.1	PROJECT OVERVIEW	1
1.2	INCINERATOR LOCATION.....	1
SECTION 2.	REGULATORY CONTEXT	3
2.1	BACKGROUND INFORMATION	3
2.1.1	Dioxins and Furans	3
2.1.2	Mercury	3
2.1.3	Used Oil and Waste Fuel	3
SECTION 3.	PERFORMANCE LIMITS	5
3.1	PRIMARY INCINERATOR.....	5
3.2	USED OIL.....	5
3.3	INCINERATOR ASH.....	7
SECTION 4.	INCINERATOR OPERATION	8
4.1	PRIMARY INCINERATION	8
4.1.1	Emissions	8
4.1.2	Dust/Odour Control Measures	8
4.1.3	Staffing and Equipment	8
4.1.4	Operator Training	9
4.2	USED OIL INCINERATOR and FURNACES	9
SECTION 5.	WASTE MANAGEMENT.....	10
5.1	APPROACH.....	10
5.2	ACCEPTABLE WASTE FOR INCINERATION/WASTE OIL FURNACES	10
5.3	UNACCEPTABLE WASTE FOR INCINERATION	11
5.4	WASTE VOLUMES	12
5.4.1	Solid Waste.....	12
5.4.2	Used Oil	12
5.4.3	Incineration Ash.....	12
5.5	WASTE INCINERATION RATE	12
SECTION 6.	MONITORING AND TESTING.....	14
6.1	INCINERATOR EMISSIONS TESTING.....	14
6.2	WASTE OIL TESTING.....	14

6.3	ASH TESTING.....	14
SECTION 7.	MAINTENANCE	15
SECTION 8.	REPORTING	16
8.1	NATIONAL POLLUTANT RELEASE INVENTORY	16
8.2	GREENHOUSE GAS EMISSIONS.....	16
SECTION 9.	PLAN REVIEW AND CONTINUAL IMPROVEMENT.....	18
SECTION 10.	REFERENCES.....	19

LIST OF TABLES

Table 3-1	Emission Standards for Solid Waste Incinerators	5
Table 3-2:	Summary of Used Oil and Waste Fuel Guideline	6
Table 3-3:	Used Oil Impurity Limit.....	7
Table 3-4:	Guidelines for Solid Waste/Process Residuals Suitable For Landfill	7
Table 6-1:	Summary of Incinerator Emissions Testing	14
Table 8-1:	NPRI Incineration Reportable Substance List.....	16

LIST OF FIGURES

Figure 1-1	Incinerator and Waste oil furnaces locations	2
Figure 5-1:	Process Flow Chart for Waste Incineration.....	13

LIST OF APPENDICES

APPENDIX I:	Technical Specifications: Eco Waste Solutions Incinerator
APPENDIX II:	MBK-SIT-0011 – Incinerator Loading

SECTION 1. INTRODUCTION

1.1 PROJECT OVERVIEW

This Incinerator Waste Management Plan (IWMP) describes the performance limits, waste management plans, operation, monitoring and record keeping requirements for the primary incinerator and onsite waste oil burning furnaces.

This update to the 2014 IWMP (Version 5) is a component of the Meadowbank Environmental Management System. The objectives of this Plan are summarized as follows:

1. To define the operating procedures to be used in the incineration of appropriate non-hazardous solid waste generated at the Meadowbank Mine;
2. To define acceptable/non-acceptable types of solid waste to be placed in the Meadowbank incinerator; and
3. To define operating and monitoring requirements for the incinerator and waste oil burning furnaces.

AEM will be responsible for managing and implementing this IWMP.

The primary incinerator is required for the disposal of solid waste from the accommodation camp, kitchen, shops, and offices that cannot be landfilled at the Meadowbank Gold Project Site. The incineration of waste will ensure that no waste which could attract wildlife and/or create leachate (putrescible materials) is disposed at the onsite landfill. The materials to be incinerated will be limited to putrescible waste such as paper, food packaging and food waste. A number of small waste oil burning furnaces, to provide space heating, will be utilized in order to recycle used petroleum products such as heavy lubricants and engine oil. The waste oil burning furnaces have been included within this IWMP.

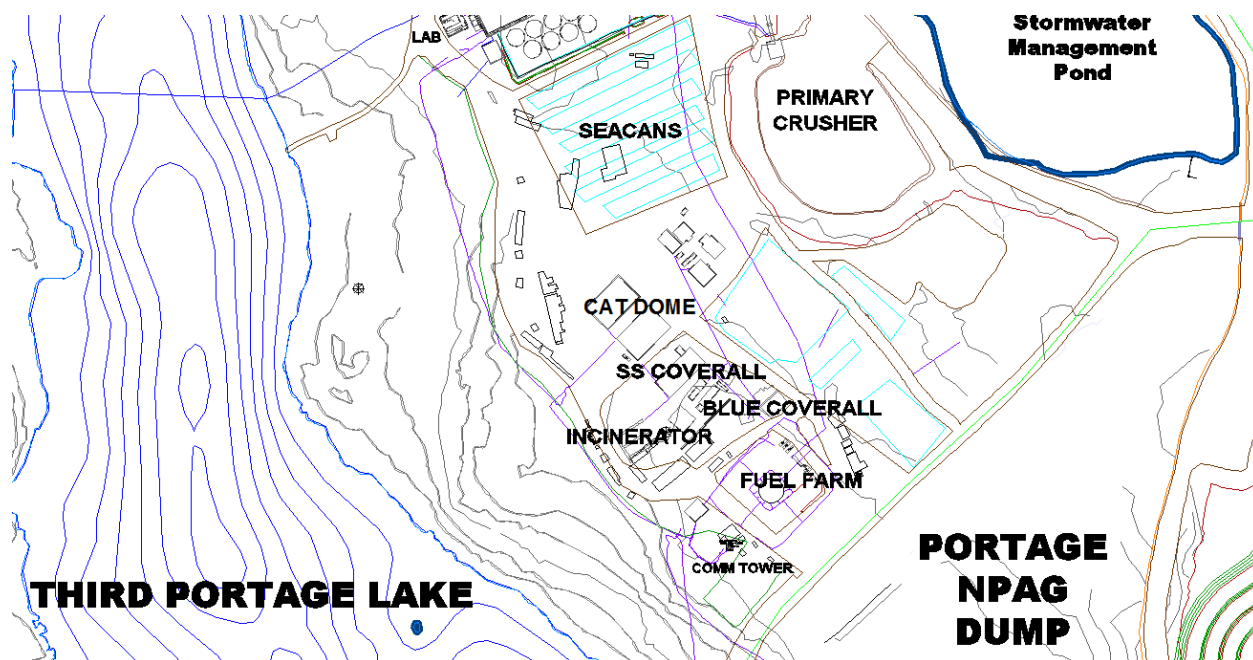
Ash produced from the incineration process is disposed of within the on-site landfill according to the GN Environmental Guideline for Industrial Waste Discharges (GN, 2011). The incinerator ash will be tested to confirm its suitability for landfill disposal (Section 3.3 and 6.3). If monitoring indicates the ash is not suitable for landfilling, it will be buried within the Tailings Storage Facility (TSF). Materials buried within the TSF are expected to freeze over a period of time, resulting in permafrost encapsulation (Golder, 2014).

The camp is currently accommodating ~520 persons on any given day during operations, and the expected life of operation of the incinerator is until 2020 (Golder, 2014).

1.2 INCINERATOR LOCATION

The primary incinerator is located away from the plant site and accommodations complex, adjacent to the fuel storage facility. Thirteen waste oil burning furnaces were installed on site at the cat dome, SS coverall and, blue coverall to provide space heating (see Figure 1-1). One waste oil burner is also located in the incinerator.

Figure 1-1 Incinerator and Waste oil furnaces locations



SECTION 2. REGULATORY CONTEXT

The following section outlines the regulatory context related to solid waste incinerators and waste oil furnaces, and discusses how the regulations apply to the incinerator and waste oil furnaces at the Meadowbank site.

Performance parameters for the incinerator at Meadowbank will be in accordance with the emission guidelines set out by the Canadian Council of Ministers of the Environment (CCME) Canada-wide Standards for Dioxins and Furans (CCME, 2000a) and the CCME Canada-wide Standards for Mercury Emissions (CCME, 2000b).

Best management practices regarding the management of used oil and waste fuel are provided in the Environmental Guideline for Used Oil and Waste Fuel (GN, 2012). AEM will ensure used oil is managed and controlled according to these guidelines.

Ash produced from the incineration and waste oil burning process will be disposed of according to the Nunavut Environmental Guideline for Industrial Waste Discharges (GN, 2011).

2.1 BACKGROUND INFORMATION

2.1.1 Dioxins and Furans

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), commonly known as dioxins and furans, are toxic, persistent, bioaccumulative, and result predominantly from human activity. Due to the extraordinary environmental persistence and capacity to accumulate in biological tissues, dioxins and furans are slated for virtual elimination under the CEPA, the federal Toxic Substances Management Policy (TSMP) and the CCME Policy for the Management of Toxic Substances (CCME, 2000a).

2.1.2 Mercury

Mercury is a naturally occurring substance, which is transformed through biological processes to methyl mercury, a persistent substance which bioaccumulates in the food chain and is particularly toxic to humans and wildlife. Mercury levels originate from a combination of naturally-occurring mercury and anthropogenically emitted mercury. Under a variety of regional, national, bi-national and internal programs, treaties and agreements, mercury is being targeted for emissions reductions consistent with the CCME Policy for the Management of Toxic Substances, which identifies that mercury shall be managed through its lifecycle to minimize release (CCME, 2000b).

2.1.3 Used Oil and Waste Fuel

According to GN Environmental Guideline for Used Oil and Waste Fuel (GN, 2011) 'used oil' means engine, turbine and gear lubricating oil, hydraulic and transmission fluid and insulating coolant (i.e. transformer fluid) that is unsuitable for its intended purpose due to the presence of impurities or the loss of original properties, but does not include waste oil derived from animal or vegetable fat or a petroleum product spilled on land or water. 'Waste fuel' means a flammable or combustible petroleum hydrocarbon,

that is unsuitable for its intended purpose due to the presence of impurities or the loss of original properties, and includes gasoline, diesel and fuel oil, aviation fuel, kerosene, naphtha, but does not include paint, solvent or propane.

SECTION 3. PERFORMANCE LIMITS

3.1 PRIMARY INCINERATOR

AEM selected a Primary Camp Waste Incinerator (model no, ECO 1.75TN 1P MS 60L) from Eco Waste Solutions, which is designed to comply with the regulations in Table 3-1, where the maximum emissions are expressed as a concentration in the exhaust gas exiting the stack of the facility. The specifications of the incinerator are available in Appendix I. In addition to incinerator technology, the implementation of the waste management plan is designed to limit emissions of dioxins and furans from the incinerator.

Table 3-1 Emission Standards for Solid Waste Incinerators

Emissions	Sector	Units	Guideline Maximum	Reference guideline
Dioxins and Furans	Municipal Waste	pg I-TEQ/m ³	80	CCME, CWS 2000a
Dioxins and Furans	Sewage Sludge Incineration	pg I-TEQ/m ³	80	CCME, CWS, 2000a
Mercury	Municipal Waste	µg/R m ³	20	CCME, CWS, 2000b
Mercury	Sewage Sludge Incineration	µg/R m ³	70	CCME, CWS, 2000b

Notes Stack concentrations are corrected for 11% oxygen

At Meadowbank, the primary incinerator may be subject to either Municipal or Sewage Sludge standards based upon the total amount of waste type incinerated (>50% as one type) or upon the territorial designation of facility type. According to the Canada Wide Standards “municipal solid waste” includes any waste that might be disposed of in a non-secure landfill site if not incinerated (i.e., non-hazardous wastes regardless of origin), but does not include “clean” wood waste.

Compliance to these performance limits will be confirmed by stack testing performed by an external contractor once every two years. Should the performance limits above be exceeded then an investigation will be undertaken to determine the cause of the exceedance. In most cases exceedances will be related to improper waste being fed into the incinerator. AEM will conduct additional stack testing the following year to determine if the cause of the exceedance has been rectified.

3.2 USED OIL

AEM manages used oil and waste fuel according to the GN Environmental Guideline for Used Oil and Waste Fuel (GN, 2012).

Table 3-2 summarizes some main points of the guideline that pertain to waste oil generated on site, as per the Environmental Guideline for Used Oil and Waste Fuel (GN, 2012).

Table 3-2: Summary of Used Oil and Waste Fuel Guideline

As per 'Used Oil and Waste Fuel Management Regulations'	
Disposal	Waste oil/Waste fuel will not be disposed of directly into the environment
Storage	Storage is not acceptable for the long-term management of these wastes except under extraordinary circumstances and should be considered as a temporary measure only. Store used oil and waste fuel in its original container or another container certified by the Canadian Standards Association for this purpose. Containers should be located so as to enable their physical inspection for damage or leakage and should be protected from the sun, weather and physical damage. Waste oil/Waste fuel will be stored as per the <i>Hazardous Materials Management Plan</i> (Version 3, October 2013)
Sampling and Analysis	Waste oil will be tested for: <i>Flash point</i> <i>Existence and amount of each impurity Listed in Table 3-3</i>
Burning	Open burning used oil and waste fuel should be avoided. Used oil and waste fuel appliances should not be operated on property that is zoned residential. Waste Oil that exceeds guidelines will not be burned.
Records	The following is recorded in association with the incineration of used oil: <i>Volume of Used oil generated</i> <i>Volume of used oil incinerated/consumed</i> <i>Name and Address of person in charge, management or control of the used oil</i> <i>A summary of maintenance performed on incinerator or processing equipment</i> <i>The destination of the used oil products shipped from the facility (if any)</i>

Table 3-3 summarizes the maximum level of contaminants in used oil that can be used as fuel for the incinerator or consumed by the waste oil burning furnaces as stipulated within the GN Environmental Guideline for Used Oil and Waste Fuel (GN, 2012). Under the regulations blending of used oil that exceeds one of more of the criteria listed in Table 3-3 is not allowed.

Table 3-3: Used Oil Impurity Limit

Impurity	Units	Maximum Level Allowed in Used Oil
Cadmium	ppm	2
Chromium	ppm	10
Lead	ppm	100
Total Organic Halogens (as chlorine)	ppm	1000
Polychlorinated biphenyls	ppm	2

3.3 INCINERATOR ASH

Ash resulting from the incineration of solid waste is disposed of in the landfill and tested for metals according to the GN Environmental Guideline for Industrial Waste Discharges (GN, 2011). Ash that does not meet these guidelines will be buried within the Tailings Storage Facility (TSF). Table 3-4 summarizes the guidelines for metals parameters based on leachate test results.

Table 3-4: Guidelines for Solid Waste/Process Residuals Suitable For Landfill

Parameter	Concentration maximum (mg/L)
Arsenic	2.5
Barium	100
Cadmium	0.5
Chromium	5
Lead	5
Mercury	0.1
Selenium	1
Silver	5
Zinc	500

NOTE: Standards based on leachate test results

SECTION 4. INCINERATOR OPERATION

4.1 PRIMARY INCINERATION

The controlled-air batch (dual chamber) incinerator used at Meadowbank is based on the principals of pyrolysis (starved-air burning condition) and complete oxidation (high temperature, excess oxygen and sufficient time). The incineration system is a two-stage process. In the first stage, waste is converted to gas in the primary chamber at approximately 650 to 850°C. At this temperature any potentially infectious material is destroyed. This process is self-fueling until the volume is reduced by 90%. Gases from the primary chamber enter the secondary chamber of oxygen rich and turbulent conditions, which is typically at a higher temperature – around 1000°C. Combustion is complete after a minimum retention time. A used oil burner is used in the secondary chamber to reduce the quantity of fuel needed for the operation of the incinerator.

Critical process parameters and process control data as per the incinerator operation specifications such as temperature, combustion air flow and burner output are computer controlled to maintain optimal combustion conditions. These parameters are recorded daily and the records are kept for at least 2 years.

For an incinerator capacity suitable for the predicted volumes of waste to be generated at the Meadowbank site the total particulate matter (PM) generated is extremely low (confirmed through stack testing). Therefore dust collection technologies such as bag house filters are not being employed, and no fly ash is generated. Ash residual from the incinerator is generated and is removed daily.

4.1.1 Emissions

The Eco Waste Solutions Incinerator used by AEM is designed to meet performance limits described in Section 3.1. The Primary incinerator has been designed by Eco Waste Solutions using good engineering practice to ensure required dispersion of gases to meet applicable air quality standards/objectives.

The incinerator stack design incorporates appropriate sampling ports (with caps where necessary) at appropriate locations to allow for stack testing to be undertaken during incinerator operation.

4.1.2 Dust/Odour Control Measures

Modern incinerators are commonly designed such that the non-turbulent atmosphere in the primary burn chamber reduces the formation of particulate matter. Therefore, the need for additional dust and /or odour control measures is not required.

4.1.3 Staffing and Equipment

The computerized incinerator requires one person to operate and monitor the equipment for approximately 1 to 1.5 hours per day (for ash removal, loading and start-up). Operators are not required to be in attendance during the rest of the operation, as it is a fully automated process. This incinerator is designed so that the operators are not exposed to high temperatures during loading or ash removal due to complete cool down after the burn cycle. Also, the waste is not allowed to combust until the chamber is sealed thus isolating the worker from smoke and high temperatures. The operating procedure for the incinerator

loading can be found in Appendix II.

4.1.4 Operator Training

Operator training was initially provided by an experienced technician from the incinerator supplier/manufacture (Eco Waste Solutions). Training for operation of the incinerator is now given by the supervisor in charge of the incinerator, who was originally trained by Eco Waste Solutions.

4.2 USED OIL INCINERATOR and FURNACES

Used oil is used as auxiliary fuel at the secondary chamber at the incinerator. This used oil burner at the incinerator has the capacity to handle approximately 200,000 liters of used oil per year. This used oil burner will reduce the amount of fuel used in the incinerator.

Thirteen (13) waste oil furnaces were installed in the existing blue coverall, cat dome and site services coverall to provide space heating. One waste oil burner is also located at the incinerator. These waste oil furnaces/burners have an aggregate capacity to handle approximately 410,000 liters of waste oil per year, however more may be put in service to expand the waste reduction program and minimize the shipment of this material south each year. The source of the waste oil will be from oil changes on the mining equipment and light vehicles as well as oil changes on mechanical gearboxes within the mill. The waste oil is filtered onsite prior to use as a fuel source.

In accordance with the Interim Closure and Reclamation Plan (Golder, 2014), salvageable buildings and surface structures, including the primary incinerator and used oil furnace, will be dismantled and demobilized from the site. No structural material will be incinerated during the closure phase of the mine.

SECTION 5. WASTE MANAGEMENT

The amount of waste will be reduced through purchasing policies that focus on reduced packaging and on-site diversion and segregation programs. At Meadowbank the main objective of the waste management plan relating to incineration is to minimize the amount of solid waste to be incinerated by following an effective waste segregation and reduction program to ensure that only appropriate types of waste are incinerated.

Figure 2 provides a schematic diagram for the management of solid waste and used oil produced on site.

5.1 APPROACH

A waste segregation and reduction program is implemented at the site (i.e. the separation of non-food waste items suitable for storage and subsequent transport and disposal or recycling). This will allow materials that are unsuitable for incineration to be either landfilled on site or hauled offsite to a licensed disposal/recycling facility. The waste segregation program will also document the quantities and types of materials that are incinerated. In addition AEM is now incorporating a waste reduction strategy for materials that originally were being incinerated. For example styrofoam coffee cups and plastic lids were eliminated from general site use in 2012 and replaced with stainless steel mugs and re-washable plastic cups. Other materials will be considered during the life of mine for elimination from the incinerator waste stream.

5.2 ACCEPTABLE WASTE FOR INCINERATION/WASTE OIL FURNACES

Acceptable wastes for incineration, in the primary incinerator as per the operational instructions, include the following:

- Organic matter including food;
- Food containers and wrappings including plastics that are contaminated by food;
- Paper and cardboard; and
- Dead animals (small size only).

Acceptable wastes for incineration in the used oil furnaces include the following:

- Waste oils; and
- Flammable or combustible petroleum hydrocarbons unsuitable for its purpose due to the presence or contaminants or loss of original properties (such as gasoline, diesel fuel, aviation fuel, kerosene, naphtha or fuel oil).

5.3 UNACCEPTABLE WASTE FOR INCINERATION

Materials that are not listed above are unacceptable for incineration. These materials include, but are not limited to:

- Uncontaminated plastics, including chlorinated plastics;
- Inert materials such as concrete, bricks, ceramics, ash;
- Bulky materials such as machinery parts or large metal goods such as appliances (shipped south and recycled in an accredited facility);
- Radioactive materials such as smoke detectors;
- Potentially explosive materials such as propane tanks, other pressurized vessels, unused or ineffective explosives;
- Other hazardous materials such as organic chemicals (PCBs, pesticides), other toxics (arsenic, cyanide);
- Electronics (shipped south and recycled in an accredited facility);
- Batteries (shipped south and recycled in an accredited facility);
- Asbestos;
- Dry wall;
- Vehicles and machinery (shipped south and recycled in an accredited facility);
- Fluorescent light bulbs;
- Whole tires; and
- Any materials containing mercury.

Unacceptable wastes for incineration in the used oil furnace include the following:

- Used oil that exceeds the Maximum Impurity Limits for parameters listed in Table 3.3;
- Waste oil with a flash point of less than 37.7 deg C;
- Paint;
- Solvents; and
- Propane.

5.4 WASTE VOLUMES

5.4.1 Solid Waste

The quantity of waste being incinerated is averaging 1750 kg per day during operations with a camp size of ~520 persons during operations.

5.4.2 Used Oil

The quantity of used oil generated from the servicing of machinery and generators is estimated at approximately 400,000 liters per year (Meadowbank Gold Project – 2015 Annual report).

5.4.3 Incineration Ash

The quantity of ash from the incinerator is approximately 240 tonnes/year, assuming that the incineration process results in a 63% reduction in mass. Assuming the ash has a total density of 1.2 tonnes /m³, then a volume of approximately 200 m³/yr of ash will require disposal. Incinerator ash will be disposed of in the onsite approved landfill.

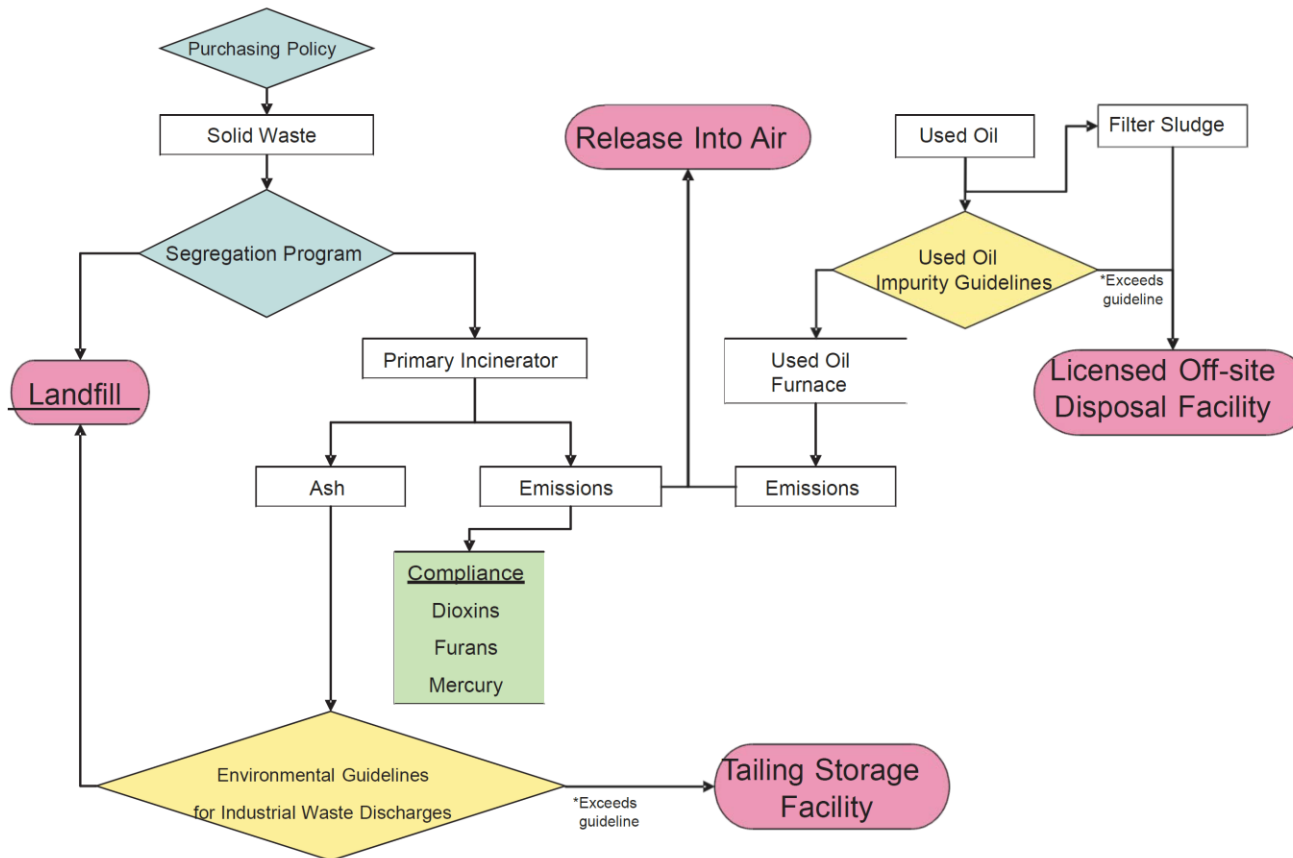
5.5 WASTE INCINERATION RATE

The incinerator has an approximate incineration capacity of 1750 kg / h based on a 10 hour burn cycle. If this cannot be achieved the primary chamber can be used as storage. According to the Eco Waste Solution, the type of waste that is used will never exceed the weight limit. To ensure maximum efficiency, 3 quarters of the chamber has to be filled to ensure that the gas outlet of the primary chamber is never blocked.

The system has a sizable front door for easy access to manually load feed waste into the unit with a front end loader. Dry waste (paper, cardboard) and wet waste (organic matter including food) will be layered to ensure proper combustion and maximum efficiency according to the incinerator operational instructions.

The batch cycle for the Primary Chamber typically lasts approximately 10 hours for the burn cycle and is followed by a cool down of approximately 6 hours. The Secondary Chamber operates with a retention time of approximately 2 seconds.

Figure 5-1: Process Flow Chart for Waste Incineration



KEY:
Yellow fill indicates where a particular test is required
Pink fill Indicates final disposal or release
Blue fill indicates waste management practices/decisions to be made
Green fill indicates where compliance testing is required

PROJECT		AEM AGNICO-EAGLE MINES LIMITED MEADOWBANK DIVISION			
TITLE		PROCESS FLOW CHART FOR WASTE INCINERATION			
		PROJECT No. 07-1413-0047		FILE No.	
		DESIGN	LL	07DEC07	SCALE NTS
		CADD	LL/GG	07DEC07	REV.
		CHECK			
		REVIEW			
		FIGURE 2			

SECTION 6. MONITORING AND TESTING

The following presents the monitoring and testing plan for the incinerator.

6.1 INCINERATOR EMISSIONS TESTING

The incinerator stack incorporates appropriate sampling ports at appropriate locations, in right angle configuration, to allow for stack testing to be undertaken during incinerator operation. Table 6-1 summarizes the frequency of testing that is completed.

Table 6-1: Summary of Incinerator Emissions Testing

	Frequency	Number of Tests Required	Relevant Guideline
Furans and Dioxins	Biennial	3	CCME, CWS 2000a
Mercury	Biennial	3	CCME, CWS 2000b

6.2 WASTE OIL TESTING

No sampling frequency for waste oil is specified in the GN Environmental Guideline for Used Oil and Waste Fuel (2012). To ensure compliance with the Guideline parameters, AEM will sample the waste oil feedstock twice a year. Waste oil that does not meet the regulation impurity limits is drummed and shipped off site as hazmat to a re-refining facility or licensed disposal facility.

6.3 ASH TESTING

The purpose of sampling ash is to determine its acceptability for disposal in the landfill, pursuant to the GN Environmental Guidelines for Industrial Discharge (2011). No sampling frequency is specified in this guideline. To ensure compliance with the Guideline parameters, ash will be sampled twice a year by AEM. Should an exceedance be measured, an investigation will be undertaken to identify the cause and eliminate the source for this exceedance. Ash with metals concentrations exceeding the GN Guidelines will be buried within the Tailings Storage Facility (TSF); materials buried within the TSF are expected to freeze over a period of time, resulting in permafrost encapsulation (Golder, 2014). If deemed necessary, the ash will be packaged in drums and sent to a licensed hazardous waste disposal facility in the south.

SECTION 7. MAINTENANCE

Maintenance of the incinerator is scheduled annually. This maintenance is performed to evaluate the insulation and structural integrity of the incinerator. This is done to ensure the incinerator is functioning at its optimal standard.

When maintenance is performed, 4 small single chambered incinerators are used to incinerate the waste that would normally be disposed in the Eco Waste main unit, to prevent a back log of putrescible waste which would attract wildlife.

SECTION 8. REPORTING

In order to demonstrate compliance with performance limits, an annual incineration management report will be submitted as an Appendix in the Meadowbank Gold Projects Annual Report to the NWB, Government of Nunavut (GN), Environment Canada (EC), and NIRB. The quantity and type of materials incinerated on site during operations, together with results from stack emission testing, waste oil testing and ash monitoring, are to be included within the annual report.

8.1 NATIONAL POLLUTANT RELEASE INVENTORY

The NPRI is a Canadian database containing information on the annual on-site release of specific substances to the air, water and land from industrial and institutional sources (EC, 2007). The NPRI provides a list of tracked substances and requirements for reporting incinerator emissions. Table 8-1 lists the substances under the NPRI that Meadowbank is required to report annually. In addition, there are certain substances as indicated in Table 8-1 that may require reporting depending on the quantity of incinerator emissions. Whether or not reporting is necessary will depend on results of the periodic stack emission testing data and the quantity of annual emissions calculated with emission factors.

Table 8-1: NPRI Incineration Reportable Substance List

Substance Name	Notes
Hexachlorobenzene	Required to Report
Dioxins and Furans	
Carbon Monoxide	Required to Report if released to air from facility in a quantity of 20 tonnes or more per annum
Oxides of nitrogen	
Sulphur dioxide	
Total Particulate matter with diameter <100 microns	
Particulate matter with diameter less than or equal to 10 microns (PM10)	Required to Report if released to air from facility in a quantity of 0.5 tonnes or more per annum
Particulate matter with diameter less than or equal to 2.5 microns (PM2.5)	Required to Report if released to air from facility in a quantity of 0.3 tonnes or more per annum

8.2 GREENHOUSE GAS EMISSIONS

AEM is committed to reporting greenhouse gas emissions (GHG) in support of Canada's Voluntary Challenge Registry; currently termed the Canadian GHG Challenge Registry. AEM has developed a

baseline and monitoring system for GHG to evaluate and report on progress in improving efficiency and reductions in GHG.

SECTION 9. PLAN REVIEW AND CONTINUAL IMPROVEMENT

This Incinerator Waste Management Plan will be maintained by AEM to reflect the current operations at the Meadowbank Gold Project, permit requirements and regulatory setting. The Plan will be reviewed on a regular basis and revised when necessary to ensure that the project staff, operators and regulatory bodies are kept aware of any changes to operational procedures.

The latest Incinerator Waste Management Plan will be made available at all times by AEM for review by the NWB, Government of Nunavut, and Environment Canada.

SECTION 10. REFERENCES

CEPA, 1999. Canadian Environmental Protection Act. March 31, 1999

Canadian Council of Ministers of the Environment (CCME), 2000a. Canada-Wide Standards for Dioxins and Furans, May, 2000

Canadian Council of Ministers of the Environment (CCME), 2000b. Canada-Wide Standards for Mercury Emissions, June 2000

Canadian Council of Ministers of the Environment (CCME), 2001, Canada-Wide Standard for Waste Incineration – Stack Testing Requirements.

Government of Nunavut, 2011. Environmental Guideline for Industrial Waste Discharges. April 2011.

Government of Nunavut, 2012. Environmental Guideline for Used Oil and Waste Fuel. June 2012.

Environment Canada (EC), 2007. National Pollutant Release Inventory (NPRI). http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm

Golder (Golder Associates Ltd.), 2007. Final Report On Landfill Design and Management Plan, Meadowbank Gold Project Nunavut, *Project 06-1413-089/9000, Doc. No. 458, Rev. 0*, submitted to Meadowbank Mining Corporation, dated August 27, 2007.

Golder (Golder Associates Ltd.), 2014. Interim Closure and Reclamation Plan, Meadowbank Gold Project, *Project 13-1151-0131*. Submitted to Meadowbank Division on January 7 2014.

Letter from Nunavut Impact Review Board to Cumberland Resources Ltd, dated December 30, 2006
Re: Meadowbank Gold Mine Project Certificate; Nunavut Land Claims Agreement Article 12.5.12.

National Guidelines for Hazardous Waste Incineration Facilities - Design and Operating Criteria, Volume 1, March 1992, (CCME).

APPENDIX I

TECHNICAL SPECIFICATIONS:

**ECO WASTE SOLUTIONS INCINERATOR MODEL NO. ECO 1.75TN 1P
MS 60L**

TECHNICAL DATA SHEET

Technical Data

Supply all technical data for each item applicable, in the format shown on the following pages. Include drawings necessary for a technical evaluation of each item.

Equipment Number

TBD

Equipment Description

Camp Waste Incinerator

Manufacturer

Eco Waste Solutions

Model Number

ECO 1.75TN 1P MS 60L

Total Installed Weight, kg

44,500 kg (estimated with building)

1 Waste Incinerator

Waste classification: (TYPES)

1. Camp Waste

2. Sewage Sludge

3. Waste Oil

Mixed waste charge classification: Break-down of each type of waste (%)

1. Camp Waste - 75%

2. Sewage Sludge - 25%

3. Waste Oil - N/A charged into secondary

**Emissions:

SO₂ (mg/m³)

50 mg/m³

CO (mg/m³)

7 mg/m³

NO_x (ppm)

< 50 ppm

VOCs µg/m³

50 - 2000 µg/m³

Particulate (mg/m³)

20 mg/m³

PM₁₀ (g/s)

N/A

Dioxins/Furan (pg I-TEQ/m³)

< 80

Mercury (µg/Rm³)

N/A - Materials containing Mercury to be excluded from incinerator waste stream

Flue Gas Temperature (°C)

1000°C

Flue Gas Flow Rate (kg/s)

1.996 kg/s (max)

Incineration capacity: (kg/h)

175 kg/h (10 hour burn)

Charge per cycle: (kg)

1750kg

Burning rate: (kg/h)

175 kg/hr average

Off-time per cycle: (h)

6 hr cool down

Heat value: (kJ/kg or BTU/lb)

5125 BTU/lbs (Solid and Sewage sludge mixed waste)

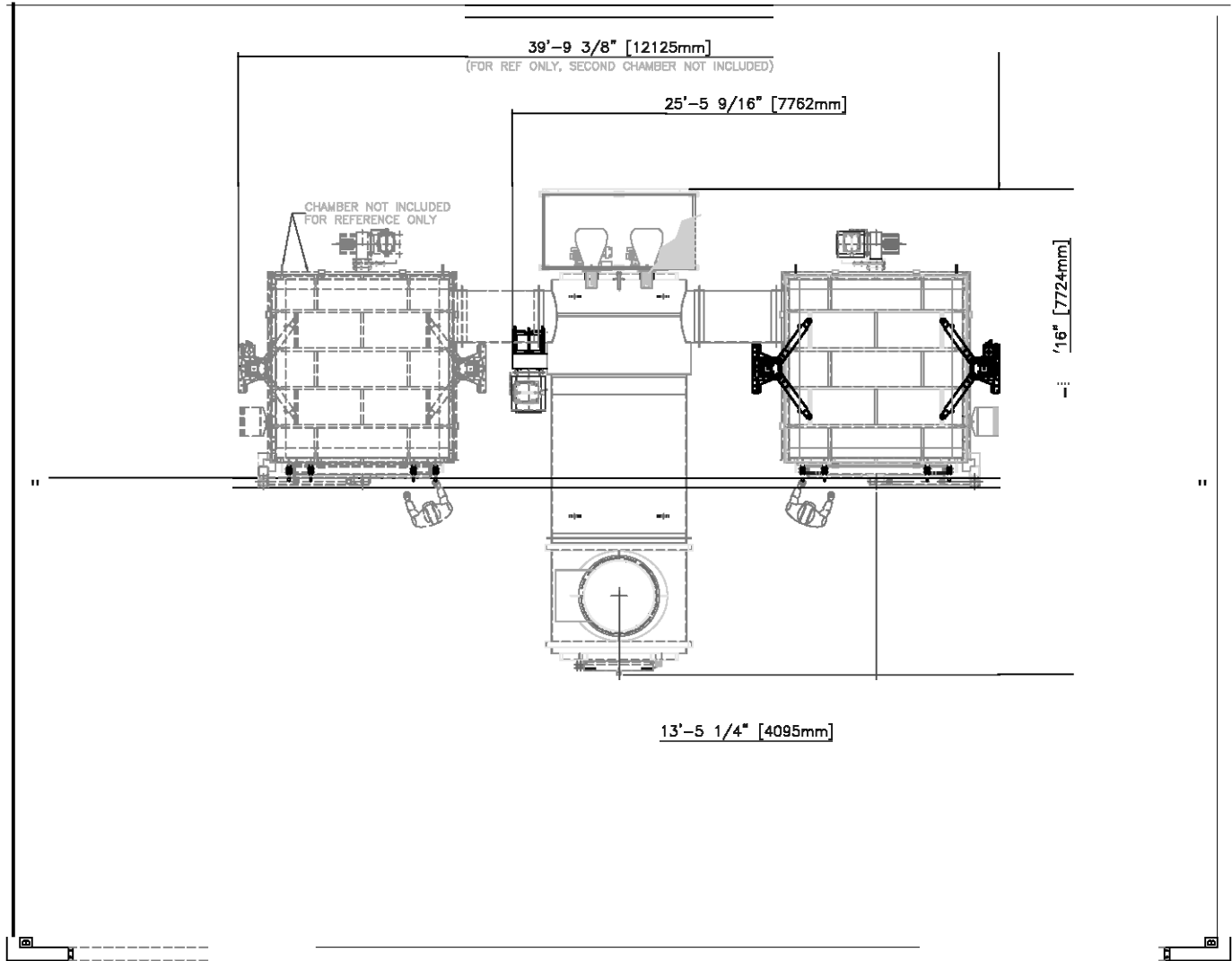
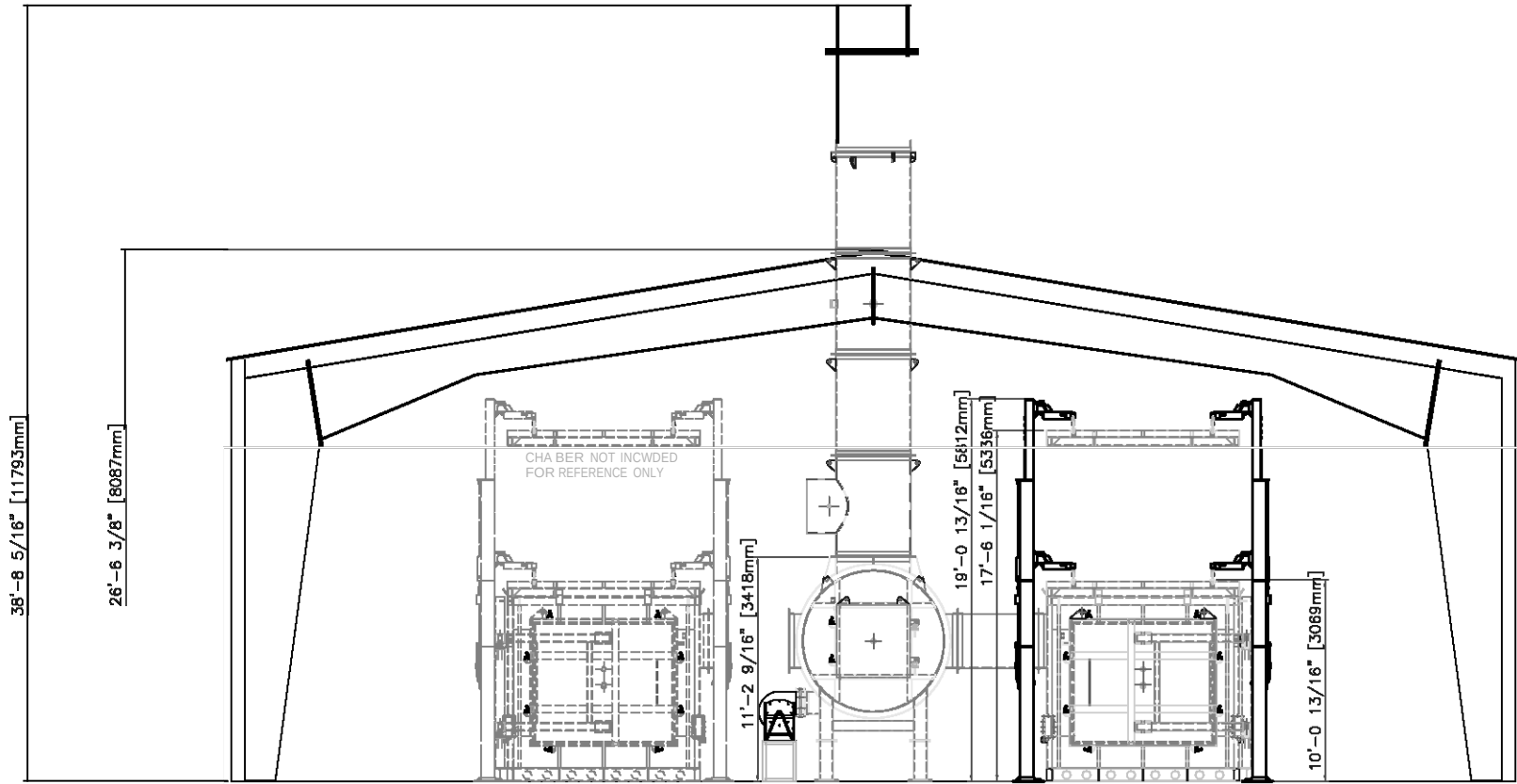
**The emission estimates provided are given as volumetric concentrations or pollutants; as per test reporting standards. Estimates are based on previous air emission tests.

Fuel mixing ratio with waste oil (if applicable)	N/A
Capability to burn waste oil with loading rate (kg/h)	60.6 kg/h (8 hour liquid burn)
Applicable auxiliary burner.	N/A
Incinerator to bear CSA label?	All electrical components CSA or UL approved. Approval of complete incinerator package at additional cost..
Temperature: Primary chamber (°C):	705°C
Temperature: Secondary chamber (°C):	1000°C
Burner Efficiency:	High
Internal Volume of Primary Chamber:	2.43(l) x 2.43(w) x 2.29(h) m
Internal Volume of Secondary Chamber:	1.83 (dia) x 5.49(l) m
Destruction efficiency	95% DRE
Tested Emission results (rates)	- See Section 1 (Emissions)
Stack internal diameter (mm)	965mm
Height of Stack (m)	7.62m
Stack materials of construction	Refractory Lined - Mild Steel (44W HSLA)
Spark Arrester length (mm)	1092mm
Spark Arrester open area (m ²)	0.425m ²
Burner System	Primary Burner - Riello RL28/2 Secondary Burner - Qty(2) Riello RL100/M Liquid Waste Burner - Eco Waste Solution Liquid Waste Oxidizer
Valve Train	N/A - Integrated in Burners
Charging System	N/A - Batch System
Charging opening size	1.78m (w) x 1.43m(h)
Charging Chute size	N/A - no chute
Ash Removal System	N/A - Manual
Expected ash production per cycle (kg)	200kg (estimated)
Maximum Capacity of ash removal system	N/A
2. Materials of Construction	
External Casing	Mild Steel (44W HSLA)
Spark Arrester	Stainless Steel (SS 304)
Insulation in Primary Chamber	Walls - Ceramic Fibre Blocks (152mm (6") Thick) Floor, Door Sills & Breech entrance - Castble (101 - 152mm (4-6") Thick)
Insulation in Secondary Chamber	Walls - Ceramic Fibre Blocks (152mm (6") Thick) Breech exit & Stack Entrance - Castable - (76 -152mm (3-6") Thick)
Insulation in Stack (materials and thickness)	Insulating Castable (76mm (3") Thick)
Charging Chute	N/A
Paint System Used	Carboline - Silicon Zinc Primer, Silicon Finish
Dry Film Thickness of Paint	Primer - 2 mils (50 micron) Final Coat - 2 mils (50 micron)
Primary Chamber Burner Rating	(663 - 1266)x10 ³ KJ/hr
Secondary Chamber Burner Rating	(1582 - 6119)x10 ³ KJ/hr
3. BLOWERS	
Blower Manufacturer	New York Blower
Primary Chamber Blower Capacity (m ³ /hr)	2696
Primary Blower Pressure (kPag)	0.25
HP/ RPM	1.15 hp @ 2200rpm
Secondary Chamber Blow Capacity (m ³ /hr)	4247
Secondary Blower Pressure (kPag)	0.5
HP/ RPM	1.9hp @ 4900 RPM
4. CONTROL SYSTEM	
Please list all instrumentation and details including	- Please See Appendix A (Attached)
CSA approval and labelling:	

AGNICO-EAGLE MINES LIMITED ("AEM"), MEADOWBANK DIVISION.: MEADOWBANK
 GOLD PROJECT
 INCINERATOR
 INQUIRY NO.: MDB-S-M-268

SECTION: 00 43 45
 TECHNICAL DATA SHEET
 REV. 0B

5. INCINERATOR BUILDING (if applicable)	
Overall Length (mm)	12 192mm
Overall Width (mm)	12 192mm
Overall Height (mm)	6420 mm
Shipping Dimensions (mm)	6660 x 3050 x 914 mm
6. DIMENSIONS	
Overall Length (mm)	6 858 mm
Overall Width (mm)	7 188 mm
Overall Height (mm)	11 049 mm
Shipping Dimensions (mm)	Largest Pieces (L x W x H) mm
	Primary Chamber - 3403 x 3225 x 2895
	Secondary Chamber - 6172 x 2413 x 2794
	Shipping Container - 12 000 x 2438 x 2591
7. WEIGHTS (KG)	
Incinerator	20 275 kg
Stack	4082 kg
Blowers & Burners	400 kg (Blowers) 580 kg (Burners)
Total Weight	25 337kg



FOR REVIEW ONLY.

BILL OF MATERIAL		
ITEM QTY.	DESCRIPTION	WEIGHT kg.

REV.		DESCRIPTION	APPROVED
THIS DOCUMENT IS THE PROPERTY OF ECO BURN INC. AND SHALL NOT BE USED, COPIED OR TRANSFERRED TO OTHER DOCUMENTS WITHOUT PRIOR WRITTEN PERMISSION OF ECO WASTE SOLUTIONS.			
DRAWN: J.S.	DATE: 19-08-08	BCO WASTE SOLUTIONS	
CHECKED:	DATE:		
PROJECT NAME: HATCH - MEADOWBANK		CUSTOMER P.O.	
PROJECT NUMBER: MDB-S-268		CUSTOMER EQUIPMENT. 1	
SCALE:		TITLE:	
JOB NO. --- OB-2MS		BUILDING DRAWING HATCH MEADOWBANK	
THIRD ANGLE		DWG. NO. MDB-EC01.75TN1PMS60L-XXX	REV.

APPENDIX II

ANNUAL COMPLIANCE AND REPORTING TEMPLATE

Appendix 2
Annual Report for
Incinerated Waste Management

Contact Information			
Company Name:			
Contact Name:			Position
Contact Email:			
Address			
City/Town:			Province:
Postal Code:			
Telephone:			Fax:

Incinerator Data and Information

Name of Emission Unit	
Type of Process	
Description of Process	
Description of Material Produced from incineration	
Manufacturer of Emission Unit	
Model No.	

Dates of Commencing:	Date
Construction	
Operation	
Modification	

Operating Information	Hour/day	Days/week	Weeks/year
Maximum Operating hours			
Average Operating hours			

Annual Throughput	Dec-Feb (%)	Mar-May (%)	Jun-Aug (%)	Sep-Nov (%)

Incinerator Charging Rate	Maximum (kg/day)	Average (kg/day)	Annual (tonnes/year)

Appendix 2

Annual Report for Incinerated Waste Management

[illegible]

Fuel Usage Data	Maximum	Typical
Firing rate		

Fuel Type	

Factor Determination:	Check Applicable Box
Municipal Waste Incineration	
Sewage Sludge Incineration	

Stack Emissions Tests For Compliance (must be corrected for 11% oxygen)

	Date	Test 1	Test 2	Test 3	Average	Compliance (check)
Furans and Dioxins						
Mercury						

Provide Test method details:

[illegible]

Appendix 2
Used Oil Impurity Limits

Contact Information			
Company Name:			
Contact Name:		Position	
Contact Email:			
Address			
City/Town:		Province:	
Postal Code:			
Telephone:		Fax:	

Volume of Used Oil Generated:	

Volume of Used Oil incinerated/Cons	

Sample Analysis:

Flash Point:	

Impurity	Units	Maximum Level Allowed	Sample #			
Cadmium	ppm	2				
Chromium	ppm	10				
Lead	ppm	100				
Total Organic Halogens (as chlorine)	ppm	1000				
Polychlorinated biphenyls	ppm	2				
Ash content	%	-				

Volume of Products Produced from Used Oil Use:

Maintenance Performed on Incinerator:

Destination of Used Oil not Incinerated:

Appendix 2
Guidelines for Ash Testing
Environmental Guidelines for Industrial Waste Discharges

Parameter	Concentration maximum (mg/L)	Sample Number		
Ammonia Sulphide	100			
Benzidine	100			
Benzyl Chloride	100			
Enthalamine	100			
Ethylenediamine	100			
Maleic Anhydride	100			
Potassium Permanganate	100			
Quinoline	100			
Strychnine	100			
Tetrachloroethanes	100			
Arsenic	2.5			
barium	100			
Cadmium	0.5			
Carbon tetrachloride	0.5			
Chromium	0.5			
Cyanide (free)	20			
DDT	3			
Endrin	0.02			
Heptachlor + Heptachlor epoxide	0.3			
Lead	5			
Lindane	0.4			
Mercury	0.1			
Methoxychlor	10			
Methyl ethyl Ketone	200			
Metolachlor	5			
PCBs	50*			
Selenium	1			
Silver	5			
Tetrachloroethylene	3			
Toxaphene	0.5			
Trialomethanes	10			
2, 4, 5-TP (Silvex)	1			
Zinc	500			

* based on concentration by mass

APPENDIX II

MBK-SIT-0011 – INCINERATOR LOADING

PROCEDURE NUMBER:

MBK-SIT-0011

People concerned	Agnico-Eagle employees working on the AWPR	Prepared by	Site Services
		Approved by	Roger Sauvé, Site Services General Foreman
Issuing date :	2011-11-30		

This procedure corresponds to the required minimum standard. Each and every one also has to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.

Objective:

To load the incinerator

Concerned departments:



Site services

Required equipment

- Proper Protective Equipment: mask, glasses, fire retardant coveralls, welding gloves, rechargeable mask, face shield

Impacts



Health & Safety



Process/Quality



Costs



Environment

Procedure	Risks/ Impacts
1. There are 2 BLUE ash bins, one of which has an ORANGE spray on it. There is a sign on the yard which indicates a cold and hot side. The one with the cold side could be dumped into the roll off. 24 hours after ash deposition	 Prevent incident and /or accident
2. After the dumping of the ash bin, inspect the roll off bin to ensure there is no red hot ash that will start a fire	
3. If there is smoke or red ash seen, ask the team leader to arrange for the small water truck located in the incinerator to give it a good spray of water to avoid a fire	
4. Bring empty ash bin into the incinerator building for the new batch	
5. Go outside of the incinerator and move the ash bin from the hot side to the cold side	
6. Close the breaker switch to the OFF position for the primary chamber and lock it using Ensure a “Zero State of Energy” and follow lock-out- Tag out Standard MBK- HSS-0010	
7. Turn on the primary chamber exhaust vacuum system	
8. Open the door and make sure the burn is good; If not: call the supervisor or team leader	
9. Tie the door in the open position for safety	



Incinerator Loading



10. Empty the chamber and remove all ashes using large shovels into the ash bin	
11. When taking out the fresh ash bin, make sure to put on the hot side of the sign	
12. Once the chamber is completely cleaned, load the bottom row with medium wet bags	
13. Put two layers of contaminated cardboards and contaminated rags	
14. Put one row of dry garbage bags	
15. Put two more layers of cardboard and rags	
16. Put one row of dry to wet bags	
17. Continue the same way and finish with the wet bags on top and no cardboards (this will help keep the flames from coming up and also prolong the life of the chamber since the flames are not in direct contact with the top wall of the chamber, it will also cut down on having to reset the burner which is caused by the flame being high at the top)	
18. Close the door and make sure all the locking latches are in proper position	



Incinerator Loading



19. Turn off the primary chamber exhaust vacuum system	
20. Unlock the primary chamber breaker and turn it to the ON position	
21. Start the burning cycle - Never open the door after the start - If the burner does not start, call team leader or supervisor	
22. Do not store any flammable products around the primary and secondary chambers within the marked area - Never add any accelerant into the chamber to help the start	

**TAILINGS STORAGE FACILITY: OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL,
VERSION 6, MARCH 2016**



MEADOWBANK GOLD PROJECT

TAILINGS STORAGE FACILITY

Operation, Maintenance and Surveillance Manual

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 6
March 2016

TAILINGS STORAGE FACILITY
OPERATION, MAINTENANCE AND
SURVEILLANCE MANUAL
MEADOWBANK GOLD PROJECT
AGNICO EAGLE MINES LIMITED

This Operation, Maintenance and Surveillance Manual has been prepared by Agnico Eagle Mines Limited and is to be used for the operation, maintenance and surveillance of the Tailings Storage Facility at the Meadowbank Gold Project. All Registered Manual Holders are responsible for ensuring that they are using the most recent revision of this document. This Operation, Maintenance and Surveillance Manual, may not be copied in whole or in part without the written consent of Agnico Eagle Mines Limited.

IMPLEMENTATION SCHEDULE

This Plan is immediately implemented.

DISTRIBUTION LIST

AEM - General Manager Meadowbank

AEM- Environment Superintendent

AEM- Mine Operations Superintendent

AEM- Engineering Superintendent

AEM- General Superintendent Mine Operations

AEM- Energy and Infrastructure Superintendent

AEM- Corporate Environment Director

AEM- Health and Safety Superintendent

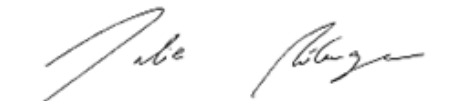
Golder- Dike Design Engineer

SNC- Dike Design Engineer

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
(first revision)	February 2012	All	All	
V2	August 27, 2013	All	All	
V3	September 15, 2013	All	All	Updated items mentioned by MDRB and the Mine Inspector in the Annual Geotechnical Inspection in September 2013
V4	January 2015	All	All	
V5	October 2015	All	All	
V6	March 2016	All	All	

Approved by:



Julie Belanger
Engineering Superintendent



Jamie Quesnel
Environment Superintendent

TABLE OF CONTENTS

DISTRIBUTION LIST	IV
DOCUMENT CONTROL	V
LIST OF TABLES.....	VIII
LIST OF FIGURES.....	VIII
LIST OF APPENDICES	VIII
 SECTION 1 • INTRODUCTION.....	 1-1
1.1 Purpose	1-1
1.2 Registered Manual Holders and Revisions	1-1
1.3 Regulatory, CDA and MAC Guideline Requirements.....	1-1
1.4 Dam Classification	1-2
1.5 Annual Review of Manual.....	1-2
1.6 Reference Documents and Drawings.....	1-2
 SECTION 2 • ROLES AND RESPONSIBILITIES.....	 2-1
2.1 Roles, Responsibilities and Authority	2-2
2.2 Required Levels of Knowledge.....	2-2
 SECTION 3 • FACILITY DESCRIPTION	 3-1
3.1 Background.....	3-1
3.2 Design and Operational Criteria	3-3
3.3 Facility Components	3-3
3.3.1 Perimeter Containment Structures	3-3
3.3.2 Internal Deposition Structures	3-3
3.3.3 Perimeter Water Control Structures.....	3-3
3.4 Tailings Distribution System	3-3
3.5 Water Management System and Piping.....	3-5
3.6 Facility Closure	3-5
3.7 Instrumentation.....	3-5
3.8 Public Safety.....	3-5
 SECTION 4 • OPERATIONS.....	 4-1
4.1 Operational Philosophy	4-1

4.2	Deposition Planning Criteria and Constraints	4-1
4.3	Water Management	4-2
SECTION 5 • MAINTENANCE.....		5-1
5.1	Containment Structures.....	5-1
5.2	Ditches and Sumps	5-1
5.3	Instrumentation.....	5-1
5.4	Pipelines and Pumps.....	5-1
SECTION 6 • SURVEILLANCE		6-1
6.1	Inspections.....	6-1
6.1.1	Routine Inspections	6-1
6.1.2	Special Inspections	6-3
6.1.3	Annual Inspection	6-3
6.2	Instrumentation and Survey.....	6-3
6.2.1	Ground Temperature and Piezometric Level Monitoring.....	6-6
6.2.2	Anomalous Measurements	6-6
6.2.3	Seepage Monitoring.....	6-7
6.3	Water Quality	6-7
SECTION 7 • REPORTING AND DATA MANAGEMENT.....		7-1
7.1	Reporting	7-1
7.1.1	Inspection Documents	7-1
7.1.2	Instrumentation Measurements	7-1
7.1.3	Emergencies	7-1
7.2	Data Management	7-1
SECTION 8 • EMERGENCY PREPAREDNESS PLAN		8-1
8.1	Emergency Procedures	8-1
8.1.1	Operation	8-1
8.2	Emergency Details	8-2
8.2.1	Access to the Project Site	8-2
8.2.2	Emergency Assessment	8-2
8.2.3	Emergency Communication and Actions.....	8-2
8.2.4	Site Emergency Procedure	8-3
8.2.5	Communication Equipment Location	8-3
8.3	Medical and First Aid Services	8-4
8.4	On Site Equipment and Material	8-4
8.4.1	Pumping Equipment.....	8-4
8.4.2	Mobile Equipment	8-5
8.4.3	Earthwork Material and Equipment.....	8-1
SECTION 9 • EMERGENCY RESPONSE REFERENCE DOCUMENTS		9-1

SECTION 10 • REFERENCES.....10-1

LIST OF TABLES

Table 1-1	List of Registered OMS Manual Holders.....	1-3
Table 1-2	Record of OMS Manual Revisions and Addenda	1-4
Table 1-3	Regulatory Requirements	1-5
Table 1-4	Classification of Dams in Terms of Consequences of Failure (after CDA 2007)	1-6
Table 1-5	Tailings Storage Facility Documentation Summary	1-7
Table 1-6	Listing of Specifications for Tailings Storage Facility	1-8
Table 1-7	List of Construction Drawings for Embankment Structures	1-9
Table 1-8	List of Construction Drawings for Infrastructure and Piping.....	1-10
Table 2-1	Roles and Responsibilities	2-1
Table 2-2	Recommended Minimum Knowledge of OMS Manual	2-4
Table 3-1	Design and Operational Criteria.....	3-5
Table 6-1	Surveillance Items and Frequencies	6-4
Table 9-1	Emergency Response Reference Documents.....	9-1
Table 9-2	Potential Effects or Causes of Embankment Failure Mechanisms	9-1
Table 9-3	Threshold Criteria During Operation	9-3
Table 9-4	Communication Charts for Each Emergency Level	9-4
Table 9-5	Responsibilities of Persons for Each Emergency Level.....	9-4
Table 9-6	Names and Contact Details (to be updated as required).....	9-5

LIST OF FIGURES

Figure 1	AEM Tailings Storage Facility Management Structure	2-2
Figure 2	Plan of Tailings Storage Facility.....	3-2
Figure 3	Spigot Locations.....	3-4
Figure 4	Approximate Location of Current Instrumentation	6-5
Figure 5	Earthwork Material and Equipment Location	8-1

LIST OF APPENDICES

Appendix I	Water Quality and Flow Monitoring Plan
Appendix II	Tailings Storage Facility - Inspection Form
Appendix III	Dike Failure Scenario Appendices from the ERP
Appendix IV	Central Dike – Specific Trigger Values

LIST OF ACRONYMS AND ABBREVIATIONS

%	Percent
°C	Degrees Celsius
1:100	1 in 100 years (return period)
2H:1V	Slope of 2 horizontal units to 1 vertical unit
AEM	Agnico Eagle Mines Limited
CDA	Canadian Dam Association
Elev.	Elevation
EPP	Emergency Preparedness Plan
ERP	Emergency Response Plan
g	Gravitational acceleration constant (9.80 m/s ²)
Golder	Golder Associates Ltd.
m	Metre
M	Million
MAC	Mining Association of Canada
OMS	Operation, maintenance and surveillance
SD1	Saddle Dam 1
SWD	Stormwater Dike
TSF	Tailings Storage Facility
tpd	Tonnes per day

LIST OF DEFINITIONS

Active Layer: Ground above the top of permafrost. This layer freezes and thaws seasonally.

Permafrost: Bedrock or soil at a temperature at or below 0°C for a continuous period of two or more years. It is important to note that permafrost is not permanent. It is also important to note that the term permafrost does not imply the presence or absence of ice in the bedrock or soil.

SECTION 1 • INTRODUCTION

1.1 PURPOSE

This operation, maintenance and surveillance (OMS) manual provides a reference document to be used by the personnel responsible for the operation, maintenance and surveillance of the Tailings Storage Facility (TSF) at the Meadowbank Gold Project that is owned and operated by Agnico Eagle Mines Limited (AEM).

The TSF is the permanent surface storage facility for tailings produced during the operation of the mine. Refer to Section 3.0 for description details of the TSF.

Qualified personnel shall be used for the operation, maintenance and surveillance of the TSF and adequate records shall be maintained for regulatory, general and reference purposes. As the management structure changes, the OMS manual should be revised and distributed accordingly. A primary objective during the early phases of operation and development of the TSF, especially during that of the North Cell, was to optimize these activities for use during subsequent development phases.

This OMS manual addresses the operational issues of the TSF. It does not examine design, construction or closure issues in detail. Details of the design and construction requirements for the TSF are presented in the references provided later in this document. Details on closure are included in the Closure Plan.

1.2 REGISTERED MANUAL HOLDERS AND REVISIONS

Each copy of this OMS manual is assigned a unique identification number.

The AEM Engineering Superintendent is responsible for maintaining an up-to-date list of the registered holders of this OMS manual in Table 1-1.

The AEM Engineering Superintendent is also responsible for the issue of all revisions and addenda to all Registered Manual Holders of this OMS manual. Revisions will be made, as and when required, by re-issuing a complete section, table and/or appendix so that the superseded section, table and/or appendix can be removed and replaced. All Registered Manual Holders are responsible for placing the revisions and addenda in their copy of the OMS manual and for recording receipt of the same in Table 1-2.

1.3 REGULATORY, CDA AND MAC GUIDELINE REQUIREMENTS

This OMS manual sets out procedures to ensure compliance with the AEM regulatory requirements which are summarized in Table 1-3.

The Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2007) states "Dam operation, maintenance and surveillance encompass a number of activities and constraints defined to ensure that the dam is managed with appropriate regard for safety." The preparation and use of this OMS manual achieves this requirement. Reference to CDA (2007) was made in the preparation of this OMS manual.

The Mining Association of Canada (MAC) has prepared two reference documents for management of tailings facilities: "A Guide to the Management of Tailings Facilities" (MAC 2008) and "Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities" (MAC 2005). Both of these documents were used in preparation of this OMS manual.

1.4 DAM CLASSIFICATION

Table 1-4 presents the classification information and the following is noted for the perimeter containment structures of the TSF (i.e. Saddle Dams 1 to 5, inclusive, the Stormwater Dike and the Central Dike):

- Loss of life: the embankment is classified as "high" due to the limited number of workers in the Portage and Goose Pits downstream of the Central Dike coupled with AEM's procedures for pit evacuation in the event of an emergency;
- Environmental and Culture Values: the embankment is classified as "high" due to the water license requirements and environmental permitting considerations;
- Infrastructure and Economic Losses (third parties): the embankment is classified as "high" due to the water license requirements and environmental permitting considerations; and
- The dam classification for the TSF perimeter containment structures is determined by the highest of the three ratings above; therefore, these structures are classified as "high" consequence structures.

1.5 ANNUAL REVIEW OF MANUAL

This OMS manual will be reviewed by AEM on an annual basis and revised as necessary to accommodate changes in the condition and operation of the TSF. The Registered Manual Holders of the OMS manual are encouraged to provide comments and suggestions for improvement of the OMS manual and the procedures specified in it to the AEM Engineering Superintendent. The comments and suggestions communicated will be considered in the annual review.

1.6 REFERENCE DOCUMENTS AND DRAWINGS

A summary of the documentation prepared for the TSF, including design reporting, as-built reporting, technical specifications, construction drawings, instrumentation installation reporting and deposition planning, is presented in Table 1-5. The most current technical specifications and construction drawings referenced in Table 1-5 are presented in Table 1-6 to Table 1-8, inclusive. All design and as-built documents can be found in hard copy onsite in the engineering department, as well as in electronic copies on the dikes server.

Table 1-1 List of Registered OMS Manual Holders

[illegible]

Table 1-2 Record of OMS Manual Revisions and Addenda

[illegible]

Table 1-3 Regulatory Requirements

Document	Document Reference and/or No.	Review Date
Territorial Lands Act – Land Lease	Production Lease KVPL08D280	Expires December 27, 2027
Environmental Impact Assessment	NIRB Project Certificate No. 004	Only required if substantial modifications to original application are to be carried out
Water License Type “A”	Nunavut Water Board Water Licence 2AM-MEA0815	Expires July 22, 2025

Table 1-4 Classification of Dams in Terms of Consequences of Failure (after CDA 2007)

Dam Class	Population at Risk [Note 1]	Incremental losses		
		Loss of Life [Note 2]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	Significant loss or deterioration of <i>important</i> fish or wildlife habitat Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very high	Permanent	100 or fewer	Significant loss or deterioration of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g., <i>highway, industrial facility, storage facilities for dangerous substances</i>)
Extreme	Permanent	More than 100	Major loss of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services (e.g., <i>hospital, major industrial complex, major storage facilities for dangerous substances</i>)

Note 1. Definitions for population risk:

None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary – People are only temporarily in the dam-breach inundation zone (e.g., *seasonal cottage use, passing through on transportation routes, participating in recreational activities*).

Permanent – The population at risk is ordinarily located in the dam-breach inundation zone (e.g., *as permanent residents*); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

Note 2. Implications for loss of life:

Unspecified – The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

Table 1-5 Tailings Storage Facility Documentation Summary

Item	Description	Reference
TSF Design Basis	Report	Golder (2008)
Stormwater Dike and Saddle Dam 1 Geomembranes	Technical Memorandum	Golder (2009)
Revised configuration for Saddle Dam 1	E-Mail	Golder (2009; no formal document issued)
Deposition Plan (North Cell)	Report	Golder (2011, 2012)
Deposition Plan (North Cell)	Presentation	AEM (September 2013)
Construction Report TSF	Report	AEM (June 2013)
North Cell Diversion Ditches	Report	AEM (July 2013)
Deposition Plan (North & South Cells)	Presentation	AEM (August 2014)
Central Dike As-Built Report	Report	AEM (January 2016)
Saddle Dam 3 As-Built Report	Report	AEM (January 2016)
Saddle Dam 4 As-Built Report	Report	AEM (January 2016)
Saddle Dam 5 As-Built Report	Report	AEM (January 2016)
Deposition Plans (North & South Cell)	Presentation	AEM (November 2015)
<i>Update as Required</i>		

Table 1-6 Listing of Specifications for Tailings Storage Facility

Item (Prepared By)	Specification No. and Title	Revision No. and Title	Date of Revision
Golder	Specification-TSF Dike Construction	Doc. 795 Rev. 0	October 16, 2009
Golder	Central Dike Design Changes	Doc 1453 1312210034 TME Rev0	April 24, 2014
Golder	Detailed Design Report for Saddle Dams 3, 4 and 5	Doc 1504 1416081 SD3,4 & 5 Design Rev1	May 12, 2015
<i>Update as Required</i>			

Table 1-7 List of Construction Drawings for Embankment Structures

Drawing No. (Prepared by)	Title	Revision No.	Date of Revision
4100-30 to 4100-39 (Golder)	Tailings Storage Facility – Stormwater Dike	0	July 10, 2009
4100-50 to 4100-60 (Golder)	Tailings Storage Facility – Saddle Dam 1	0	July 10, 2009
SD2-SD3-01 to SD2-SD3-13 (Golder)	Tailings Storage Facility –Saddle Dam 2 and Saddle Dam 3	A	August 25, 2010
SD6-01 to SD6-11 (Golder)	Tailings Storage Facility – Saddle Dam 6	A	September 13, 2010
Figure 1—Supersedes Drawing Nos. 4100-30, 4100- 31, and 4100-32 (Golder)	Agnico-Eagle Mines Limited, Meadowbank Gold Project Nunavut, Stormwater Dike Staged Layout Plan	N/A	August 5, 2009
Figure 2—Supersedes Drawing Nos. 4100-33, Detail 3 on 4100-34 (Golder)	Tailings Storage Facility Typical Cross-Section and Details	N/A	August 5, 2009
Figure 1—Supersedes Drawing Nos. 4100-51, 4100- 52, 4100-53, and 4100-58 (Golder)	Tailings Storage Facility Saddle Dam 1 Rockfill Plan and Liner Details	N/A	August 17, 2009
All drawings in the Construction Report TSF (AEM)	Construction Report Tailings Storage Facility	N/A	June 15, 2013
All drawings in the Detailed Design Report for Saddle Dams 3, 4 and 5 Doc 1504 1416081 SD3,4 & 5 Design Rev1	Detailed Design Report for Saddle Dams 3, 4 and 5	N/A	May 12, 2015
<i>Update as Required</i>			

Table 1-8 List of Construction Drawings for Infrastructure and Piping

Drawing No. (Prepared by)	Title	Revision No. and Title	Date of Revision
All Booster Pump Design Drawings	Booster Pump Design Drawings, MEAD-360	N/A	June 26, 2012
Weekly Update Geotech Planning – Tailing Deposition (AEM)	North Cell Tailings Storage Facility Tailings Deposition Plan	Updated Weekly	N/A
All drawings in the Construction Summary Report North Cell Diversion Ditches (AEM)	Construction Summary Report North Cell Diversion Ditches	N/A	July 27, 2013
All South Cell Infrastructures Drawings (AEM)	Reclaim pump drawings 61-430 Pig launcher drawings 61-360	N/A	October 2014
<i>Update as Required</i>			

SECTION 2 • ROLES AND RESPONSIBILITIES

There are several AEM department teams involved in the operation, maintenance and surveillance of the TSF:

The Engineering Department has a team of people that:

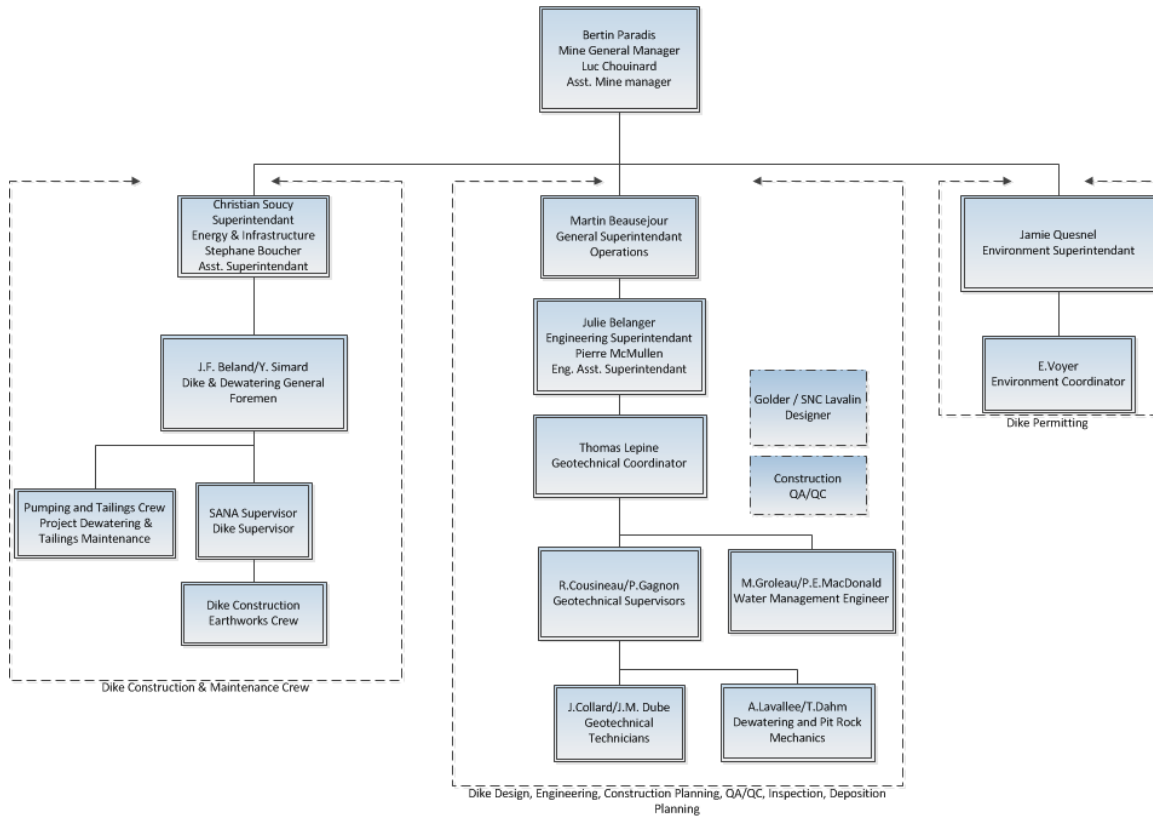
- Plan and oversee the construction of the embankments of the TSF;
- Provides the overall management of the TSF;
- Oversees the design, development, construction and deposition activities of the TSF;
- Monitors the thermistor instrumentation of the TSF;
- Monitors quantity and manages the water of the TSF, including the perimeter water control structures;
- Carries out operation, maintenance and surveillance of the tailings distribution system;
- Conducts visual inspections of the TSF, including the perimeter water control structures;
- Monitors the water level elevations of the perimeter sumps and the embankment slope monitoring points; and
- Coordinates activities and ensure compliance with the regulatory requirements of the TSF.

The Environment Department has a team of people that:

- Monitors the water quality from the sumps of the TSF; and
- Coordinates activities and ensure compliance with the regulatory requirements of the TSF.

The organizational chart of the current management team is shown on Figure 1. This chart shall be updated to reflect changes in management and/or changes in operational criteria in accordance with AEM's overall management and operational requirements.

Figure 1 AEM Tailings Storage Facility Management Structure



Note: To be updated as required

2.1 ROLES, RESPONSIBILITIES AND AUTHORITY

The roles and responsibilities for each AEM position and the authority during the operational cycle of the TSF are listed in Table 2-1. The roles and responsibilities of each position should be updated to reflect changes to the overall management structure.

All site personnel are responsible for informing their Superintendent of any indications of abnormal situations that may be observed.

2.2 REQUIRED LEVELS OF KNOWLEDGE

The recommended minimum levels of knowledge by the various positions are as summarized in Table 2-2. Training of personnel shall be carried out to ensure the minimum levels of knowledge set out in Table 2-2 are attained by all personnel and positions involved in the operation of the facility. AEM's training department, with support from relevant personnel, shall carry out all training. Training shall be logged and registered according to the department protocols.

Table 2-1 Roles and Responsibilities

Position	Role	Responsibility
General Mine Manager	Oversees mine development and planning, operations and permitting	Initiate and oversee emergency or contingency protocols during emergency events. Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual. Ensures that proper planning is carried out and that required resources are made available. Oversees and provides input in all matters arising in the operation and management of the mine including the TSF.
Engineering Superintendent /Geotechnical Coordinator/ Geotechnical Supervisors	Overall TSF management	Coordinates all TSF management related activities. Coordinates with Environmental Superintendent on environmental issues. Ensures Mining Association of Canada (MAC) compliance. Ensures Canadian Dam Association (CDA) compliance. Ensures monitoring is carried out in accordance with the TSF monitoring program, other applicable programs, approved protocols and frequency. Reviews existing and assesses future monitoring requirements. Reviews construction designs and schedules. Reviews the QA/QC system to meet construction design. Reviews TSF operating and training manuals – assists in completion of manuals. Ensures documentation and records related to TSF development, construction and operations are kept and are up-to-date. Authorizes emergency work in the event of non-compliance or emergency operational requirement. Reports operational issues to the Mine Superintendent. Ensures all systems are properly maintained. Prepares TSF development, construction, QC and activity reports. Coordinates and reviews regular facility inspections by AEM staff.
Dike and Dewatering Foreman	Oversees TSF development and maintenance	Maintains access to the TSF, road surface repairs, dust control and snow removal. Oversees and provides input in construction of the TSF matters. In charge of earthwork construction and piping installation and maintenance.

Position	Role	Responsibility
		Supervises Contractor(s).
Environment Superintendent	Oversees environmental data collection and processing	Liaise with external stakeholders including NIRB, Nunavut Water Board and government agencies Assesses current and future monitoring requirements. Reviews government permits and recommends monitoring for compliance Reviews TSF development and deposition plans Prepares TSF water management reports. Oversees TSF water, collection pond and groundwater sampling in accordance with approved protocols. Interprets environmental (facility water quality) data Monitors compliance with water quality and quality from the TSF, and reports non-compliance events and/or trends to Operations Manager. Supervises Environmental Coordinator. Indicates water quality sampling locations, sample collection protocols and analytical parameters in coordination with the Environmental Consultant. Senior TSF environmental oversight. Acts as AEM's contact for governmental oversight of TSF. Reports environmental issues to the General Manager and Operations Manager. Ensures with Engineering Superintendent TSF instrumentation data collection, processing and reporting. Reviews government permits and recommends monitoring for compliance. Assesses future monitoring requirements. Ensures compliance with regulatory requirements. Validates laboratory test results. Processes laboratory data and prepares summary reports. Ensures compliance with water management protocols. Develops and maintain site wide and TSF water balance. Supervises Environmental Technician.
Geotechnical Engineering Consultant	TSF annual inspections	Provides construction-level design, reports, drawings and technical specifications. Provides deposition planning design and reporting. Communicates through Engineering Superintendent and Environment Superintendent. Performs regularly scheduled Third Party Inspections.

Position	Role	Responsibility
		Performs Special Inspections, as required. Reviews as-built and monitoring reporting. Reviews field quality assurance (QA) and quality control (QC) programs. Reviews geotechnical designs relative to actual field conditions.

Table 2-2 Recommended Minimum Knowledge of OMS Manual

Position	Recommended Minimum Knowledge
General Mine Manager / Assistant Mine Manager	Review of the OMS Manual with an understanding of the operational requirements. Detailed knowledge of emergency response procedures.
Mine Operations Superintendent	Basic knowledge of the OMS Manual, with an understanding of the design and operational requirements. Detailed knowledge of emergency response procedures.
Engineering Superintendent/ Geotechnical Coordinator/ Geotechnical Supervisors	Detailed understanding of the OMS Manual, with a complete understanding of the design and operational requirements. Detailed and ongoing review of all monitoring, inspections and embankment safety reviews. Complete understanding of all related technical documents for design, operation, risk assessment and emergency response. Review of the operations manuals on an annual basis. Detailed knowledge of emergency response procedures.
Environment Superintendent	Detailed understanding of the OMS Manual, with an understanding of the design and operational requirements set out in this OMS Manual. Detailed understanding of all operational elements within the facility and their operational and maintenance requirements. Detailed knowledge of emergency preparedness and emergency response procedures.
Environmental Coordinator	Detailed understanding of the OMS Manual, with a complete understanding of the design and operational requirements. Detailed and ongoing review of all monitoring, inspections and embankment safety reviews. Complete understanding of all related technical documents for design, operation, risk assessment and emergency response. Review of the operations manuals on an annual basis. Detailed knowledge of emergency preparedness and emergency response procedures
Process Plant Superintendent	Basic knowledge of the OMS Manual, with an understanding of the design requirements. Detailed knowledge of emergency response procedures.
External Personnel (Consultants and Contractors)	Varied levels of knowledge and understanding depending on involvement. Detailed knowledge of emergency preparedness plan.

SECTION 3 • FACILITY DESCRIPTION

3.1 BACKGROUND

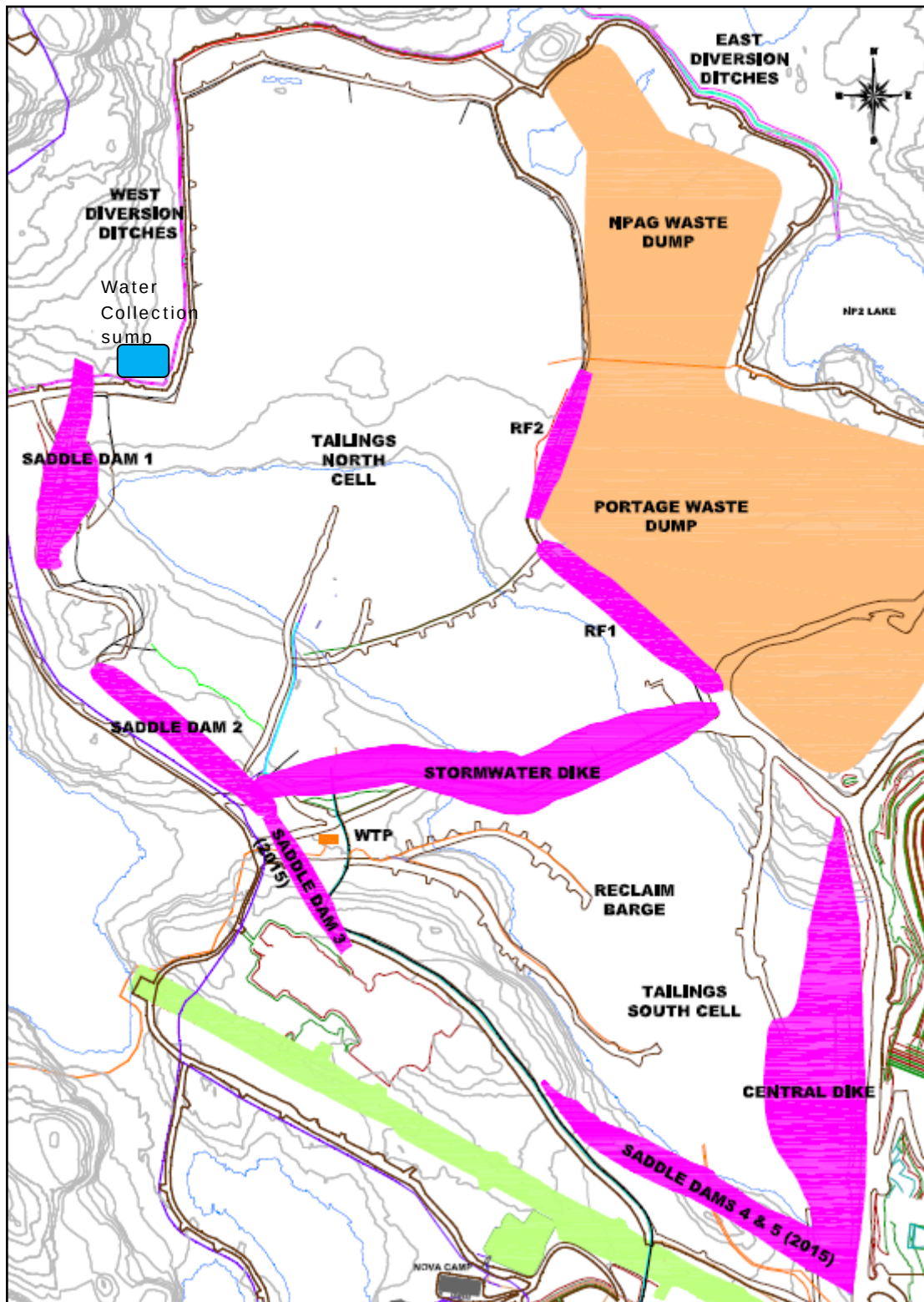
The TSF is the permanent surface storage facility for tailings produced during the operation of the mine. The TSF is located north of the Process Plant Site, as presented on Figure 2, and will be developed in two cells in the following order:

1. North Cell; and
2. South Cell.

The main components of the TSF are:

- Perimeter containment structures (Saddle Dams 1 to 5, inclusive, rockfill structures RF1 & 2 and the Central Dike);
- Seepage and run-off perimeter water control structures;
- Internal deposition structure (Stormwater Dike);
- Deposition infrastructure;
- Dewatering infrastructure;
- Instrumentation; and
- Reclaim water system: supernatant pond and water treatment facility.

Figure 2 Plan of Tailings Storage Facility



3.2 DESIGN AND OPERATIONAL CRITERIA

The main design and operational criteria for the TSF are summarized in Table 3-1.

3.3 FACILITY COMPONENTS

3.3.1 Perimeter Containment Structures

A series of containment structures comprising of Saddle Dam 1 (SD1), to SD5, inclusive, and the Central Dike form the perimeter of the TSF. These structures are shown on Figure 2.

3.3.2 Internal Deposition Structures

To facilitate deposition within the TSF, the Stormwater Dike (SWD) is located within the facility (refer to Figure 2). This structure divides the North Cell and the South Cell.

3.3.3 Perimeter Water Control Structures

The design objective of the perimeter water control structures, comprising of ditches and sumps, is to collect surface water runoff and seepage from the TSF for pumping back to the tailings facility. The purpose of controlling the runoff and seepage from the TSF is to prevent it from reporting to the downstream environment. The perimeter water control structures will be used throughout the operating life of the TSF. These will continue to be used into the post-closure of the project until both the TSF and adjacent ground returns to pre-development permafrost conditions or the surface runoff and seepage waters are of acceptable quality to be discharged directly to the environment.

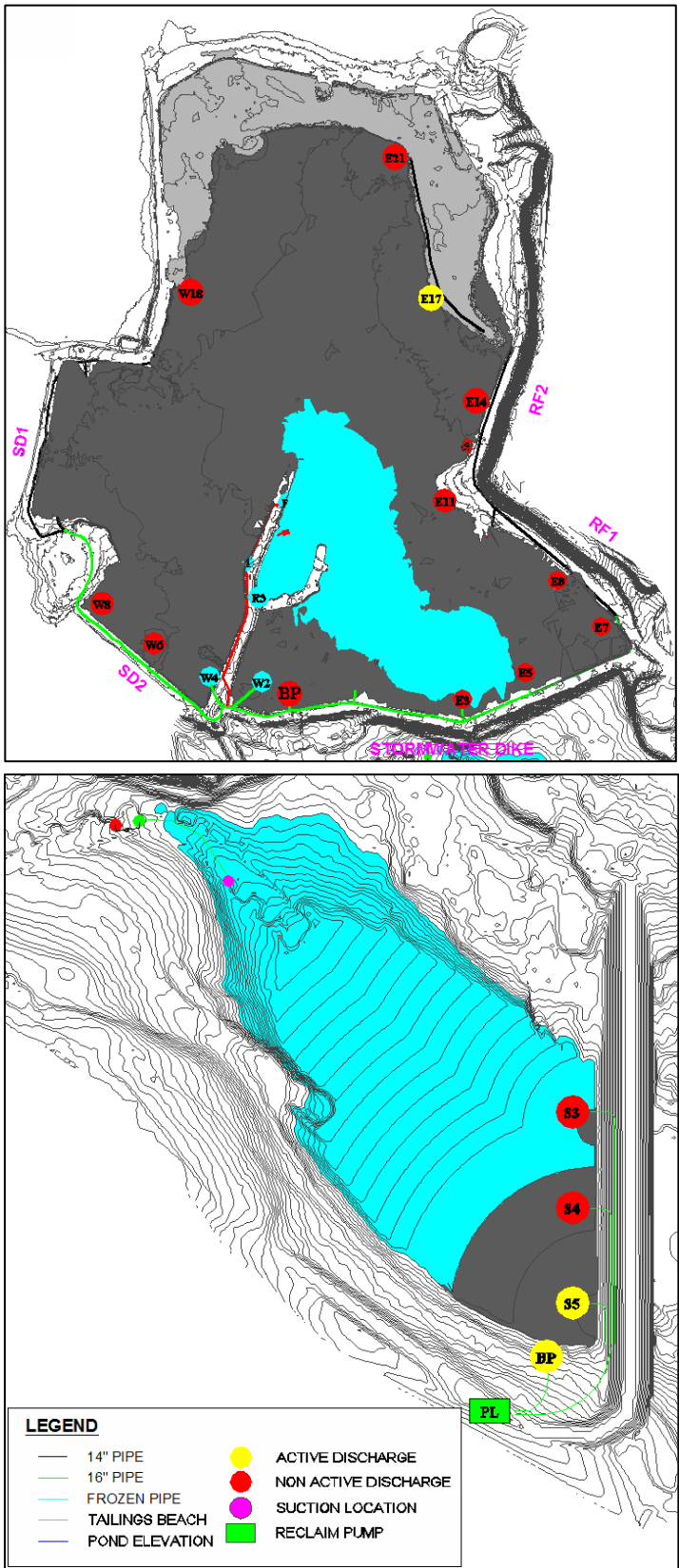
The ditches surrounding the TSF are designed to capture seepage and surface runoff water and provide gravity flow of the water into the sumps.

The sumps are collection points for flows from the ditches and the TSF to enable pumping of water to the water treatment plant.

3.4 TAILINGS DISTRIBUTION SYSTEM

The tailings distribution piping system for transporting slurry from the Process Plant to and for deposition into the TSF is presented on Figure 3.

Figure 3 Spigot Locations



3.5 WATER MANAGEMENT SYSTEM AND PIPING

Water is pumped from the supernatant pond to the Mill Plant for recirculation. Water collected from the non-contact perimeter ditches and sumps is generally directed by the diversion ditches or pumped into the environment if the limits are respected. Water collected from the Saddle Dams seepage collection systems are sent directly to the TSF.

3.6 FACILITY CLOSURE

A cover of non-acid generating waste rock will be placed over the TSF to promote drainage from the surface; no pond will be maintained within the facility. The tailings will begin freezing during operations and remain fully frozen into the post-closure period. Additional details are provided in the closure plan.

3.7 INSTRUMENTATION

The perimeter containment structures of the TSF are instrumented with geotechnical instrumentation and monitored during operations. Monitoring will continue during post-closure. Monitoring is performed to confirm performance of the structures relative to the design.

3.8 PUBLIC SAFETY

Public access to the mine site is restricted by security gates and on-site security upon exiting aircraft and vehicles.

Table 3-1 Design and Operational Criteria

Component	Item	Criteria	Source/Comment
Perimeter Containment Structure Design	Life of mine (LOM Budget2016_V00) Storage Capacity	24.1 Mm ³	Calculated by AEM
	Life of mine total ore	29.9Mt	AEM
	Life of Mine	8 years	AEM
	Canadian Dam Association hazard classification	High	CDA (2007)
	Seismicity for this site: Peak horizontal acceleration based factored 1 in 10,000 year event	0.04 g	Golder (2007)
	Stability: Minimum factor of safety for static load conditions	1.3	Golder (2007)
	Stability: Minimum factor of safety for pseudostatic load conditions	1.1	Golder (2007)
	Embankment crest width	10.0 m (nominal)	Refer to drawings
	Perimeter containment structure downstream side slope*:	1.5H:1V for rock fill	Refer to drawings

Component	Item	Criteria	Source/Comment
	Perimeter containment structure upstream side slope*:	3H:1V (2H:1V for part of Central Dike only)	Refer to drawings
	Interior embankments downstream side slope*:	1.5H:1V for rock fill	Refer to drawings
	Interior embankments upstream side slopes*:	3H:1V	Refer to drawings
Perimeter Water Control Structure Design	Design Event Storage Capacity: Temporary sumps :	1:10 year freshet runoff event	Refer to drawings
	Perimeter sumps:	1 :100 year freshet runoff event	
	Ditch Gradient	Minimum 0.5%	Refer to drawings
Process Plant Rate	Nominal daily processing rate	10,900-11,000 tpd	AEM
Operation	Tailings discharge solids content	52%	AEM
Operation	Average deposited slurry dry density	1.39 t/m ³	Assumed value pending field trials.
Operation	Deposition slope angle for slurry	SC: sub-aerial: 1.1% ; sub-aqueous: 3.6% NC: sub-aerial: 0.45% ; sub-aqueous: 2.36%	Assumed value pending survey.
Ice	Ice entrapment (by volume)	50% (30% pore water and 20% pure ice entrapment)	Assumed value pending field investigations.
Operation	Specific Gravity for tailings solids	1.6	AEM
Operation: Water Control Structures	Perimeter sump recommended Freeboard	Minimum 1.5 m	Refer to drawings
Operation: Water Control Structures	Design Pump Capacity	Sufficient to dewater a sump for the 1:100 design event in a 2 week period.	

Note: *Fill placement to be in accordance with the relevant specification.

SECTION 4 • OPERATIONS

Operation of the TSF requires the management of tailings deposition and storage using inputs from the deposition plan and management of water within the facility.

4.1 OPERATIONAL PHILOSOPHY

Tailings are pumped from the process plant and deposited in the TSF as slurry according to the deposition plan. The objectives of the deposition plan are to:

- Develop long tailings beaches upstream of the perimeter structures;
- Maintain the supernatant pond away from the upstream faces of the perimeter structures;
- Receive tailings from the process plant at all times;
- Limit ice entrapment within the deposited tailings; and
- Provide a flexible plan with the realization that the tailings will be variable in properties (e.g. solids content) and having a variable schedule depending on the processing schedule.

The perimeter ditches of the TSF will intercept and route surface water runoff and seepage from the TSF to the sumps. The sumps are to provide short-term water storage prior to pumping to the tailing pond. A practical minimum level of water should be maintained during operations.

4.2 DEPOSITION PLANNING CRITERIA AND CONSTRAINTS

The following constraints were identified as being desirable inputs into the deposition planning work:

- During winter months, deposition would use a “pull back”;
- Limit switching between tailings deposition lines so to reduce line flushing requirements;
- Changing between deposition points on a given line will, in general, consist of stopping the flow of tailings in the line, redirecting it through a bypass, flushing the line with water for cleaning and the relocation of the deposition point followed by the reinstatement of tailings flow through the deposition line; and
- All pipelines should be flushed of tailings and fully dewatered prior to periods of non-use to reduce the likelihood of materials and/or water freezing within the pipelines.

Operating Criteria and constraints should be reviewed periodically and updated in the OMS Manual as required (Table 3-1).

4.3 WATER MANAGEMENT

The perimeter ditches will intercept and route runoff and seepage from the TSF to the sumps. The diversion ditches redirect runoff water away from the TSF to the environment. The sumps will provide short-term storage prior to the pumping of the water to the tailing pond. A practical minimum level of water within the sump should be maintained during operations. The maximum operating water level for a given sump is 1.5 m below the sump rim.

SECTION 5 • MAINTENANCE

Maintenance at the TSF is important for safe, continuous operation, and integrity of the facility.

The objectives of the maintenance program are to review and identify maintenance requirements, executing corrective measures and timely repairs of the containment structures, perimeter water control structures, facility access, and infrastructure.

5.1 CONTAINMENT STRUCTURES

Erosion of the rock fill embankments is not expected. However, it is expected that periodic maintenance and re-sloping especially following thawing at the start of each summer may be required at times during operations.

The SWD, as it is an internal structure, is tolerant to settlement. Maintenance during the summer is expected once the frozen materials thaw. Grading, reshaping and nominally compacting additional material should be expected.

The exposed liner should be inspected during the summer season. Repairs shall be done for any damage during that season.

5.2 DITCHES AND SUMPS

Flows may erode the ditches and/or sumps. Sediment, snow and/or ice may accumulate in the ditches and sumps and will require removal to maintain operational functionality and provide storage capacity. Removal of excessive material deposits from the ditches and sumps should be performed as required. The ditches and sumps will require routine monitoring for signs of deterioration and to address any cleaning and maintenance that is required.

Pumps located at the temporary and perimeter sumps will require maintenance based on Manufacturer's specifications and recommendations.

5.3 INSTRUMENTATION

The instrumentation of the TSF shall be maintained to enable collection of the data. Repair, replacement and installation of additional instrumentation should be expected during the development of the TSF.

5.4 PIPELINES AND PUMPS

Maintenance on pumps and tailing pipes should be performed during Mill Plan scheduled shut-down periods or when they are not in operation. General inspection of the pipes should be performed on a regular basis. The heat tracing of the tailings distribution and dewatering pipelines will require maintenance. After each change of deposition point, the pipeline is cleaned and drained with a pig. The pipes are inspected after the cleaning.

SECTION 6 • SURVEILLANCE

The principal objective of the TSF surveillance program is to identify conditions that would compromise the integrity of the facility well in advance of problems occurring and adjusting the design and/or operation to reduce risk. The TSF surveillance program focuses on four areas of interest:

1. Stability and deformation of the perimeter containment structures;
2. The thermal conditions beneath and within the TSF;
3. The quantity and quality of seepage from the TSF; and
4. Material movement and placement (locations and quantities of all material types being deposited, disposed and placed) in the TSF.

Table 6-1 (see Section 6.2) was developed to determine the items which will be monitored, the monitoring frequency and the responsible party. The items should be monitored at a frequency such that project commitments and/or requirements are satisfied and such that trends may be developed for optimization of the operation of the TSF. Table 6-1 should be reviewed and updated as required while maintaining the project commitments.

6.1 INSPECTIONS

A series of regularly scheduled inspections is required to ensure that the TSF facility is performing as intended and to identify problems and issues so that necessary corrective actions may be implemented in a timely manner. Surveillance tasks include visual inspections, monitoring of instrumentation and water levels and preparation of written and photographic documentation.

The main types of inspections are as follows:

- Routine inspections – performed by AEM geotechnical team;
- Monthly or Bi-Monthly Inspection – performed by AEM geotechnical team;
- Special Inspections – performed by AEM and the Geotechnical Engineering Consultant depending on the event; and
- Annual Inspection – performed by a Geotechnical Engineering Consultant familiar with the design and operation of the facility.

6.1.1 Routine Inspections

Routine visual inspections are to be carried out by AEM personnel at the TSF to assess operational status of various elements of the facility. The frequencies for these inspections are as follows:

- In areas of active deposition: daily; and

- In areas without deposition: monthly.

Inspections of the TSF perimeter containment structures and water control structures are to be conducted and documented. Inspection forms used to conduct and document these inspections are included in Appendix II.

The following is a list of general information which should be recorded during each inspection:

❖ Water Control Structures (by Engineering department):

- Sump water elevation (staff gauge readings) noted and reviewed to ensure normal freeboard;
- General dewatering pipeline condition, signs of leaks or abnormal conditions; and
- Depth of flow in ditches, inspection of ditches and downstream berm condition, signs of potential seepage.

❖ Perimeter Containment Structures (by Engineering department):

- Inspection of the general condition of interior and perimeter embankment crest, toe, and slopes, looking for: settlement, erosion, seepage, cracking, liner deterioration, animal burrows or other abnormal conditions;
- Description and status of embankment construction activities; and
- Inspection of embankment slopes for any signs of instability.

❖ Tailings Distribution System (by Engineering department and Dikes and Dewatering Supervisor):

- General pipeline condition, signs of leaks or abnormal conditions;
- Deposition location point and beach elevation relative to spigot elevation;
- Length of beach; and
- Pipeline flow, slurry density, pipeline pressure.

Documentation of the routine inspections of the TSF perimeter containment structures should be submitted to the Geotechnical Coordinator following each inspection.

The completed Perimeter Containment Structures and Water Control Structures inspection forms are stored in an electronic data base system for the TSF. Hard copies of the inspection forms are catalogued and stored on site.

6.1.2 Special Inspections

Special inspections may be required in addition to the routine inspections such as during, or at the time of: unusual climate events such as heavy rain, rapid snowmelt, anomalous instrumentation readings or significant seismic events. The Geotechnical Supervisor or Geotechnical Technician shall perform the special inspection immediately at the time of the event and shall notify the Geotechnical Engineering Consultant.

6.1.3 Annual Inspection

Annual inspections shall be carried out by a qualified Geotechnical Engineering Consultant who is familiar with the design and on-going operation of the TSF. During this inspection, the following tailings management structures will be visited:

- Central Dike;
- Stormwater Dike;
- Saddle Dams 1 to 5;
- RF-1 & 2;
- West Diversion ditches; and
- the perimeter road around the North Cell.

The objective of the inspections is to carry out a detailed review of the conditions of the facilities and facility operation during the spring freshet and prior to freeze up.

The Geotechnical Engineering Consultant issues an inspection report to AEM containing observations and recommendations. This report provides information to be used to revise the operation, maintenance and surveillance programs as necessary and to assist in planning for future operation of the facility.

6.2 INSTRUMENTATION AND SURVEY

Instrumentation is installed to monitor the stability and deformation of the perimeter containment structures, ground temperature, seepage, water quality and to monitor operational performance. Instrumentation is to be maintained, replaced, added, extended and relocated during the development of the TSF; therefore this section should be updated regularly. The current instrumentation locations are shown on Figure 4. Current instrumentation for the TSF includes thermistors. Piezometers are installed at Central Dike. Survey of the water and tailing elevation are also taken at different locations in the TSF.

The instrumentation and survey levels are to be read and recorded at the frequencies shown in Table 6-1.

Table 6-1 Surveillance Items and Frequencies

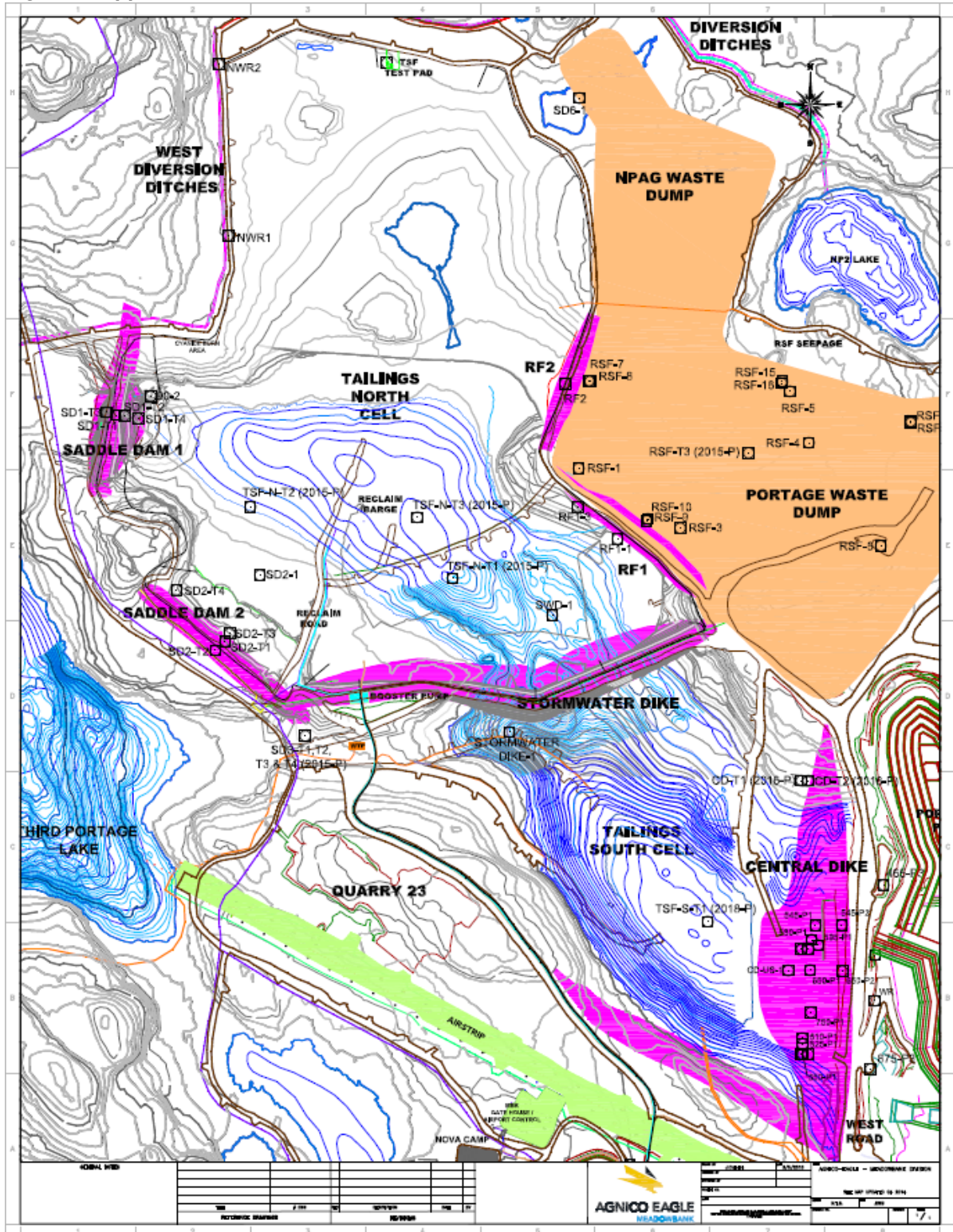
<i>Instrumentation</i>	<i>Monitored By</i>	<i>Reported To</i>	<i>Frequency</i>
Thermistors and Piezometers	Manually by Engineering and Environment Personnel	Engineering and Environment Superintendent Geotechnical Coordinator	Weekly during winter and every three (3) days during the summer
Survey	Manually by Engineering Personnel	Engineering and Environment Superintendent Geotechnical Coordinator	Daily during freshet; and Monthly during non-freshet period

The instrumentation is to be monitored by the responsible party and at the frequency shown on Table 6-1 and at any other periods of extended rainfall or run-off. Immediate readings of all instrumentation shall be carried out following a significant seismic or climatic event.

The instrumentation data shall be analyzed and summarized by the engineering and environmental departments.

The instrumentation readings are to be reviewed by the Geotechnical Engineering Consultant performing the third party inspections.

Figure 4 Approximate Location of Current Instrumentation



6.2.1 Ground Temperature and Piezometric Level Monitoring

Thermistors have been installed in the area of the TSF to measure ground temperatures. Piezometers have been installed at Central Dike to measure the piezometric level in the ground. Additional thermistors and piezometers will be installed in the future during operations and closure.

Maintenance and calibration of the instruments and extensions should be carried out according the Manufacturer's recommendations.

Data presented for the thermistors and piezometers should include:

- Time plots (presenting all thermistor nodes on each string); and
- Temperature vs. depth/elevation plots over time.

The plots shall indicate the instruments reference number, date of measurements, elevation, and depth.

6.2.2 Anomalous Measurements

Anomalous instrumentation data includes the following:

- Thermistors:
 - o Increase or decrease in measurements (over two or more readings) that cannot be explained by seasonal temperature variations or instrument malfunction.
- Piezometers:
 - o Sudden increase or decrease in measurements (over two or more readings) that cannot be explained by normal variation of the piezometric level or instrument malfunction.

If anomalous readings are observed, the following actions should be taken:

1. Inspect the embankment where possible and appropriate;
2. Check data, reductions and calculations for accuracy and correctness;
3. Re-read to verify the reading;
4. Check readout equipment to verify that it is functioning correctly;
5. Verify calibration;
6. If instrument has stopped functioning, notify the Engineering Superintendent and Geotechnical Coordinator immediately. If considered critical, a replacement instrument should be installed;
7. If the anomalous reading is confirmed, a detailed review of the effects of the reading should be carried out based on the specific inspection and design or remedial actions should be

implemented if determined necessary by the Engineering Superintendent and Geotechnical Coordinator; and

8. Increase monitoring frequency to assess progression of anomaly.

6.2.3 Seepage Monitoring

The seepage monitoring performed for the TSF comprises of visual inspections of the perimeter water control structures, the quantity tracking of water pumped to and from the TSF, rate of seepage and water quality of seepage through the embankment, and testing water samples collected from the perimeter sumps.

Visual inspections should document sediment, ice and snow deposits in the ditches and sumps.

Anomalous measurements of the seepage may occur and include the following:

- Increase or decrease in pump rates that are inconsistent with rainfall or runoff events;
- Sediments present in the seepage water; and
- Changes in seepage location, flow and quality.

If anomalous readings are observed, the following actions should be taken:

1. Inspect the water control structure area;
2. Check data, reductions, and calculations for accuracy and correctness;
3. Re-read;
4. Check readout equipment to verify that it is functioning correctly;
5. Verify calibration;
6. If the anomalous seepage measurement is confirmed, a detailed review of the effects of the increased seepage should be carried out based on the specific inspection and design or remedial actions should be implemented if determined necessary by the Engineering Superintendent and Geotechnical Coordinator;
7. Manage the seepage properly by collecting it, then pumping the seepage and sending it to a treatment facility, treating it if necessary, then finally discharging the seepage through a final discharge point; and
8. Increase monitoring frequency to assess progression of anomaly.

6.3 WATER QUALITY

The quality of water collected in the sumps and sampled from the water sampling locations is to be monitored. The monitoring plan available in Appendix I summarizes water quality and water flow monitoring to be conducted for the Meadowbank gold project.

SECTION 7 • REPORTING AND DATA MANAGEMENT

7.1 REPORTING

7.1.1 Inspection Documents

All inspection documents and reviews shall be submitted to the Engineering Superintendent and the Geotechnical Coordinator and accessible to all in the local network.

7.1.2 Instrumentation Measurements

Instrumentation measurements (thermistors and piezometers) and water quality results collected shall be reported to the Engineering Superintendent and the Geotechnical Coordinator. Pumping rates during dewatering and operation shall be reported to the Engineering Superintendent and the Geotechnical Coordinator.

7.1.3 Emergencies

All documents regarding instrumentation and inspection during an emergency situation and prior to the emergency shall be made available to all parties involved including the General Manager, Assistant General Manager, Environment Superintendent, Engineering Superintendent, Geotechnical Coordinator, Process Plant Superintendent, Mine Operations Superintendent, Maintenance Superintendent, and the Geotechnical Engineering Consultant.

7.2 DATA MANAGEMENT

All surveillance records including visual embankment inspections, instrumentation measurements, flow, and water quality results shall be stored in an electronic library or database system which is easily accessible to staff involved with the TSF. Hard copies shall be catalogued and stored on site. Examples of surveillance data stored, but not limited to, are:

- Routine operation inspection reports, perimeter containment structures visual inspections, water control structure inspections and water management inspections,
- Special Inspections;
- Annual Inspections;
- Instrumentation Measurements;
 - o Thermal- thermistor data;
 - o Piezometer data; and

- Water quality testing results.

SECTION 8 • EMERGENCY PREPAREDNESS PLAN

The Dam Safety Guidelines prepared by the Canadian Dam Association (2007) states that “A dam which does not impose an unacceptable risk to people or property, and which meets safety criteria that are acceptable to the government, the engineering profession and the public is a safe dam”.

This guiding principle has been taken into account for the design of the TSF embankments and the emergency procedures.

The TSF perimeter containment structures are classified as a “High Consequence of Failure” (CDA 2007) as discussed in Section 1.4.

To respond to possible hazards and emergencies involving the TSF, emergency response plans have been designed. This section provides a summary of the actions, triggers and measures in the event of an emergency.

In case of an emergency, the documents listed in Table 9-1 shall be referenced. The Emergency Response Plan (ERP) shall also be referenced. The Dike Failure Scenario Appendices from the ERP are included in Appendix III.

8.1 EMERGENCY PROCEDURES

The purpose of the Emergency Preparedness Plan (EPP) is to present a basic procedure for responding to potential failure mechanisms. The procedure identifies various measurable or observable effects or causes of the failure mechanisms and identifies the appropriate people to notify. Potential failure mechanisms are summarized in Table 9-2 with potential measurable and observable causes and effects.

8.1.1 Operation

Table 9-3 summarizes the triggers for implementing the EPP with respect to the potential measurable and observable effects or causes of the various failure mechanisms during operations.

Table 9-4 indicates the chain of communication to follow so persons in charge are notified for different states of emergency.

Table 9-5 indicates the responsibilities of persons for each emergency level in terms of who performs the decision making, mobilization, and action to be taken.

Table 9-6 indicates the names and contact numbers of the persons in charge during an emergency event.

8.2 EMERGENCY DETAILS

In the unlikely event of a catastrophic dike breach that could endanger workers the Code 1 procedure described in Section 8.2.4 would be followed to warn all workers of the situation. Then an evacuation of the affected areas and pits would be carried out and directed by the ERT Team in person and over the emergency channel. In the event of an embankment failure, the following information should be used during the emergency response:

Project Name: Meadowbank Gold Project

Perimeter Containment Structure Names: SD1, SD2, SD3, SD4, SD5, Central Dike

Owner's Name: Agnico Eagle Mines Limited (867) 793-4610

Site Location: Latitude: 65°01'07"N Longitude: 96°04'26"W

8.2.1 Access to the Project Site

- 80 km north of the Hamlet of Baker Lake;
- Site accessible by all-weather private road from Baker Lake; and
- Site accessible by aircraft and helicopter.

	Name	Phone Number
Local Charter Company:	Calm Air International Ltd.	Baker Lake : (867) 793-2873
Local Helicopter Company:	Kitikmeot Helicopters Ltd	(867) 983-2544
Charter Aircraft Company:	Nolinor Aviation	(450) 476-0018

8.2.2 Emergency Assessment

In case of an event, emergency assessment will be done first by AEM Geotechnical Engineering personnel and the Engineering Superintendent on site. Assessment will be done according to the criteria stated in the Table 9-2 and 9-3.

8.2.3 Emergency Communication and Actions

In case of an event, after the emergency assessment, the persons involved in the emergency response team need to be notified following the chain of command stated in Table 9-4. Contact details of each person are available in Table 9-6.

According to the nature of the event, a decision and action plan will be taken by the persons notified. The action plan will be defined according to the level of emergency and the cause of the event. The

immediate action plan will be taken with material and equipment available on site, as listed in Section 8.4.

8.2.4 Site Emergency Procedure

As specified in the Emergency Response Plan, Ver. 9, Section 4:

In the event of an immediate emergency that is or could impact persons or equipment, the employee will have to follow our emergency procedure:

- Emergency is initiated - by calling **6911** on desk type phones, or calling on two-way radio on **"Working Channel" – Code 1 – Code 1 – Code 1**.
- All communication stops except for those involved with the Emergency – i.e.: First Aid Room attendants, Medics, ERT as required.
- All work stops in First Aid Room / Clinic – and in affected area – depending on seriousness of Emergency – the whole site.
- First Aid Room Attendant / Medic will answer the phone and/or radio.
Note: if the First Aid Room Attendant / Medic do not answer, then Security Guard will answer and/or a Supervisor on radio will answer so that Emergency Response can be initiated.
- **Responder** – will ask where the medic is required.
- **Caller** – will give a brief description of the Emergency – name, location and what is wrong and/or required.
- **Responder** – will confirm location and details of incident and activate the **ERT** team. Security will be notified by responder and a page will be sent out to all **ERT** team members on site. (All **ERT** team members on site now carry pagers).
- The person at the casualty(s) will administer First Aid if trained to do so.
- Incident Commander Center will be immobilized as to ensure that communications, transportation, and effective deployment of **ERT** resources are conducted. It is mandatory that the Official In-Charge be notified immediately.
 - ❖ Transportation will be arranged to meet at the **ERT** hall by the two large doors for medical gear and **ERT** team members.

The **ERT** team (minimum of 6 team members) will assemble as quickly as possible. (Expectation – when the pager goes off – all **ERT** team members will make their way expediently to the **ERT** hall).

8.2.5 Communication Equipment Location

Communication equipment can be found at the following locations:

- Phone land lines are located in the main office;
- Base station radios are located in the main office;

- Drills will have either base station radios or handhelds—depending on their distance from camp and will have satellite phones available; and
- Emergency Communication Plans (including emergency contact numbers) are located adjacent to all phones and radios and in each drill.

8.3 MEDICAL AND FIRST AID SERVICES

In case of injury the medic and First Aid station are located in the Service Building. The nearest hospital is located in Baker Lake.

Health Center: Baker Lake Health Center Phone #: (867) 793-2816
(867) 793-2817

8.4 ON SITE EQUIPMENT AND MATERIAL

8.4.1 Pumping Equipment

The following is a list of onsite pumping equipment available for use during an emergency event:

Unit Number	Description	Model
61PWA01	Dewatering pump #1	Godwin model HL250M
61PWA02	Dewatering pump #2	Godwin model HL250M
61PWA03	Dewatering pump #3	Godwin model HL250M
61PWA04	Dewatering pump #4	Godwin model HL250M
61PWA05	Dewatering pump #5	Godwin model HL250M
61PWA06	Dewatering pump #6	Godwin model HL250M
61PWA07	Pit Dewatering pump #7	Godwin model CD80M
61PWA08	Pit Dewatering pump #8	Godwin model CD80M
61PWA09	Dike Dewatering pump #9	Godwin model CD100M
61PWA10	Dike Dewatering pump #10	Godwin model CD103M
61PWA11	Dike Dewatering pump #11	Godwin model CD103M
61PWA12	Dike Dewatering pump #12	Godwin model CD103M
61PWA13	Pit Dewatering pump #13	Godwin model HL5MS
61PWA14	Pit Dewatering pump #14	Godwin model HL5MS
61PWA15	Bay-Goose Seepage dewatering pump #9	Godwin model CD103M
61PWA16	Bay-Goose Seepage dewatering pump #10	Godwin model CD103M
61PWA17	Bay-Goose Seepage dewatering pump #11	Godwin model CD103M
61PWA18	Bay-Goose Seepage dewatering pump #12	Godwin model CD103M

Note: To be updated as required

8.4.2 Mobile Equipment

The following are lists of onsite mobile equipment of AEM and SANA available for use during an emergency event:

AEM Mobile Equipment List (to be updated as required)

MODEL	EQUIP	MODEL	EQUIP	MODEL	EQUIP	MODEL	EQUIP	MODEL	EQUIP	MODEL	EQUIP	MODEL	EQUIP
LOADING		HAULING		DEWATERING PUMP		PICKUP		PICKUP		FROST FIGHTER		TRAILER	
307 (SS)	BAC03	777F	HTR01	HL250M	PWA01	F-350	PCK01	F-250	PCK53	IDF-350	HEA01	TANKER (SS)	TRL01
330D (SS)	BAC04	777F	HTR02	HL250M	PWA02	F-350	PCK03	F-250	PCK54	ALMAND MH-1000	HEA02	B DUMP (SS)	TRL03
345D	BAC05	777F	HTR03	HL250M	PWA03	F-350	PCK04	F-250	PCK55	ALMAND MH-1000	HEA03	LOW BED (SS)	TRL04
385C	BAC06	777F	HTR04	HL250M	PWA04	F-350	PCK05	F-250	PCK56	ALMAND MH-1000	HEA04	LOW BED (SS)	TRL05
345DL	BAC07	777F	HTR05	HL250M	PWA05	F-350	PCK06	F-250 (SS)	PCK57	ALMAND MH-1000	HEA05	F. TANK (SS)	TRL06
PC1250	BAC08	777F	HTR06	HL250M	PWA06	F-350	PCK08	F-250	PCK58	IDF-350	HEA06	F. TANK (SS)	TRL07
390	BAC09	777F	HTR07	CD80M	PWA07	F-350	PCK09	F-250	PCK59	IDF-350	HEA07	L BODY (SS)	TRL08
RH120	BAC10	777F	HTR08	CD80M	PWA08	F-350	PCK10	F-250	PCK60	IDF-350	HEA08	FIRE PUMP TRL	TRL09
RH120	BAC11	773E	HTR09	CD100M	PWA09	F-350	PCK11	F-250 (SS)	PCK61	IDF-350	HEA09	DISPATCH COM	TRL10
CAT6030	BAC13	777F	HTR11	CD103M	PWA10	F-350	PCK12	F-250	PCK62	IDF-350	HEA10	DISPATCH COM	TRL11
IT14G (SS)	LOA01	777F	HTR12	CD103M	PWA11	F-350	PCK14	F-250	PCK63	IDF-350	HEA11	DISPATCH COM	TRL12
IT14G	LOA02	777F	HTR14	CD103M	PWA12	F-350	PCK15	F-250	PCK64	IDF-350	HEA12	DISPATCH COM	TRL13
992G	LOA03	773D	HTR15	HL5MS	PWA13	F-350	PCK16	F-350	PCK65	IDF-350	HEA13	DISPATCH COM	TRL14
992G	LOA04	785B	HTR20	HL5MS	PWA14	F-350	PCK17	F-550	PCK66	IDF-350	HEA14	DISPATCH COM	TRL15
420E (SS)	LOA05	785B	HTR21	HL125M	PWA16	F-350	PCK18	F-250	PCK67	IDF-350	HEA15	DISPATCH COM	TRL16
966H (SS)	LOA06	785B	HTR22	HL125M	PWA17	F-250	PCK19	F-250	PCK68	IDF-350	HEA16	DISPATCH COM	TRL17
TC44H (SS)	LOA08	785D	HTR23	FUSION		F-250	PCK20	F-250 (SS)	PCK70	IDF-350	HEA17	DISPATCH COM	TRL18
966H (SS)	LOA09	785D	HTR24		FUS01	F-250	PCK21	F-250	PCK71	IDF-350	HEA18	DISPATCH COM	TRL19
980H (SS)	LOA10	785D	HTR25		FUS02	F-350	PCK22	F-250	PCK72	IDF-350	HEA19	DISPATCH COM	TRL20
420E	LOA11	785C	HTR26	TRUCK		F-350	PCK23	F-250	PCK73	IDF-350 (SS)	HEA20	DISPATCH COM	TRL21
980H	LOA12	785C	HTR28	T800	TRK01	F-250	PCK24	F-250	PCK74	IDF-350 (SS)	HEA21	STEAMER (SS)	TRL22
992K	LOA13	785D	HTR29	TRUCK (SS)	TRK05	F-250	PCK25	F-450	PCK75	IDF-350 (SS)	HEA22	TOWHAUL TRL	TRL25
980K	LOA15	785D	HTR30	FRD WATER (SS)	TRK07	F-250 (SS)	PCK26	F-250	PCK76	IDF-350 (SS)	HEA23	F. TANK	TRL27
IT14G	LOA16	DRILL		SEPTIC (SS)	TRK08	F-250 (SS)	PCK27	FORK LIFT		IDF-350 (SS)	HEA24	GENIE	
DOZER		DM45E	RBD01	CEMENT (SS)	TRK11	F-250	PCK28	H/STER RH35 (SS)	FKL02	IDF-350 (SS)	HEA25	GS3232	SC105
D9T	DOZ01	DM45E	RBD02	Truck (SS)	TRK12	F-250	PCK29	CAT (WHI)	FKL03	IDF-350 (SS)	HEA26	S85 (SS)	SC106
D9T	DOZ02	DM45E	RBD03	TRUCK (SS)	TRK13	F-250 (SS)	PCK30	CAT	FKL05	MOBILE TANK	MFT01	Z-45/25	SC107
D8R (SS)	DOZ03	DM45E	RBD04	FUEL	TRK14	F-250	PCK31	CAT (SHOP)	FKL06	LIGHT TOWER		Z-45/25 (SS)	SC108
D9T	DOZ05	CM785	RBD05	GARBAGE (SS)	TRK15	F-250 (SS)	PCK32	740DR321T	FKL07	AL5080D	LGT01	S85 (REN07)	SC110
D9T	DOZ06	DML	RBD06	FIRE TRUCK	TRK16	F-250	PCK33	ETDR40TT	FKL08	L-20	LGT02	S85	SC111
D9T	DOZ07	DML	RBD07	FUEL	TRK17	F-250	PCK34	H/STER	FKL09	L-20	LGT03	S85	SC112
834H	DOZ08	DML	RBD08	S.Plow (SS)	TRK18	F-250 (SS)	PCK35	CAT 1255C	FKL10	L-20 (SS)	LGT04	S125	SC113
D6T (SS)	DOZ09	BUS		S.Plow (SS)	TRK19	F-250 (SS)	PCK36	CAT R80	FKL11	L-20	LGT05	S125 (SS)	SC114
GRADER		H77 (SS)	BUS01	Fountain Tire	TRK20	F-250	PCK37	CRANE		L-20	LGT06	32' (SS)	SC115
16H (SS)	GRA01	E-350 (SS)	BUS02	Service	TRK21	F-250	PCK38	120T (SS)	MCR01	L-20	LGT07	32' (SS)	SC116
160H (SS)	GRA02	E-350 (SS)	BUS03	LUBE TRUCK	TRK22	E-350	PCK39	80T (SS)	MCR02	L-20	LGT08	SKID STEER	
16M	GRA03	VANE350	BUS04	SHOP	TRK23	F-250	PCK40	35T (SS)	MCR03	LTC4	LGT09	262C	SKD01
16M	GRA04	32006-S (SS)	BUS05	FUEL	TRK24	F-250 (SS)	PCK41	25T (SS)	MCR05	LTC4	LGT11	753	SKD02
16M	GRA05	(SS)	BUS09	Service Truck	TRK25	F-250	PCK42	200T (SS)	MCR06	LTC4	LGT12	262C	SKD03
HAMMER		E-350	BUS06	LUBE TRUCK	TRK26	F-350	PCK43	MULE		LT5000-4MH SS	LGT18	262C	SKD04
V56	HAM01	27-May-10	BUS08	CEMENT	TRK27	F-250	PCK44	OBSOLETE	VSE01	HYSTER HANDLER		SNOW BLOWER	
V56	HAM02	INTER PB105	BUS10	PUMP	TRK28	F-350	PCK45	Mule	VSE02	GTH844	TPA01	SNOW BLOWER	SBL01
GENSET			BUS11	FUEL	TRK29	F-250	PCK46	Mule (SS)	VSE05	GTH844	TPA02	SNOW BLOWER	SBL02
GEH220-2	GEN26		BUS12	WATER	TRK30	F-250	PCK47	Mule	VSE06	HR45 (SS)	TPA03	SNOW BLOWER	SBL03
D200P3	GEN27	COMPACTOR		Service Truck	TRK31	F-250	PCK49	Kubota	VSE08	1056C (SS)	TPA04	COMPRESSOR	
ATV			CPT01	LUBE TRUCK	TRK32	F-250	PCK50	Kubota (SS)	VSE12	1056D (HW)	TPA05		COM01
	ATV02	(SS)	CPT02	FIRE TRUCK	TRK33	F-250 (SS)	PCK51	Kubota	VSE13	BOAT ENGINE		SULLAIR	COM02
	ATV03	EMERGENCY VEHICLE		MECHANICAL SERVICE TR		F-450 WH	PCK52	WELDING MACHINE			ENG56	QGD25 QINCY	COM03
	ATV05	SNOWCAT	SNC01	SERVICE	WHM02			400D	SMD01		ENG57	2545 IR	COM04
								WITH AIRPACK	SMD02			2545 IR	COM05
								500P WIT AIR	SMD03				

SANA Mobile Equipment List (to be updated as required)

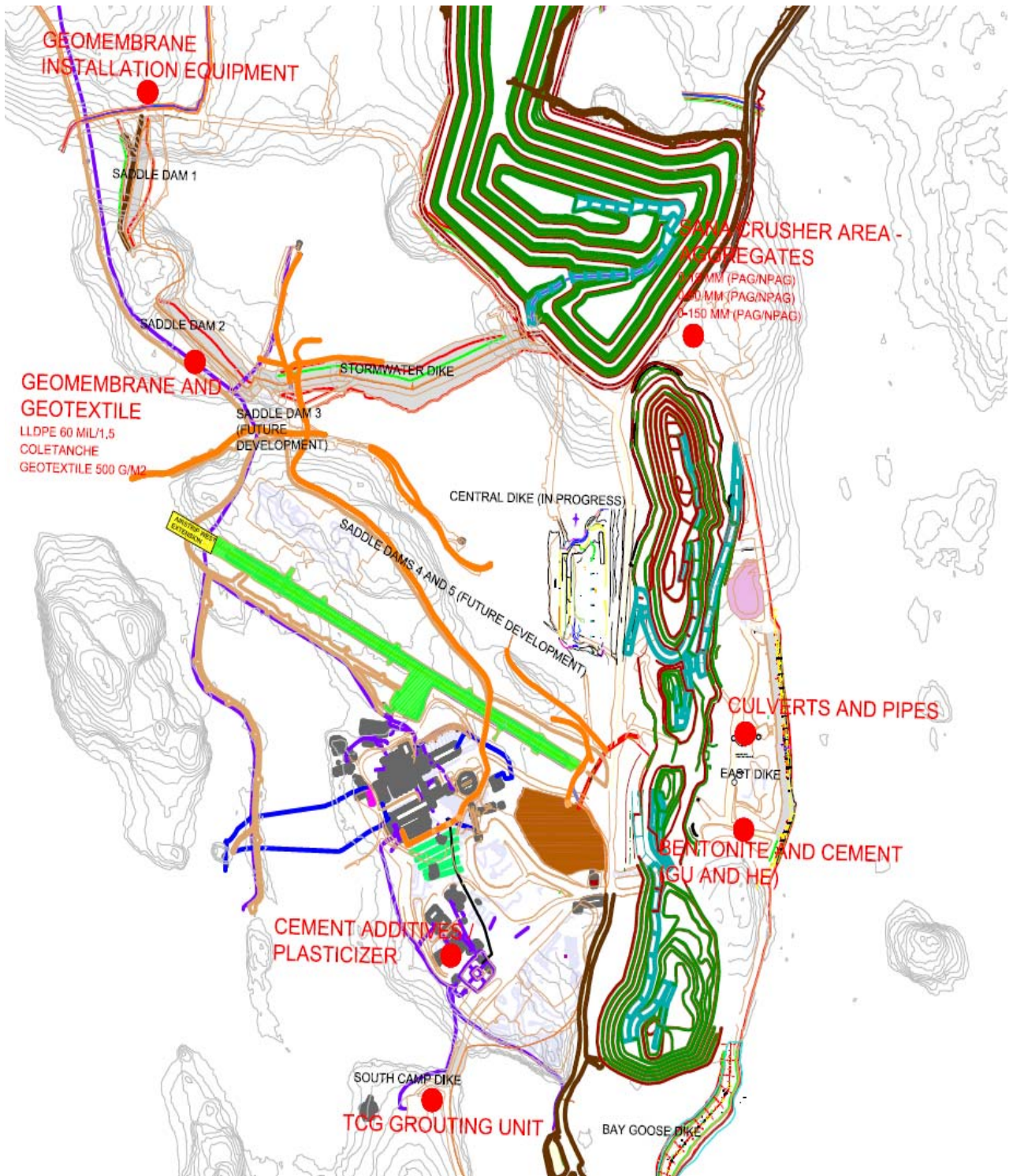


Equipment	Model	Number
Excavator	CAT 345	3
Excavator	Komatsu 1250	1
50 T Haul trucks	CAT 773F	5
Bulldozer	D8	1
Loader	CAT 980	3
Loader	CAT 906	1
Loader	Komatsu Wa600	2
Compactor	CAT 10T	1
Compactor	Hamm 20T	1
Fuel trucks		2
Water trucks		2
Drills	Novamac	2
Compressors	Various	5
Welding machine	Various	3

8.4.3 Earthwork Material and Equipment

Figure 5 presents the earthwork material, including geomembrane and cement, available on site in case of an emergency.

Figure 5 Earthwork Material and Equipment Location



SECTION 9 • EMERGENCY RESPONSE REFERENCE DOCUMENTS

Table 9-1 Emergency Response Reference Documents

Document	Current Revision
Emergency Response Plan	Updated by AEM. Version 9, November 2014
Emergency Preparedness Plan	In TSF OMS Manual, Version 6, February 2016

Note: To be updated as required

Table 9-2 Potential Effects or Causes of Embankment Failure Mechanisms

Embankment Failure Mechanism	Potential Measurable and Observable	
	Causes	Effects
Overtopping	(1) Slurry/water level within the cell rises. (2) Embankment crest settlement	Increase of seepage leading to erosion of downstream foundation soils. Increase in seepage pumping rate during operations Increase in turbidity / suspended solids of seepage
Internal Erosion	(1) Loss of tailings water, erosion through embankments (2) Loss of mineral soil foundation at defect in embankment section.	Sinkhole observable at crest Increase in seepage pumping rate during operations Increase in turbidity / suspended solids of seepage
Slope Instability	(1) Ice or wave forces, or traffic on crest, seepage, weakness of foundation soils (2) Earthquake seismic event	Increase in settlement and/or settlement rate Increase in displacement and/or displacement rate of embankment toe Cracks along the embankment crest Sloughing of the face Bulging of embankment toe

Embankment Failure Mechanism	Potential Measurable and Observable	
	Causes	Effects
	or blasting	
Unexpected settlements	Consolidation of foundation soils or embankment fills	Potential slurry/water overtopping the embankment leading to erosion of downstream foundation soils. Increase in seepage pumping rate during operations Increase in turbidity / suspended solids of seepage

Table 9-3 Threshold Criteria During Operation*

		Threshold Criteria During Operation			
		Green Acceptable Situation	Yellow Areas of Concern	Orange High Risk Situation	Red Emergency Situation
Criteria	Cumulative crest settlement from operations start up	No settlement observed	< 0.2 m	> 0.2 m and < 1.0 m Increasing rate of settlement	> 1.0 m Increasing rate of settlement
	Downstream toe displacement	No displacement observed	Affecting seepage collection system	Loss of roadway	Loss of roadway
	Shear crack along rockfill embankment (differential settlement)	No shear crack observed	< 0.4 m deep	> 0.4 m and < 0.8 m deep	> 0.8 m deep
			< 5 m length along the dike	> 5 m and < 10 m length along the dike	> 10 m length along the dike
	Tension crack embankment alignment at crest	No tension crack observed	< 0.25 m deep	> 0.25 m and < 1 m deep	> 1 m deep
			< 0.10 m wide across the dike	> 0.10 m and < 0.20 m wide across the dike	> 0.20 m wide across the dike
			< 5 m length along the dike	> 5 m and < 10 m length along the dike	> 10 m length along the dike
	Sloughing along downstream rockfill embankment face	No sloughing observed	Observed	Observed and worsening from yellow situation	Observed and worsening from orange situation
	Embankment lateral cumulative deformation	No deformation observed	< 0.1 m	> 0.1 m and <0.25 m	> 0.25 m
	Seepage through embankment	No seepage observed	< 1/3 pumping rate capacity	> 1/3 and < 2/3 pumping rate capacity	> 2/3 pumping rate capacity
Action Required	Increase of seepage rate	No increase in seepage rate	< 5% per day over five consecutive days	> 5% < 10% per day over four consecutive days	> 10% per day over three consecutive days
	Turbidity of seepage water	No turbidity observed	Turbidity observed for first time	Turbidity observed and source of sediments matching cut-off wall or foundation till mineralogy	Turbidity observed and source of sediments matching cut-off wall or foundation till mineralogy
	Sinkhole on crest	No depressions or sinkholes on crest observed	Localized depression of embankment crest	Observed	Well developed
Personnel Notified			Monitor as normal All cracks filled or repaired If cracks re open implement engineering review Identify source of turbidity	Implement engineering review Suspend activities on embankment crest at chainage of concern Intensify monitoring at chainage of concern	Remove personnel and equipment from pit and suspend activities
		Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder), Specialized Contractor (if required), Mine Operations Manager, Environment Superintendent, Mine Manager,	Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder), Specialized Contractor (if required), Mine Operations Manager, Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder), Specialized Contractor, Mine Operations Manager, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder), Specialized Contractor, Mine Operations Manager, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).
Excluding Central Dike – See appendix IV for Specific trigger for Central Dike					

Table 9-4 Communication Charts for Each Emergency Level

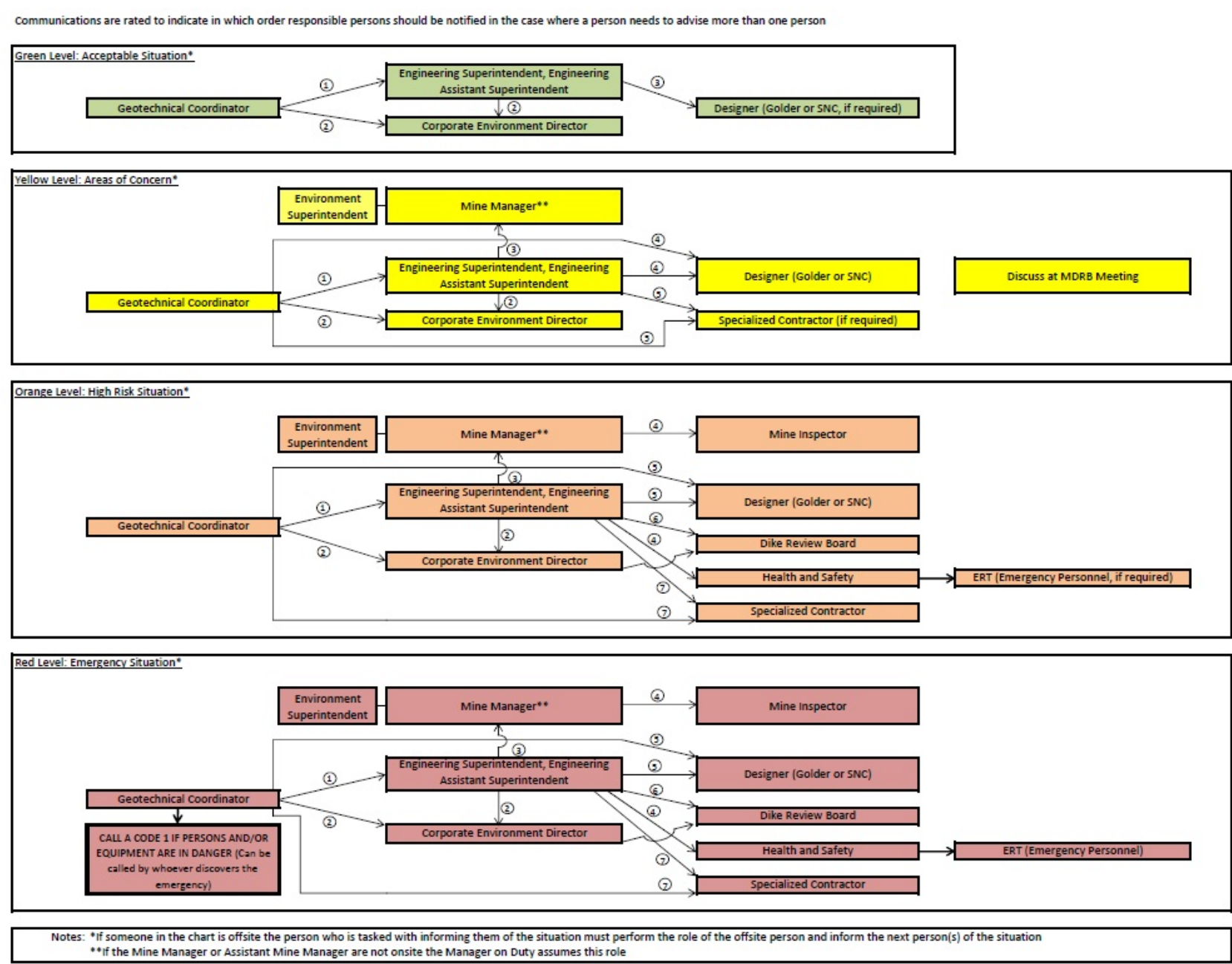


Table 9-5 Responsibilities of Persons for Each Emergency Level

	Decision Making	Mobilization	Performing the Action to be Taken
Green Acceptable Situation	Geotechnical Supervisors	Geotechnical Supervisors	Geotechnical Team*
Yellow Areas of Concern	Geotechnical Supervisors Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC)	Geotechnical Supervisors Geotechnical Coordinator	Geotechnical Team* Specialized Contractor (if required)
Orange High Risk Situation	Geotechnical Supervisors Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety (if required)	Geotechnical Supervisors Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent	Geotechnical Team* Specialized Contractor ERT (if required)
Red Emergency Situation	Geotechnical Supervisors Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety	Geotechnical Supervisors Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent Superintendent Mine Manager Health and Safety	Geotechnical Team* Specialized Contractor ERT

*The Geotechnical Team consists of the Geotechnical Coordinator, the Geotechnical Supervisors, the Dewatering and Pit Geotechnical Engineer/Technician, Water and Tailings Management Engineers, and the Geotechnical Technicians.

Table 9-6 Names and Contact Details (to be updated as required)

Internal Emergency Response Contact Information Chart		
Position	Name/Location	24-Hour Contact #
Geotechnical Supervisors	Patrice Gagnon Rebecca Cousineau	Ph: 819-759-3555 ext 6726 Cell: 418-376-0975
		Ph: 819-759-3555 ext 6726 Cell: 647-888-7856
Geotechnical Coordinator	Thomas Lepine	Ph: 819-759-3555 ext. 6837 Cell: 418-473-8077
Engineering Superintendent	Julie Belanger	Ph: 819-759-3555 ext. 6721 Cell: 819-856-1667
Engineering Assistant Superintendent	Pierre McMullen	Ph: 819-759-3555 ext. 6721 Cell: 819-860-2556
General Superintendent – Mine Operations	Martin Beausejour	Ph: 819-759-3555 ext. 6767 Cell: 819-355-2913
Corporate Environment Director	Gonzalo Rios	Ph: 604-608-2557 ext. 6537
Designer (Golder)	Golder Burnaby: Dan Walker, Fiona Esford, Paul Bedel Golder Montreal: Yves Boulianne, Annie Beaulieu	Burnaby Office: 604-296-4200 Montreal Office: 514-383-0990
Specialized Contractor	SANA (FGL Group)	Onsite Ph: 819-759-3555 ext. 6963 Ph: 418-615-0559
Environment Superintendent	Kevin Buck / Jamie Quesnel	Ph: 819-759-3555 ext 6838 Cell: 819-651-2974
Mine Manager	Bertin Paradis / Luc Chouinard (asst.)	Ph: 819-759-3555 ext. 6725 Cell: 819-355-9348
		Ph: 819-759-3555 ext. 6725 Cell:
Dike Review Board	Anthony Rattue Norbert Morgenstern Don Hayley	anthony.rattue@bell.net norbertm@ualberta.ca don.hayley@icloud.com
Mine Inspector	Martin VanRooy	Martin.vanRooy@wscc.nu.ca
Health and Safety	Normand Ladouceur	Ph: 819-759-3555 ext. 6720 Cell: 819-860-6258
	Yves Levesque (asst.)	Ph: 819-759-3555 ext. 6720 Cell: 819-856-9051
ERT (Emergency Personnel)	Emergency personnel available on site to assist with spill and emergency response activities	Coordinated by the Emergency Measures Counsellor
Incident Commander	André Rouleau	Ph: 819-759-3555 ext. 6809 Cell: 819-355-2191 Code 1
	Normand Ladouceur	Ph: 819-759-3555 ext. 6720 Cell: 819-860-6258 Code 1
Emergency Measures Counsellor	André Rouleau	Ph: 819-759-3555 ext. 6809 Cell: 819-355-2191
Health Professionals / Medical Clinic	Medical Clinic 1	Ph: 819-759-3555 ext. 6734
	Medical Clinic 2	Ph: 819-759-3555 ext. 6751

AEM Management Representative	Bertin Paradis	Ph: 819-759-3555 ext. 6725 Cell: 819-355-9348
Human Resource Superintendent	Dominic Richard	Ph: 819.759.3555 x 6723 Cell:

SECTION 10 • REFERENCES

Canadian Dam Association (CDA) 2007. Dam Safety Guidelines.

Golder Associates Ltd. (Golder) 2008. Detailed Design of Tailings Storage Facility, Meadowbank Gold Project. December 17, 2008. Doc. 784 Ver. 0.

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Golder 2011. 2011 Tailings Deposition Plan Update, Meadowbank Gold Project. July 18, 2011. Doc. 1272 Ver. 0.

Golder 2015. 2015 Detailed design report for Saddle Dams 3, 4 and 5. Meadowbank Gold Project. May 12, 2015. Doc. 1504 Ver. 1.

Mining Associate of Canada (MAC) 2005 Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities.

Mining Association of Canada (MAC) 2008. A Guide to the Management of Tailings Facilities. Second Edition.

AEM, Emergency Response Plan, Ver.9, November 2014

Appendix I

Water Quality and Flow Monitoring Plan

Appendix II

Tailings Storage Facility - Inspection Form

All parts of this inspection form should be completed. Adverse conditions should be described and location stated. Additional information and relevant photographs should be attached.

Inspecting Officer	
Report No.	
Inspection Date	12/11/2015

Dam	☐	
Dike	☐	
Crest Elevation (m)		
D/S Toe Pond Elev. (m)		
South Cell Water Elev. (m)		

Last Inspection Date											
Weather during the current inspection	C°	Sunny	☐	Overcast	☐	Rain	☐	Snow	☐	Wind	☐
Main changes occurred since the last inspection	Comments:										

TABLE OF CONTENT

DOWNSTREAM SLOPE AREA	2
UPSTREAM SLOPE AREA	3
DOWNSTREAM BERMS	4
UPSTREAM BERMS	5
CREST SURFACE	6
DAM / DIKE INSTRUMENTATION	7
GENERAL CONDITION SUMMARY	8
RECOMMENDATIONS	8
APPENDIX I : PLAN	9
APPENDIX II : PHOTOGRAPHS	10

1) DOWNSTREAM SLOPE AREA

	<i>Presence</i>	<i>Crest</i>	<i>Slope</i>	<i>Toe</i>	<i>Pictures</i>
A) Erosion	☐	☐	☐	☐	☐
B) Settlements	☐	☐	☐	☐	☐
C) Bulging	☐	☐	☐	☐	☐
D) Sloughing	☐	☐	☐	☐	☐
E) Slope Protection	☐	☐	☐	☐	☐
F) Vegetation	☐	☐	☐	☐	☐
G) Animals Burrows	☐	☐	☐	☐	☐
H) Seepage*	☐	☐	☐	☐	☐
I) Ice	☐	☐	☐	☐	☐
J) Snow	☐	☐	☐	☐	☐

* Seepage

Location 1	Downstream Toe of the Dike (freshet in not located, coming from under).				
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					
Location 2					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					

☐ Sand boils presence	Type	
	Location(s)	

Comments :

UPSTREAM SLOPE AREA

	<i>Presence</i>	<i>Crest</i>	<i>Slope</i>	<i>Toe</i>	<i>Pictures</i>
A) LLDPE	☐	☐	☐	☐	☐
B) Bituminous Membrane	☐	☐	☐	☐	☐
C) Sink Holes	☐	☐	☐	☐	☐
D) Water on Liner	☐	☐	☐	☐	☐
E) Objects over the Liner	☐	☐	☐	☐	☐
F) Damages on Liner	☐	☐	☐	☐	☐
G) Erosion	☐	☐	☐	☐	☐
H) Settlements	☐	☐	☐	☐	☐
I) Bulging	☐	☐	☐	☐	☐
J) Sloughing	☐	☐	☐	☐	☐
K) Slope Protection	☐	☐	☐	☐	☐
L) Vegetation	☐	☐	☐	☐	☐
M) Animals Burrows	☐	☐	☐	☐	☐
N) Ice	☐	☐	☐	☐	☐
J) Snow	☐	☐	☐	☐	☐

Comments:

DOWNSTREAM BERMS

	<i>Presence</i>	<i>Pictures with scale</i>
A) Cracks	☐	☐
B) Erosion	☐	☐
C) Settlements	☐	☐
D) Bulging	☐	☐
E) Sloughing	☐	☐
F) Vegetation	☐	☐
G) Animals Burrows	☐	☐
H) Seepage*	☐	☐
I) Drainage Trench	☐	☐
J) Snow	☐	☐

* Seepage

Location 1					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	<i>Comments :</i>		
Sample taken					
Location 2					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	<i>Comments :</i>		
Sample taken					

☐ Sand boils presence	Type	
	Location(s)	

Comments:

2) UPSTREAM BERMS

	<i>Presence</i>	<i>Pictures with scale</i>
A) Cracks	☐	☐
B) Erosion	☐	☐
C) Settlements	☐	☐
D) Bulging	☐	☐
E) Sloughing	☐	☐
F) Vegetation	☐	☐
G) Animals Burrows	☐	☐
H) Seepage*	☐	☐
I) Drainage Trench	☐	☐
J) Snow	☐	☐

* Seepage

Location 1					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					
Location 2					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					

☐ Sand boils presence	Type	
	Location(s)	

Comments:

3) CREST SURFACE

	<i>Presence</i>	<i>Pictures with scale</i>
A) Cracks	☐	☐
B) Erosion	☐	☐
C) Settlements	☐	☐
D) Bulging	☐	☐
E) Sloughing	☐	☐
F) Vegetation	☐	☐
G) Animals Burrows	☐	☐
H) Seepage*	☐	☐
I) Drainage Trench	☐	☐
J) Rutting	☐	☐
K) Mud	☐	☐
L) Pond (Puddle)	☐	☐
M) Saturated Soil	☐	☐
N) Snow	☐	☐

* Seepage

Location 1					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					
Location 2					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					

☐ Sand boils presence	Type	
	Location(s)	

Comments:

4) **DAM / DIKE INSTRUMENTATION**

(Plot any newly installed instrumentation on relevant plans and cross-sections)

<i>Instruments</i>	<i>Operational</i>	<i>Damaged</i>	<i>Measurement Taken</i>
☐ <i>Inclinometers</i>	☐	☐	☐ Bi-monthly
☐ <i>Piezometers</i>	☐	☐	☐ Daily 3hrs interval
☐ <i>Thermistors</i>	☐	☐	☐ Daily 3hrs interval
☒ <i>Piezometers (Manual) (47)</i>	☐	☐	☐ Every 3 Days
☒ <i>Thermistors (manual) (16)</i>	☐	☐	☐ Every 3 Days

Instrumentation List :

Comments:

5) GENERAL CONDITION SUMMARY

6) RECOMMENDATIONS

☒ Action required	☐ <i>None</i>	☐ <i>Further monitoring</i>	☐ <i>Immediate remediation</i>
☒ Plan or Sketch Attached (3)	See Appendix I		
☒ Photographs (14)	See Appendix II		

Review Officer: _____ Review Agency: _____ Date Reviewed: [Click here to enter](#)
(DD/MM/YR)

REVIEW COMMENTS:

7) **APPENDIX I : PLAN**

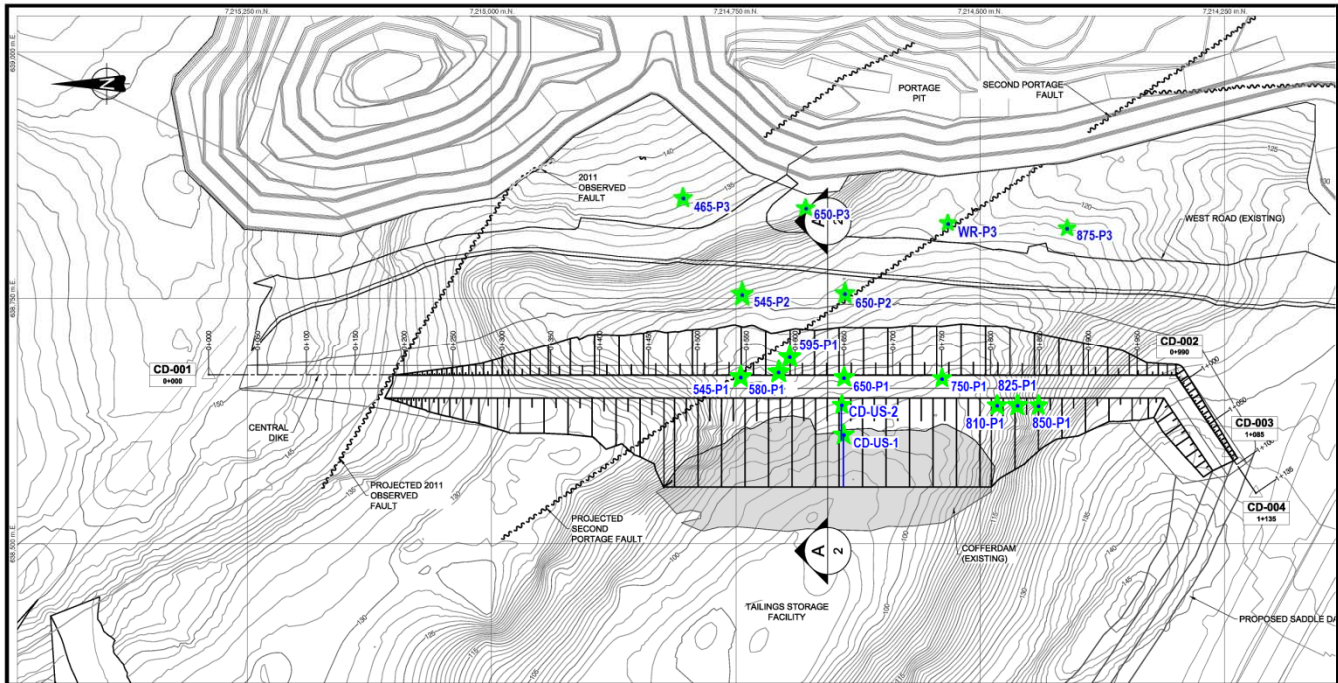


Figure 1 :

APPENDIX II : PHOTOGRAPHS



Figure 2:



Figure 3:

Tailings Storage Facility - OMS Manual
Version 6; March 2016

DAILY REPORT DIKE AND GEOTECHNICAL ENGINEERING AGNICO-EAGLE MINES MEADOWBANK PROJECT				
Date: 12/12/2014		Technician / Engineer: _____		
Weather: Sunny ☐ Overcast ☐ Rain ☐ Snow ☐ Wind ☒		Comments: _____		
Health and Safety: Concern / Incident Y ☐ N ☒				
Comments: _____				
Dewatering Dikes				
<u>BayGoose Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation:
Instrumentation	Piezometers (Auto.) ☒	Photos	Y ☐ N ☒	
	☐			
	Thermistors (Auto.) ☒			
	Thermistors (4) (Manual) ☐			
	Inclinometer ☐	Work Activity	Y ☐ N ☒	Description:
	See Page (2,6,7,9,10,11) ☐			
	USB key (DL9) ☐			
<u>East Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation:
Instrumentation	Piezometers (Auto.) ☒	Photos	Y ☐ N ☒	
	☐			
	Thermistors (Auto.) ☒			
	Thermistors (Manual) ☐	Work Activity	Y ☐ N ☒	Description:
	Inclinometer ☐			
	Survey Prisms ☐			
<u>South Camp Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation:
Instrumentation	Thermistor (Manual) ☐	Photos	Y ☐ N ☒	
	☐			
		Work Activity	Y ☐ N ☒	Description:
<u>Vault Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation:
Instrumentation	Thermistors (Manual) ☐	Photos	Y ☐ N ☒	
	☐			
		Work Activity	Y ☐ N ☒	Description:
	Vault Lake : 2 Flowmeter ☐			
Instrumentation	Piezo. Vpond 11 (Manual) ☐			
	☐			
Tailings Facilities System				
<u>Stormwater Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation:
		Photos	Y ☐ N ☒	
		Work Activity	Y ☐ N ☒	Description:
<u>Saddle Dam 1</u>		Field Visit	Y ☐ N ☒	Comment / Observation:
		Photos	Y ☐ N ☒	
Instrumentation	Thermistors (Manual) ☐	Work Activity	Y ☐ N ☒	Description:
	☐			
<u>Saddle Dam 2</u>		Field Visit	Y ☐ N ☒	Comment / Observation:
		Photos	Y ☐ N ☒	
Instrumentation	Thermistors (Manual) ☐	Work Activity	Y ☐ N ☒	Description:
	☐			
<u>Coffer Dam - Central Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation:
		Photos	Y ☐ N ☒	
Instrumentation	Piezometers (Manual) ☐	Work Activity	Y ☐ N ☒	Description:
	Thermistor (Manual) ☐			
<u>OTHER</u>		Work Activity	Y ☐ N ☒	Description:
	☐			
Ground Control Inspection - Open Pit				
Review of Ground Control ☐ Y ☐ N ☒ Pit Visit ☐ Y ☐ N ☒ Comment/Observations:				
Items to Review (num.): _____				
Items Follow Up in Ground Control Register (after visit) Y ☐ N ☒				

Appendix III

Dike Failure Scenario Appendices from the ERP

Dike Failure Scenarios

1. Dewatering Dikes (removed)
 2. Central Dike
 3. Saddle Dams
 4. Storm water Dike
-

Appendix 2

Central Dike

Central Dike

The Central Dike system is comprised of a Central Dike, a series of perimeter dikes, and the natural basin of the northwest arm of Second Portage Lake, as shown on the general mine site plan provided at the beginning of this document. The Central Dike cross-section consists of:

- A rockfill embankment, constructed from run-of-mine waste rock, placed in lifts and compacted, with the upstream face designed at 3H:1V and 2H:1V and the downstream face designed at a 1.5H:1V slope;
- An upstream two zone granular filter and inverted granular filter along the foundation;
- A bituminous liner with appropriate cover on the upstream face and part of the foundation;

A central or upstream key trench; The Central Dike is a high consequence structure, based on Dam Safety Guidelines (CDA, 2007). Slope stability analyses show that the dike will meet or exceed design FoS for stability under static and pseudostatic earthquake load conditions. Consequently, the probability of failure of the Central Dike is considered to be very low.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Central Dike see Table A.2 below.

Table A.2: Meadowbank Tailings Storage Facility Summary of Consequences and Proposed Monitoring / Action for Rare Event Based On Water Retaining Embankment Failure Modes Identified in ICOLD Study (1995)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Pond Level rises because of restricted outflow (excessive inflow is a far less likely scenario). Water will spill at the low point on the dike system, which will depend on the construction schedule.	Water spills over the crest but, as this crest is both wide and comprises coarse compacted rock fill, minimal damage to the dike is credible. There will be considerable warning time prior to overtopping given the design freeboard and the storage volume.	Adjust decant and/or deposition rate. Add spillway in Central Dike, Saddle Dam, or natural ground.
	(2) Dam crest settles more than available freeboard over a distance of (say) 50m or so. This scenario requires unexpected foundation condition, such as glacial lake clay deposit. Settlement would occur upon placement of rock fill during dike raise construction. Freeboard is greatest immediately after a raise and this scenario is therefore unlikely to occur.	Water and tailings spill over crest and if settlement was rapid might erode the crest. Travel of tailings will be dependent on volume of water available, and level of thaw. Tailings would only go to the pit, and not reach the lake.	The situation envisaged is unlikely. This scenario would develop slowly during construction of the dike. Crest settlement would be evident at least several weeks before an overtopping event occurred. Easily observed cracks should be evident during summer period, but could be hidden during the winter. Systematic crest settlement monitoring is appropriate, and included in the design. Production and addition of tailings to the Tailings Storage Facility could be stopped to maintain freeboard. A spillway could also be constructed. The tailings deposition plan maintains a long beach between the dike and the pond, which provides additional freeboard to overtopping of the dike by pond water.

Internal Erosion	(1) Dike Section: Upstream bituminous liner contains defects arising from undetected damage during installation. May lead to loss of water, but filter retains tailing.	Loss of water into the rock fill. This is not a catastrophic failure mode, because the rock fill of the dike will be stable, and at its worst, would lead to temporary suspension of mining. Plus the bituminous liner does not propagate a tear like a plastic liner, so undetected damage is typically small and does not grow. Also, the foundation slopes down towards the tailings, so seepage impounds in the rock fill and will tend to reduce further seepage	Not necessary to monitor directly. Will become evident as possible seepage at dike toe. QA/QC program during construction is the main defence against this scenario.
	(2) Dike Section: Upstream bituminous liner contains defects arising from undetected damage during installation. This defect occurs at the same location as a filter defect.	Loss of tailings and water into the rock fill. This is not a catastrophic failure mode, because the rock fill of the dike will be stable, and at its worst, would lead to temporary suspension of mining. Accumulation of ponded water within the rock fill would decrease the head difference driving flow, thereby limiting the potential for a catastrophic failure.	Not necessary to monitor directly. Will become evident as possible intensive seepage at dike toe, and potentially as tailings fines within seepage downstream of the toe. QA/QC program during construction is the main defence against this scenario.
Seepage within Embankment	Seepage on its own is not a credible failure scenario. The rock fill is pervious so seepage will daylight on the downstream face. Flow through the rock fill will not lead to instability. Any seepage related failures must include internal erosion, see above.	No credible consequences.	No scenario specific monitoring required.
Seepage within Foundation	If the till foundation had a zone of more pervious soil (e.g. gravel seams) and the more pervious zone was preferentially exposed to water pressure, then normal seepage would transmit an unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation. This scenario requires construction defects in filters, liner, and cut off trench fill.	This failure mechanism has caused other embankment failures elsewhere because of straightforward pore pressure induced instability. However, it is unclear that it could cause failure of the Central Dike because of its large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm.	If this mechanism arises it should show itself gradually as the tailings and water level increase in the basin by buildup of pore water pressures in the foundation. This would be detected during routine monitoring of piezometers installed in the foundation. Pressure relief wells could be installed in the foundation during operations. The tailings deposition plan maintains a long beach between the pond and the dike. This will reduce seepage gradients beneath the dike. In addition, the tailings act as an upstream blanket on the bottom of the TSF to limit seepage into the foundation.

Internal Conduit Rupture	There are no water off take works or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(1) Normal Operation: The rockfill has high frictional strength and the design widths make it conservative. Slope failure requires failure in the foundation, which would then extend into the overlying dike.	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rock fill will not necessarily compromise the tailings or water retaining function of the dike.	Initial stages of failure should be observable as tension cracks in dike crest and movement at dike toe. Walk-over inspection of dikes by a trained inspector is an appropriate monitoring strategy. Survey of crest, face and toe is also appropriate. If movements associated with increases in foundation pore pressures are discovered, then construction could be stopped or staged to allow pore pressure dissipation. Placement of rockfill as a downstream toe berm could help prevent failure.
	(2) Earthquake Induced: Occurrence of an extreme earthquake, a very rare event.	The extreme earthquake loading for site is a low magnitude event. A large earthquake would not be expected to cause a catastrophic failure, rather the dike would settle. The Central Dike rock fill is placed in the dry and compacted, and will therefore have limited settlement. This would not be a failure situation. The crest is also erosion resistant for earthquake induced wave action in the impounded water.	No monitoring is necessary. Dike should be inspected following any earthquakes felt on site.
Liner Failure Due To Foundation Movement	Differential horizontal movement of the dike due to pit wall failure. Creates a breach in the liner and filter. Pit wall failure is unlikely based on assessments of pit wall stability and the setback between the pit and the toe of the dike. Also, the liner and rock fill can withstand significant deformation, making this an unlikely scenario.	Tailings and water escape into the dike rock fill, but pond there because the foundation slopes towards the dike, rather than the pit. It is noted that the tailings pond is operated approximately 500 metres away. Rapid escape of water will therefore be limited.	No enhanced monitoring. Prism monitoring program and visual inspection sufficient. Movement would be evident in setback area between dike and pit. Tailings at face of dike may be excavated to allow repair of liner, or placement of filter material. Other options include freezing tailings at face of dike.
Unexpected Settlements	The foundation till is expected to consolidate during construction and operations. There is no credible mechanism for a large degree of unexpected settlement following construction required to eliminate freeboard and release tailings/water.	A large settlement could lead to water flowing through the rock fill, but this would not cause failure of the rock fill. It could also be readily repaired by placing more end-dumped rock fill, and extending the liner, in a manner similar to the periodic raise.	No enhanced monitoring required, as excessive settlement would be apparent from prism monitoring data, and visual inspection.

A.2.1 Failure Scenario during Operations

In the case of failure of the Central Dike during operations, the 'worst-case' scenario would involve a flow of unfrozen water and tailings in association with a catastrophic failure of the dike in the later stages of mining when personnel and machinery are working in the open pit directly down-stream of the Tailings Storage Facility (TSF).

Potential Effect

The failure of the Central Dike could result in the sudden release of dike material and tailings from the TSF into that portion of the Portage Pit immediately adjacent to the dike. This could potentially result in loss of life. This would result in cessation of mining activities, either temporarily or permanently.

There would be no effect on the receiving environment water quality, fish or fish habitat because tailings would be contained within the pit and the dewatering dikes and the area would not yet be flooded.

Mitigation, Management and Monitoring

The calculated FoS for this failure mode, under static and pseudo-static conditions, are above design criteria in the Dam Safety Guidelines (CDA, 2007). Consequently, the probability of such a failure developing is low. Based on the tailings deposition plan, it is expected that the tailings pond will typically be 500 m or more from the face of the Central Dike. Furthermore, thermal modeling indicates the tailings and Central Dike will be frozen or partially frozen, and that the facility will tend to the frozen state in the long term. Therefore, a catastrophic failure of the Central Dike without some form of prior dam distress providing a warning of deteriorating conditions is not considered a credible catastrophic failure mode.

Mitigation against such a failure mode occurring will be to construct the Central Dike to design so that it is physically stable under all loading conditions. A comprehensive quality control and quality assurance program will be undertaken during dike construction to confirm foundation conditions, material type and quality, and to adjust designs as necessary to accommodate actual or unexpected conditions found at site.

- A management plan was developed for the operation of the tailings facility, and includes appropriate operational controls and monitoring activities. During operations, instrumentation will be installed to monitor not only the physical performance of the Central Dike itself, but also the performance of the TSF. The instrumentation installed and to be installed includes thermistors to monitor the thermal regime in the dike and foundations, and deposited tailings.
- Piezometers to measure pressure and to infer flow through the dike and foundation materials
- Prisms to monitor deformations within the dike.

If necessary, the stability of the foundation materials and of the dike during operations can be enhanced through the construction of a stabilizing toe berm or through freezing.

A.2.2 Failure Scenario during Closure

In the case of failure of the Central Dike during or following closure, the 'worst-case' scenario would involve a catastrophic failure of the dike and the release of tailings into the lake.

Potential Effect

Failure of the Central Dike during or following closure is not expected to result in loss of life, as mining operations will have finished.

Under this scenario, a catastrophic failure of the Central Dike could result in the sudden and unexpected release of dike material and tailings into the Portage Pit lake area. This could potentially produce a wave of sediment laden water that could over-top the East Dike.

Such a scenario would destroy fish habitat along the dike face and smother benthic habitat outwards from the failure area. Suspended solids and dissolved metals would increase in the water column and would cause displacement of fish and possible toxicity of some bottom sediments, depending on how much tailings material was lost. The new face would be subject to chronic erosion of fine tailings material until such time as a new, stable dike face could be established. Failure of the dike would not cause a change in water level. Impacts would be localized because the Central Dike is situated in the upper part of a blind arm of the lake with an extremely limited drainage area and low turnover. Consequently, transport of suspended sediment away from the area would be restricted and the area of impact would be relatively small.

Mitigation, Management, and Monitoring

The calculated FoS for the Central Dike design are greater than design criteria for post closure for static and pseudo-static (earthquake) conditions. Consequently, the likelihood of a failure occurring is low. Furthermore, thermal modeling indicates the tailings and Central Dike will progressively freeze, and that the facility will tend to the frozen state in the long term. Freezing will increase dike and tailings stability and decrease tailings mobility, and therefore this is not considered a credible catastrophic failure mode.

Mitigation against such a failure mode occurring will be to construct the Central Dike to the design so that it is physically stable under static and pseudo-static loading conditions, and to monitor during the mine life to assess the overall performance of the dike and the TSF. Data gathered during the operational period of the TSF can be used to re-evaluate the performance of the Central Dike structure in the context of longer term stability post closure.

Appendix 3

Saddle Dams

Saddle Dams

Five Saddle dams will be constructed around the limits of the tailings basin. Two Saddle Dams were built between 2009 and 2011, the three other Saddle Dams have been built in 2015. The saddle dam locations are shown on the general mine site plan provided at the beginning of this document. The saddle dams will be constructed by dumping a rockfill berm with a crest width of 30 m to allow haul truck traffic. The Saddle Dams will be re-sloped, with a minimum 15 m crest width. The downstream face will be angle of repose, or 1.32H:1V (Horizontal:Vertical), and the upstream face will be 3H:1V. The Saddle Dams will have an upstream two-zone granular filter and a liner. There is a potential for release of attenuation water, reclaim water, or tailings to Third Portage Lake in the event of an overtopping or catastrophic failure.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Saddle Dams see Table 2.2 for the Central Dike.

3.1 Failure Scenario during Operation

Depending upon the phase of operations, breach or complete failure of a Saddle Dam could result in the uncontrolled release of Attenuation Pond water, Reclaim Pond water or tailings to Third Portage Lake. There is also the possibility of the Saddle Dams being overtopped through the formation of a wave resulting from a slope failure within the Portage Waste Rock Storage Facility and the sudden release of waste rock into the TSF.

A tailings beach will be formed on the toe of each Saddle Dam. As a result, the Reclaim Pond will be pushed away from the Saddle Dams. As the tailings and Saddle Dams are expected to freeze, and freezing will reduce the chance of tailings reaching Third Portage Lake, failure of the Saddle Dams with release of tailings to Third Portage Lake is not considered to be credible.

An overtopping or breach failure of the section of the Saddle Dams located just south of the intersection with the Stormwater Dike could potentially result in flow of Reclaim Pond water and/or tailings toward Third Portage Lake.

Potential Effect

Should an overtopping event or breach occur in a Saddle Dam, water flowing toward Third Portage Lake would consist of Reclaim Pond water which is predicted to exceed Metal Mining Effluent Regulations (MMER) guidelines for a number of constituents.

As a worst case of failure resulting in a dam breach, the total predicted Reclaim Pond volume of 0.75 Mm³ could be released towards Third Portage Lake. The Saddle Dams would not be expected to fail due to overtopping. This failure mode is not expected to release a considerable volume of water to Third Portage Lake. Given the size of Third Portage Lake, the impacts to water quality and on fish from a release of Reclaim Pond water would likely be localized.

A worst case scenario would also involve the flow of non-frozen tailings into Third Portage Lake. The distance between the toe of the Saddle Dams and Third Portage Lake is on the order of 150 m to 300 m. Such a scenario would destroy fish habitat and smother benthic habitat outwards from the failure area. Suspended solids and dissolved metals would increase in the water column and would cause displacement of fish and possible toxicity of some bottom sediments, depending on how much tailings material was lost.

Mitigation, Management, and Monitoring

The dams are designed according to Dam Safety Guidelines (CDA, 2007), and were and will be constructed under controlled conditions. A comprehensive quality control and quality assurance program was and will be undertaken during construction to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual conditions found at site. The dams are predicted to eventually freeze, which will enhance stability. Therefore, failure of Saddle Dams by overtopping, full breaching or foundation and slope failure is not considered to be credible.

With respect to slope stability failure, the Saddle Dams are constructed of rockfill, which has high shear strength. Slope stability failures must therefore occur through foundation soils. The calculated FoS for slope stability failure modes through foundation soils are above the design criteria in the Dam Safety Guidelines (CDA, 2007) for static and pseudo-static conditions. Consequently, the probability of such a failure developing is low.

The tailings are expected to freeze, and freezing will reduce the chance of tailings reaching Third Portage Lake. The distance from Saddle Dam 1 to Third Portage Lake is about 300 m at its closest point. Leaks of supernatant water and or tailings from the South Saddle Dam would be most likely to occur during operations. Leaks would be visible, and could be mitigated during operations.

3.2 Failure Scenario during Closure

At closure Reclaim Pond water will be pumped to an Attenuation Pond, the basin behind the Saddle Dams will be drained and filled with run-of-mine, acid-buffering ultramafic waste rock (NPAG). The rock is expected to freeze over time. Failure of the Saddle Dams following closure is not considered to be credible. Further, the lack of water will reduce mobility of tailings if failure occurs.

Potential Effect

No effects to water quality, fish or fish habitat is expected.

Mitigation, Management, and Monitoring

As described previously, the dams were and will be designed to meet Dam Safety Guidelines (CDA, 2007). The dams were and will be constructed under controlled conditions. During the construction of the dams a comprehensive quality control and quality assurance program was and will be undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual or unexpected conditions found at site. Monitoring during operations will ensure the Saddle Dams perform

as intended. The dams will eventually freeze, which will enhance stability. Therefore, post-closure failure of the Saddle Dams by full breaching or foundation and slope failure is not considered to be credible.

Appendix 4

Stormwater Dike

Stormwater Dike

The Stormwater Dike is located at the northwest end of Second Portage Lake, within the TSF as shown on the general mine site plan provided at the beginning of this document. The location of the Stormwater Dike was selected to optimize the storage capacity of the main tailings basin, and of the Portage Attenuation Pond. The dike separates the tailings basin from the Attenuation Pond until approximately 2014 at which point the tailing deposition will start in the South tailing Cell. At the end of mine life, any remaining water will be treated within the TSF and released once discharge criteria are met.

The Stormwater Dike was constructed using rock fill, with a upstream slope of 3H: 1V and a downstream slope at angle of repose for rock fill. The minimum crest width is 12 m. Final crest is at elevation 150.0 m. The dike has a filter zone placed on the south face, underlying an impermeable element of bituminous geo-membrane. The maximum height of the dike is about 13 m. At the maximum cross section, the width of the base of the dike is approximately 95 m.

For information on the consequences and monitoring/action for the various embankment failure modes possible at Storm water Dike see Table 2.2.

4.1 Failure Scenario during Operation

If slope failure of the Stormwater Dike were to occur when tailings are at their maximum elevation in the main tailings basin, and if the tailings are not frozen, this could potentially result in the sudden flow of tailings into the Attenuation Pond area. This in turn could potentially result in the development of a wave which overtops the Saddle Dam at the northwest end, releasing tailings and reclaim water to Third Portage Lake.

Potential Effect

A breach or failure of the Stormwater Dike may cause a wave-induced overtopping of the Saddle Dam at the northwest end. The Saddle Dam would not be expected to fail due to a single overtopping wave event.

This failure mode is not expected to release water to Third Portage Lake. The distance between the toe of the Saddle Dam and Third Portage Lake is on the order of 150 m, so tailings would likely settle out. The potential impacts on Third Portage Lake water quality, fish and fish habitat would likely be minor, localized and short-lived.

Mitigation, Management, and Monitoring

The Stormwater Dike was designed to meet Dam Safety Guidelines (CDA, 1999). The upstream side slopes were designed to allow machine traffic, and are therefore highly conservative with respect to slope stability. The dike was constructed in the dry under controlled conditions. During the construction of the dike a comprehensive quality control and quality assurance program was undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual conditions found at site. The dike will eventually freeze, which will enhance stability. Therefore, failure of the dike due to overtopping is not considered to be credible.

4.2 Failure Scenario during Closure

The Stormwater Dike will be covered by tailing on both upstream and downstream side, to equal out the different elevations. At closure Reclaim Pond water will be pumped to an Attenuation Pond, the basin behind the Saddle Dams and Stormwater Dike will be drained and filled with run-of-mine, acid-buffering ultramafic waste rock (NPAG). The rock is expected to freeze over time. Failure of the Stormwater Dike following closure is not considered to be credible. Further, the lack of water will reduce mobility of tailings if failure occurs.

Potential Effect

No effects to water quality, fish or fish habitat is expected.

Mitigation, Management, and Monitoring

The Stormwater Dike was designed to meet Dam Safety Guidelines (CDA, 1999). The dike was constructed under controlled conditions. During the construction of the dike a comprehensive quality control and quality assurance program was undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual or unexpected conditions found at site. Monitoring during operations ensure the Stormwater Dike performs as intended. The dike will eventually freeze, which will enhance stability. Therefore, post-closure failure of the Stormwater Dike by full breaching or foundation and slope failure is not considered to be credible.

Appendix IV

Central Dike – Specific Trigger Values

Appendix Explanation

During the MDRB#17 meeting on July 27th, 2015, the Central Dike Instrumentation Review was presented to the Board members. The presentation was exposing the facts related to water accumulation at the downstream of the structure as well as the instrumentation results related to the same matter. Following this presentation the need to put in place an action plan to better understand the situation at Central Dike was discussed.

The Central Dike seepage action plan is in place since the beginning of August 2015. Many different steps and tasks have been undertaken and completed since then. Update on Seepage Modelling, Geophysical Survey as well as pumping test for flow measurement are some of them. The study involved many different actors and has been reviewed by the Meadowbank Dike Review Board (MDRB).

The founding of the study oriented us to assume that most of the seepage happened at the location of a primary anomaly occurring in the bedrock underneath the dike and not through it. It propose that the reclaim water of the South Cell use a system of geological structure, probably some bedrock fault, as a piping system to bring the water from the upstream basin to the downstream of the dike. Drilling investigation campaign as well as instrumentation installation campaign has been realized in November 2015 in the vicinity of the seepage path.

Maximum flow rate have been evaluated at 800 m³/hr and is now steady at 400 m³/hr. Permanent pumping system has been implemented at the downstream toe of the Central Dike to manage properly and safely the seepage.

All the parties involved agreed that the South Cell could resume operation under specific conditions:

- The water table at the downstream toe of the structure and in the Central Dike should be maintained at 115 MASL. An efficient pumping system should be in place to insure that this condition is respected;
- Daily inspection by qualified personal should continue. Any anomalies or sign of instabilities should be reported to the engineer on site;
- Frequent instruments monitoring and analysis should continue.

Deposition in the South Cell resume on October 27 2015. Since then, monitoring and visual inspection occurred on a daily basis.

Specific Trigger Value for Central Dike

The following table have been developed for the particular case of Central Dike.

Tailings Storage Facility - OMS Manual
Version 6; March 2016

		Threshold Criteria During Operation			
		Green Acceptable Situation	Yellow Areas of Concern	Orange High Risk Situation	Red Emergency Situation
Criteria	Cumulative crest settlement from operations start up	No settlement observed	< 0.2 m	> 0.2 m and < 1.0 m Increasing rate of settlement	> 1.0 m Increasing rate of settlement
	Downstream toe displacement	No displacement observed	Affecting seepage collection system	Loss of roadway	Loss of roadway
	Shear crack along rockfill embankment (differential settlement)	No shear crack observed	< 0.4 m deep	> 0.4 m and < 0.8 m deep	> 0.8 m deep
			< 5 m length along the dike	> 5 m and < 10 m length along the dike	> 10 m length along the dike
	Tension crack embankment alignment at crest	No tension crack observed	< 0.25 m deep	> 0.25 m and < 1 m deep	> 1 m deep
			< 0.10 m wide across the dike	> 0.10 m and < 0.20 m wide across the dike	> 0.20 m wide across the dike
			< 5 m length along the dike	> 5 m and < 10 m length along the dike	> 10 m length along the dike
	Sloughing along downstream rockfill embankment face	No sloughing observed	Observed	Observed and worsening from yellow situation	Observed and worsening from orange situation
	Embankment lateral cumulative deformation	No deformation observed	< 0.1 m	> 0.1 m and <0.25 m	> 0.25 m
	<u>Seepage through embankment</u>	Seepage rate follow seepage model (from 400 m3/hr to 800 m3/hr) or lower	Seepage exceed 10% from model rate	Seepage exceed 20% from model rate	Seepage exceed 30% from model rate
	<u>Increase of seepage rate</u>	No increase in seepage rate – Steady State for a specific period of time	< 5% per day over five consecutive days	> 5% < 10% per day over four consecutive days	> 10% per day over three consecutive days
	<u>Water Pond Elevation at the D/S of the Dike</u>	Water pond stable at 115 MASL	Rise < 5% per day over five consecutive days	Rise > 5% < 10% per day over four consecutive days	Rise > 10% per day over three consecutive days
Action Required	Turbidity of seepage water	No turbidity observed	Turbidity observed for first time	Turbidity observed and source of sediments matching cut-off wall or foundation till mineralogy	Turbidity observed and source of sediments matching cut-off wall or foundation till mineralogy
	Sinkhole on crest	No depressions or sinkholes on crest observed	Localized depression of embankment crest	Observed	Well developed
Personnel Notified	-	Daily inspection of the structure by qualified personal and frequent instrumentation monitoring	Daily inspection of the structure by qualified personal and frequent instrumentation monitoring All cracks filled or repaired If cracks re open implement engineering review Identify source of turbidity	Implement engineering review Suspend activities on embankment crest at station of concern Intensify monitoring at station of concern Suspend deposition activities if needed	Remove personnel and equipment from pit and suspend activities Suspend deposition activities
	-	Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder, if required).	Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder), Specialized Contractor (if required), Mine Operations Manager, Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder), Specialized Contractor, Mine Operations Manager, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder), Specialized Contractor, Mine Operations Manager, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

**DEWATERING DIKES; OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL, VERSION
4, MARCH 2016**



AGNICO EAGLE

MEADOWBANK GOLD PROJECT

DEWATERING DIKES

Operation, Maintenance and Surveillance Manual

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 5
March 2016

DEWATERING DIKES
OPERATION, MAINTENANCE AND
SURVEILLANCE MANUAL
MEADOWBANK GOLD PROJECT
AGNICO EAGLE MINES LIMITED

This Operation, Maintenance and Surveillance Manual has been prepared by Agnico Eagle Mines Limited and is to be used for the operation, maintenance and surveillance of the Dewatering Dikes at the Meadowbank Gold Project. All Registered Manual Holders are responsible for ensuring that they are using the most recent revision of this document. This Operation, Maintenance and Surveillance Manual, may not be copied in whole or in part without the written consent of Agnico Eagle Mines Limited.

IMPLEMENTATION SCHEDULE

This Plan is immediately implemented.

DISTRIBUTION LIST

AEM- General Mine Manager

AEM-General Superintendent Mine Operations

AEM- Environment Superintendent

AEM- Mine Operations Superintendent

AEM- Engineering Superintendent

AEM- Energy and Infrastructure Superintendent

AEM- Corporate Environment Director

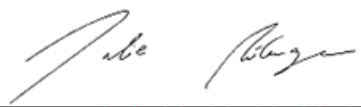
AEM- Health and Safety Superintendent

Golder- Dike Design Engineer

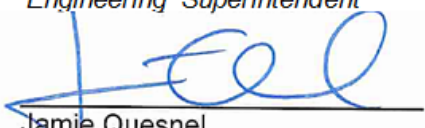
SNC- Dike Design Engineer

DOCUMENT CONTROL

Version	Date (YMD)	Section	Page	Revision
(first revision)	February 2012	All	All	
V2	August 27, 2013	All	All	
V3	September 15, 2013	All	All	Updated items mentioned by MDRB and the Mine Inspector in the Annual Geotechnical Inspection in September 2013
V4	January 2015	All	All	
V5	January 2016	All	All	

Approved by: 

Julie Belanger
Engineering Superintendent



Jamie Quesnel
Environment Superintendent

TABLE OF CONTENTS

DISTRIBUTION LIST	I
DOCUMENT CONTROL	II
LIST OF TABLES.....	V
LIST OF FIGURES.....	VI
LIST OF APPENDICES	VI
SECTION 1 • INTRODUCTION.....	1-1
1.1 Purpose	1-1
1.2 Regulatory Requirements.....	1-1
1.3 Consequences of Failure.....	1-2
1.4 Registered Manual Holders and Revisions	1-2
1.5 Annual Review of Manual.....	1-3
1.6 Reference Documents and Drawings.....	1-3
SECTION 2 • ROLES AND RESPONSIBILITIES.....	2-1
2.1 Responsibilities.....	2-1
2.2 Required Levels of Knowledge.....	2-5
SECTION 3 • DESCRIPTION OF DEWATERING DIKES.....	3-1
3.1 East Dike	3-3
3.1.1 East Dike - Design and Construction.....	3-3
3.1.2 East Dike - Instrumentation.....	3-10
3.1.3 East Dike - Dewatering	3-18
3.1.4 East Dike - Seepage Collection System	3-18
3.1.5 East Dike - Access.....	3-19
3.2 Bay-Goose Dike	3-19
3.2.1 Bay-Goose Dike – Design and Construction	3-20
3.2.2 Bay-Goose Dike – Instrumentation.....	3-28
3.2.3 Bay-Goose Dike - Seepage Collection System	3-38
3.2.4 Bay-Goose Dike - Access	3-38
3.3 South Camp Dike	3-39
3.3.1 South Camp Dike – Design and Construction	3-39
3.3.2 South Camp Dike - Instrumentation.....	3-39
3.3.3 Seepage Collection System.....	3-40
3.3.4 South Camp Dike - Access	3-40

3.4	Vault Dike	3-42
3.4.1	Vault Dike – Design and Construction	3-42
3.4.2	Vault Dike – Dewatering	3-42
3.4.3	Vault Dike - Instrumentation	3-44
3.4.4	Vault Dike - Seepage Collection System	3-45
3.4.5	Vault Dike - Access.....	3-45
SECTION 4 • DEWATERING.....		4-1
4.1	Freeboard	4-1
4.2	Water Management and Quality.....	4-1
4.3	Surveillance and Monitoring Requirements.....	4-2
4.4	Safety and Security	4-2
SECTION 5 • OPERATIONS.....		5-1
5.1	Freeboard	5-1
5.2	Water Management	5-1
5.3	Water Quality	5-2
SECTION 6 • MAINTENANCE PROCEDURES		6-1
6.1	Planned and Un-Planned Maintenance.....	6-1
6.2	Embankment Erosion	6-1
6.3	Seepage Collection System	6-1
6.4	Instrumentation.....	6-2
6.5	Access	6-2
SECTION 7 • SURVEILLANCE		7-1
7.1	Surveillance Requirements.....	7-1
7.2	Surveillance Protocols	7-6
7.3	Responsibilities and Frequency.....	7-6
7.3.1	Dewatering Inspections (Daily and Weekly)	7-7
7.3.2	Daily and Weekly Routine Inspections	7-10
7.3.3	Monthly Routine Inspections.....	7-13
7.3.4	Engineering Inspection	7-13
7.3.5	Dam Safety Review	7-14
SECTION 8 • MONITORING AND INSTRUMENTATION		8-1
8.1	Dewatering – Drawdown Rate and Water Quality	8-1
8.2	Geotechnical Monitoring.....	8-1
8.2.1	Data Collection Protocols and Schedule	8-1
8.2.1.1	Thermistors.....	8-3
8.2.1.2	Survey Monuments and Prisms.....	8-3
8.2.1.3	Slope Inclinator Casings.....	8-3
8.2.1.4	Vibrating Wire Piezometers	8-4

8.2.1.5	Seismographs.....	8-4
8.2.2	Anomalous Instrumentation Data	8-4
8.3	Seepage Monitoring - Operations	8-5
8.3.1	Data Collection Protocols and Schedule	8-5
8.3.2	Anomalous Measurements	8-6
SECTION 9 • REPORTING PROCEDURES AND DATA MANAGEMENT		9-1
9.1	Reporting Protocols	9-1
9.1.1	Inspection Documents	9-1
9.1.2	Instrumentation Measurements	9-1
9.1.3	Emergencies	9-1
9.2	Data Management	9-1
SECTION 10 • DECOMMISSIONING		10-1
10.1	General	10-1
10.2	East Dike Embankments	10-1
10.3	Seepage Collection System	10-1
10.4	Instrumentation and Monitoring	10-1
SECTION 11 • EMERGENCY PREPAREDNESS PLAN		11-1
11.1	Emergency Procedures	11-1
11.1.1	Operation	11-1
11.2	Emergency Details	11-2
11.3	Medical and First Aid Services	11-4
11.4	On Site Equipment and material	11-4
SECTION 12 • EMERGENCY RESPONSE REFERENCE DOCUMENTS		12-1
SECTION 13 • REFERENCES.....		13-1

LIST OF TABLES

Table 1.1	Regulatory Requirements.....	1-1
Table 1.2	Classification of Dams in Terms of Consequences of Failure (CDA 2007)	1-1
Table 1.3	List of Registered OMS Manual Holders	1-2
Table 1.4	Record of Revisions/Addenda.....	1-2
Table 1.5	Summary of key reference documents for the Dewatering Dikes	1-3
Table 2.1	Responsibilities during Dewatering	2-2
Table 2.2	Responsibilities during Operation.....	2-4
Table 2.3	Recommended Minimum Knowledge and Training Requirements	2-6
Table 3.1	Existing Instrumentation Summary.....	3-11
Table 3.2	Existing Instrumentation Summary.....	3-29

Table 3.3 South Camp Di­ke Existing Instrumentation Summary	3-40
Table 3.4 Vault Di­ke Existing Instrumentation Summary	3-44
Table 4.1 Design Minimum Freeboard	4-1
Table 5.1 Freeboard	5-1
Table 5.2 Sump Design Criteria	5-2
Table 7.1 Summary of Consequences and Proposed Monitoring/Action for Rare Events Based on Water Retaining Embankment Failure Modes Identified in ICOLD (1998)	7-2
Table 7.2 Inspection, Monitoring and Review Requirements	7-7
Table 8.1 Geotechnical Instrumentation Monitoring Program	8-2
Table 12.1 Emergency Response Reference Documents	12-1
Table 12.2 Potential Effects or Causes of Failure Mechanisms	12-1
Table 12.3 Threshold Criteria during Operation for East Di­ke	12-3
Table 12.4 Threshold Criteria during Operation for Bay-Goose Di­ke	12-4
Table 12.5 Threshold Criteria during Operation for South Camp Di­ke	12-5
Table 12.6 Threshold Criteria during Operation for Vault Di­ke	12-6
Table 12.7 Communication Charts for Each Emergency Level	12-7
Table 12.9 Names and Contact Details	12-8
Table 12.10 Emergency Response Summary for East Di­ke and Bay-Goose Di­ke	12-10
Table 12.11 Risk Matrix	12-13
Table 12.12 Risk assessment for East Di­ke, Bay-Goose Di­ke, South Camp Di­ke and Vault Di­ke	12-14
Table 13.1 References	13-1

LIST OF FIGURES

Figure 1 Organizational Structure	2-1
Figure 2 Site Plan	3-2
Figure 3 East Di­ke Plan and Profile	3-5
Figure 3A East Di­ke Plan view Thermistors between Sta. 60+440 to Sta.60+521	3-6
Figure 3B East Di­ke Profile view Thermistors between Sta. 60+440 to Sta.60+521	3-7
Figure 4 East Di­ke Typical Section	3-8
Figure 5 East Di­ke and Access Roads	3-9
Figure 6 Bay-Goose Di­ke Instrumentation Plan	3-24
Figure 7 Bay-Goose Di­ke – Profile View of SB and CSB Placement Zones	3-25
Figure 8 Bay-Goose Di­ke – Instrumentation Profile	3-26
Figure 9 Bay-Goose Di­ke – Typical Sections	3-27
Figure 10 Plan, cross section and profile of South Camp Di­ke	3-41
Figure 11 Vault Di­ke Typical Section	3-43
Figure 12 General Vault Pit area with the access roads	3-46
Figure 13 Earthwork Material and Equipment Location	11-8

LIST OF APPENDICES

Appendix A: Inspection Forms
Appendix B: Di­ke Failure Scenario Appendices from the ERP

SECTION 1 • INTRODUCTION

1.1 PURPOSE

This document includes procedures for the operation, maintenance and surveillance (OMS) of the Dewatering Dikes at the Meadowbank Gold Project, Nunavut, operated by Agnico Eagle Mines Limited (AEM), Meadowbank Division. The Dewatering Dikes are comprised of the following structures: East Dike, Bay-Goose Dike, South Camp Dike, and Vault Dike. The dewatering dikes isolate the open pit mining activities from Second Portage Lake, Third Portage Lake and Wally Lake.

The responsibilities of AEM staff have been allocated based on the current management structure. As the management structure changes the OMS Manual should be revised and distributed accordingly.

This OMS Manual refers to the dewatering, operations, and decommissioning phases of the Dewatering Dikes.

1.2 REGULATORY REQUIREMENTS

This manual addresses specific requirements from regulatory agencies and provides procedures to maintain compliance. Regulatory requirements are presented in the documents summarized in Table 1.1.

Table 1.1 Regulatory Requirements

Document	Document Reference No.	Review Date
Territorial Lands Act - Land Lease	Production Lease KVPL08D280	Expires December 27, 2027
Environmental Impact Assessment	NIRB project certificate No. 004	n/a – Only if substantial modifications to original application are to be carried out
Water Licence Type A	Nunavut Water Board Water License 2AM-MEA0815	Expires July 22, 2025

The operating, maintenance, surveillance and emergency procedures recommended by the Canadian Dam Association (CDA) "Dam Safety Guidelines" (CDA 2007) and the Mining Association of Canada (MAC) "Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities" (MAC, 2005) have been incorporated into this manual.

The CDA Dam Safety Guidelines (CDA, 2007) states: "dam operation, maintenance and surveillance shall be provided so that an acceptable level of dam safety is ensured." This manual contains protocols and information that will assist AEM to operate, maintain, and monitor the Dewatering Dikes in a safe manner and identify early signs of distress. Qualified personnel shall operate, maintain and monitor the structures and adequate records shall be maintained for general and reference purposes.

1.3 CONSEQUENCES OF FAILURE

The Dewatering Dikes consequence of failure classification is based on the guidelines provided in the CDA Dam Safety Guidelines (CDA 2007) and is presented in Table 1.2. The East Dike and Bay-Goose Dike are rated as “High” consequence of failure structures based on the potential for loss of life and “High” economic loss. The South Camp Dike and Vault Dike are rated as a “Significant” consequence of failure structure based on a temporary risk to workers, and classified as “Low” due to economic loss.

No flooding or inundation mapping has been completed. It is assumed that failure of the East Dike could flood the Portage Pit, resulting in associated threat to the safety of mine personnel, equipment, and other workings within the dewatered area. Similarly, it is assumed that failure of the Bay-Goose Dike could flood the Goose Pit and Portage Pit, resulting in associated threat to the safety of mine personnel, equipment, and other workings within the dewatered area. Flooding would likely cause cessation of mining operations within Portage pit only as Goose pit is depleted, either temporarily or permanently. It is assumed that failure of South Camp Dike could not flood the Goose Pit as the Third Portage Lake water level at South Camp Dike is too low. It is assumed that a failure of Vault Dike could flood Vault Pit resulting in associated threat to the safety of mine personnel, equipment, and other workings within the dewatered area. Flooding would likely cause cessation of mining operations within Vault pit, either temporarily or permanently.

Table 1.2 Classification of Dams in Terms of Consequences of Failure (CDA 2007)

Dam Class	Population at Risk [Note 1]	Incremental losses		
		Loss of Life [Note 2]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	Significant loss or deterioration of <i>important</i> fish or wildlife habitat Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very High	Permanent	100 or fewer	Significant loss or deterioration of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g., <i>highway, industrial facility, storage facilities for dangerous substances</i>)
Extreme	Permanent	More than 100	Major loss of <i>critical</i> fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services (e.g., <i>hospital, major industrial complex, major storage facilities for dangerous substances</i>)

Note 1. Definitions for population risk:

None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary – People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent – The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

Note 2. Implications for loss of life:

Unspecified – The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

1.4 REGISTERED MANUAL HOLDERS AND REVISIONS

The Engineering Superintendent is responsible for maintaining an up-to-date list of the registered holders of this OMS Manual in Table 1.3.

The Engineering Superintendent is also responsible for the issue of all revisions and addenda to the registered holders of this Manual. Revisions will be made, as and when required, by re-issuing a complete section, table or appendix so that the old section, table or appendix can be removed and replaced. Each registered holder is responsible for placing the revisions and addenda in his or her manual and for recording receipt of the same in Table 1.3.

Each copy of this manual is assigned a unique identification number.

Table 1.3 List of Registered OMS Manual Holders

Position / Name / Address or Location	OMS Manual Copy No.
General Mine Manager / Bertin Paradis, Luc Chouinard (asst.) / OFFICE	1
Environment Superintendent / Kevin Buck, Jamie Quesnel / OFFICE	2
Mine Operations Superintendent / Yan Côté, Eric Steinmetzer (asst.) / OFFICE	3
Engineering Superintendent / Julie Belanger, Pierre McMullen (asst.) / OFFICE	4
General Superintendent Mine Operations / Martin Beauséjours / OFFICE	5
Energy & Infrastructures Superintendent / Christian Soucy / OFFICE	6
Vice President, Environment / Michel Julien / AEM Toronto Office Corporate Environment Director / Gonzalo Rios / AEM Vancouver Office	7
Health and Safety Superintendent / Norman Ladouceur, Yves Levesque (asst.) / OFFICE	8
Dike Design Engineer / Golder Associates Ltd./ 500 – 4260 Still Creek Drive, Burnaby, BC, V5C 6C6	9
Dike Design Engineer / SNC-Lavalin Inc./ 5500, Boulevard des Galeries, Bureau 200, Quebec, Quebec, G2K 2E2	10
Update as Required	

Table 1.4 Record of Revisions/Addenda

Revision No.	Section	Table	Appendix	Addenda No.	Date of Revision
1	All	All	All	-	February 2012
2	All	All	All	-	August 2013
3	All	All	All	-	September 2013
4	All	All	All	-	January 2016

1.5 ANNUAL REVIEW OF MANUAL

This manual will be reviewed by AEM on at least an annual basis and revised as necessary to accommodate changes in the condition and operation of the facilities. The registered users of the manual are encouraged to provide comments and suggestions for improvement of the manual and the procedures specified in it to the Engineering Superintendent. The comments and suggestions communicated will be considered in the subsequent review.

1.6 REFERENCE DOCUMENTS AND DRAWINGS

The following Table 1.5 is a summary of key reference documents for the Dewatering Dikes. All design and as-built documents can be found in hard copy onsite in the engineering department, as well as in electronic copies on the dikes server.

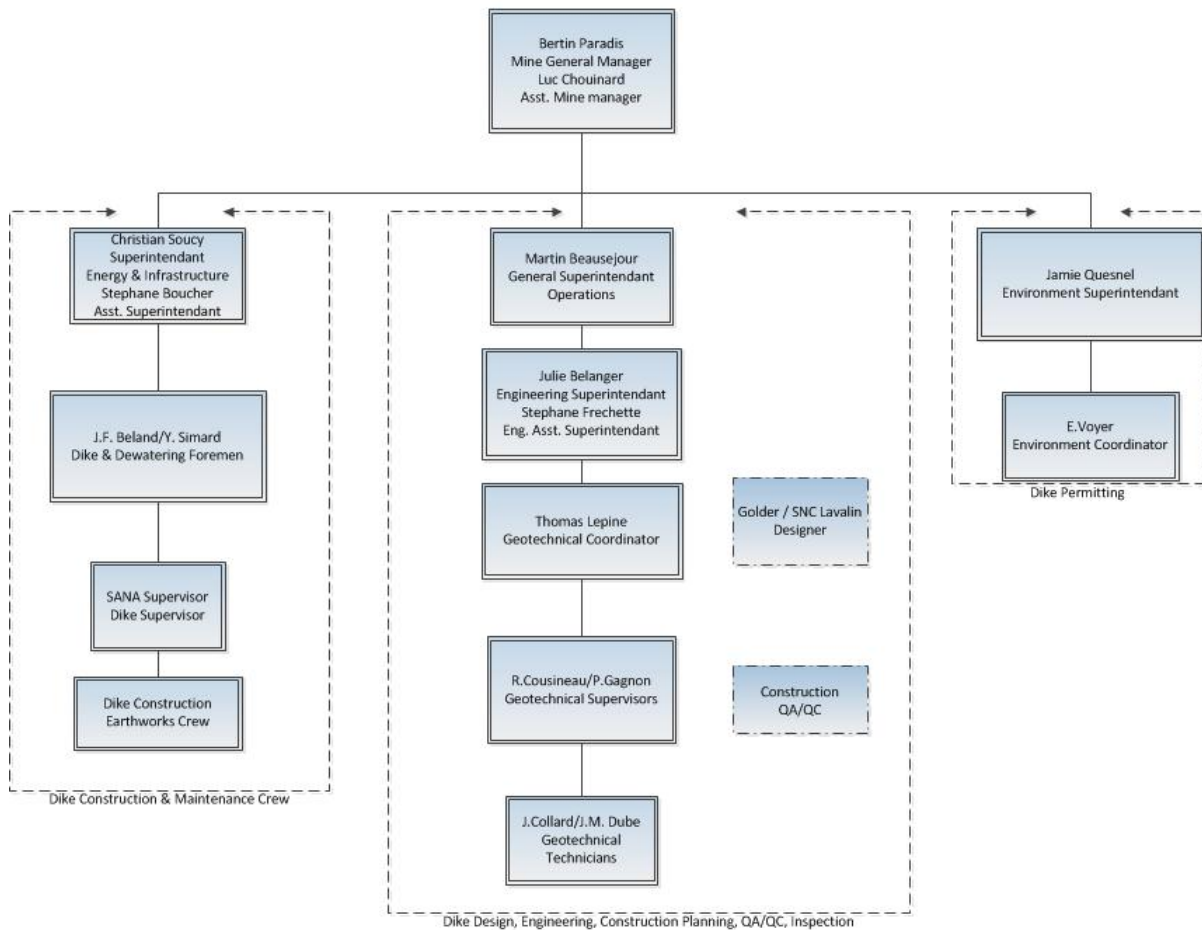
Table 1.5 Summary of key reference documents for the Dewatering Dikes

Dewatering Dike	Type of Information	Document Number	Document Title
East Dike	Design	Doc. 572	East Dike Design Meadowbank Gold Project (Golder 2008b)
	As-built	Doc. 900	East Dike Construction As-Built Report Meadowbank Gold Project (Golder 2009d)
	Remediation	Doc. 916	Meadowbank East Dike Grouting Response Plan (Golder 2009b)
		Doc. 953	East Dike CPT Investigation Meadowbank Gold Project" (Golder 2010b)
		Doc. 986	East Dike Sinkhole Investigation Program Meadowbank Gold Project (Golder 2010a)
Bay-Goose Dike	Design	Doc. 802	Bay-Goose Dike and South Camp Dike Designs (Golder 2009a)
	As-built	Doc. 1328	Bay Goose Dike Construction As-Built Report Meadowbank Gold Project (Golder 2013)
South Camp Dike	Design	Doc. 802	Bay-Goose Dike and South Camp Dike Designs (Golder 2009a)
	As-built	NA	South Camp Dike Construction Summary Report, Meadowbank Gold Project (AEM 2012)
Vault Dike	Design	610548-2020-4GER-0001	Detailed Engineering of Vault Dike (SNC, 2013a)
	Technical Specifications	610548-2020-4GEF-0001	Construction of Vault Dike – Technical Specifications (SNC, 2013b)
	As-built	NA	Construction Summary Report Vault Dike (AEM, 2013)

SECTION 2 • ROLES AND RESPONSIBILITIES

An organizational chart of the current management structure is shown in Figure 1. This chart shall be updated to reflect changes in management structure, as necessary, such that it is maintained up-to-date.

Figure 1 Organizational Structure



2.1 RESPONSIBILITIES

The responsibilities for each management position during dewatering and during operations of the Dewatering Dikes are shown in Table 2.1 and Table 2.2, respectively. For the purpose of this manual, dewatering is defined as completed, and operation begins when the downstream toe of the dike is exposed.

Table 2.1 Responsibilities during Dewatering

Position	Responsibilities
Manager of Regulatory Affairs	Liaise with external stakeholders during an emergency event including NIRB, Nunavut Water Board, NGO's, government agencies.
General Mine Manager	Initiate and oversee emergency or contingency protocols during emergency events.
	Liaise/direct/coordinate the Meadowbank Dike Review Board (MDRB).
	Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual.
Assistant Mine Manager	Initiate and oversee emergency or contingency protocols during emergency events, if General Manager is not on site.
	Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual.
Mine Operations Superintendent	Maintain access to the Dewatering Dikes, including making road repairs, controlling dust and removing snow. Maintain stockpiles of construction material.
	Carry out field maintenance on the dikes as required, including material placement, electrical and mechanical repairs.
Engineering Superintendent/Geotechnical Coordinator/ Geotechnical Supervisors	Construction of seepage collection works.
	Carry out inspections of the dikes as required in the OMS Manual.
	Monitor Dewatering Dike instrumentation as required in the OMS Manual.
	Monitor pumping rates for dewatering, upstream and downstream water levels, and freeboard.
	Liaise with Design Engineer during dewatering regarding dike performance, pumping rates, water quality, instrumentation measurements, etc.
	Review geotechnical and environmental monitoring data for compliance with Water License regulations and to evaluate dike performance with respect to design parameters.
	Prepare reports including description of activities on dikes, pumping rates, instrumentation readings, water quality data, dike performance, visual observations, etc. as required in the OMS Manual.
	Determine dewatering pumping schedule based on the water quality monitoring.
	Maintain instrumentation, readout units, data acquisition system and cabins.
	Coordinate work force as required for monitoring and maintenance.

Position	Responsibilities
	Coordinate equipment, labour, materials and maintenance activities required for pumps and pipelines during dewatering.
	Revise and update the OMS Manual to reflect as-built conditions and any other changes.
	Maintain up to date list of registered holders of the OMS Manual.
	Issue all revisions and addenda to registered OMS Manual holders.
	Carry out field operations including pumping.
Environment Superintendent	Monitor water quality.
	Monitor total suspended solids at pump intake.
	Review environmental monitoring data for compliance with Water License and regulations and to evaluate dike performance with respect to design parameters.
	Liaise with external stakeholders including NIRB, Nunavut Water Board, NGO's, government agencies.
Energy & Infrastructures Superintendent	Maintain and service pumps and pipelines for dewatering.
	Coordinate equipment, labour and materials for maintenance during dewatering.
	Carry out field maintenance on material placement, electrical and mechanical repairs.
	Coordinate labour as required for monitoring.
Design Engineer	Communicate with Engineering Superintendent/ Dike Advisor on frequent basis regarding performance of dewatering dikes.
	Review instrumentation package (to be provided by Engineering Superintendent/Dike Advisor) on a frequent basis.
Meadowbank Dike Review Board (MDRB)	Be updated on the performance of the dewatering dikes behaviour during their operation.
Emergency Response Team	Follow the guidance written in the Emergency Response Plan in an emergency situation

Table 2.2 Responsibilities during Operation

Position	Responsibilities
Manager of Regulatory Affairs	Liaise with external stakeholders during an emergency event including NIRB, Nunavut Water Board, NGO's, government agencies.
General Mine Manager	Liaise with external stakeholders including NIRB, Nunavut Water Board, NGO's, government agencies.
	Liaise / coordinate / direct the MDRB.
	Initiate and oversee emergency or contingency protocols during emergency events.
	Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual.
	Coordination of mine staff and equipment during an emergency.
Assistant Mine Manager	Oversight of Mine, Engineering, and Environment Superintendents tasks and responsibilities as laid out in the OMS Manual.
	Coordination of mine staff and equipment during an emergency if General Manager is not on site.
Mine Operations Superintendent	Maintain access to the Dewatering Dikes and seepage collection systems, including making road repairs, controlling dust and removing snow.
	Carry out field maintenance on the dikes as required, including material placement, electrical and mechanical repairs.
Engineering Superintendent/Geotechnical Coordinator/ Geotechnical Supervisors	Carry out inspections of the dikes, ditches and sumps as required in the OMS Manual.
	Monitor seepage pumping rates.
	Monitor Dewatering Dike instrumentation as required in the OMS Manual.
	Review geotechnical instrumentation and environmental monitoring data to evaluate dike performance with respect to design parameters and for compliance with Water License and regulations.
	Prepare reports including description of activities on dikes, pumping rates, instrumentation readings, water quality data, dike performance, visual observations, etc. as required in the OMS Manual.
	Liaise with Design Engineer regarding dike performance, pumping rates, water quality, instrumentation measurements, etc.
	Maintain instrumentation, readout units, data acquisition system and cabins.
	Coordinate work force as required for monitoring and maintenance.
	Coordinate equipment, labour, materials and maintenance activities required for pumps and pipelines associated with the seepage collection systems and any runoff diversions.
	Revise and update the OMS Manual to reflect as-built conditions of seepage collection system and future modifications.
	Maintain up to date list of registered holders of the OMS Manual.
	Issue all revisions and addenda to the registered OMS Manual holders.
	Liaise with MDRB as required.

Position	Responsibilities
	Carry out field operations.
Environment Superintendent	Monitor water quality of seepage and runoff collected in sumps and ditches.
	Review environmental monitoring data for compliance with Water License and regulations and to determine dike performance with respect to design parameters.
	Liaise with external stakeholders including NIRB, Nunavut Water Board, NGO's, government agencies.
Energy & Infrastructures Superintendent	Maintain and service pumps and pipelines for seepage and runoff.
	Coordinate equipment, labour and materials for maintenance during dewatering.
	Carry out field maintenance on material placement, electrical and mechanical repairs
	Coordinate labour as required for monitoring and maintenance.
Design Engineer	Purchase equipment as required.
	Communicate with Engineering Superintendent/ Dike Advisor on a frequent basis regarding performance of dewatering dikes. Frequency to be determined by Engineering Superintendent/ Dike Advisor.
	Review instrumentation package (to be provided by Superintendent/Dike Advisor) on a frequent basis, frequency to be determined by Engineering Superintendent/ Dike Advisor.
Meadowbank Dike Review Board (MDRB)	Carry out annual inspection and reporting.
	Be updated on the performance of the dewatering dikes behaviour during operation.
Emergency Response Team	Follow the guidance written in the Emergency Response Plan in an emergency situation

All site personnel are responsible for informing their Managers of any indications of abnormal situations or conditions that may be observed.

The responsibilities and authorities of each position in the OMS Manual should be updated to reflect any changes to the overall management structure as they occur.

2.2 REQUIRED LEVELS OF KNOWLEDGE

A minimum level of knowledge and training are required for personnel to adequately carry out their responsibilities and to appropriately realize their level of authority. Personnel should understand consequences of non-compliance for their area and have an understanding of emergency procedures. The recommended minimum levels of knowledge for the anticipated positions are as summarized in Table 2.3.

Table 2.3 Recommended Minimum Knowledge and Training Requirements

Position	Recommended Minimum Knowledge and Training
Manager of Regulatory Affairs	Review of the OMS Manual, with an understanding of the operational requirements. Detailed knowledge of emergency response procedures.
General Mine Manager	Detailed understanding of the OMS Manual, with a complete understanding of the design, dewatering and operational requirements, particularly monitoring, inspection and dam safety review requirements.
	Complete understanding of environmental compliance issues and monitoring requirements.
	Understanding of all related technical documents for design and construction.
	Detailed knowledge of emergency response procedures.
Assistant Mine Manager	Detailed understanding of the OMS Manual, with a complete understanding of the design, dewatering and operational requirements, particularly monitoring, inspection and dam safety review requirements.
	Complete understanding of environmental compliance issues and monitoring requirements.
	Understanding of all related technical documents for design and construction.
	Detailed knowledge of emergency response procedures.
Environment Superintendent	Detailed understanding of the OMS Manual, with a complete understanding of the design, dewatering and operational requirements.
	Detailed and ongoing review of all monitoring, inspections and dam safety reviews.
	Complete understanding of environmental compliance issues and monitoring requirements.
	Knowledge of emergency response procedures.
Mine Operations Superintendent	Basic knowledge of the OMS Manual, with an understanding of the design requirements.
	Detailed knowledge of emergency response procedures.
Engineering Superintendent/ Geotechnical Coordinator/ Geotechnical Supervisors	Detailed understanding of the OMS Manual, with a complete understanding of the design, dewatering and operational requirements.
	Detailed knowledge of monitoring protocols and requirements.
	Detailed and ongoing review of all monitoring, inspections and dam safety reviews.
	Complete understanding of all related technical documents for design, dewatering, operation, risk assessment and emergency response.
	Detailed understanding of all operational elements within the facility and their operational and maintenance requirements.
	Detailed knowledge of emergency response procedures.
Environment Personnel	Knowledge of the OMS Manual, with an understanding of the dewatering and operational requirements set out in this OMS

Position	Recommended Minimum Knowledge and Training
	Manual.
	OMS Manual should be reviewed with the Environmental Superintendent.
	Detailed knowledge of environmental monitoring protocols and requirements.
	Knowledge of emergency procedures.
Mine Personnel	Knowledge of the OMS Manual, with an understanding of the dewatering and operational requirements set out in this OMS Manual.
	Knowledge of emergency response procedures.
Engineering Personnel	Knowledge of the OMS Manual, with an understanding of the design, dewatering, and operational requirements set out in this OMS Manual.
	Detailed knowledge of monitoring protocols and requirements.
	Knowledge of emergency procedures.
Energy & Infrastructures Superintendent	Basic understanding of the OMS Manual, including the design, dewatering and operational requirements set out in the OMS Manual.
	Detailed knowledge of all operational elements set out in the OMS and required for an event of emergency, such as available materials quantity and locations, equipment inventory and locations and available labour.
	Knowledge of emergency response procedures.
External Personnel (Design Engineer and MDRB)	Varied levels of knowledge and understanding depending on involvement.
	General Manager shall determine levels of knowledge and instruct personnel.
Emergency Response Team	Knowledge of emergency response procedures.

Training of personnel shall be carried out to ensure the minimum levels of knowledge set out in Table 2.3. Training shall be documented for all personnel in a staff database organized and maintained by AEM.

The OMS Manual should be updated to reflect any changes in responsibilities or management structure as they occur.

SECTION 3 • DESCRIPTION OF DEWATERING DIKES

The Meadowbank Gold Project site is located approximately 80 km north of Baker Lake, Nunavut. The gold ore deposits are situated adjacent to and beneath Second Portage Lake, Third Portage Lake and Vault Lake. The mine plan includes the construction and operation of a series of dewatering dikes to isolate the open pit mining activities from the lakes. Figure 2 presents the site plan. The Dewatering Dikes consist of the following structures:

- East Dike;
- Bay-Goose Dike;
- South Camp Dike; and
- Vault Dike.

A description of the physical conditions of the site, as well as a description of the climate, geological and geotechnical conditions can be found in various documents including the design documents for the East Dike and Bay-Goose Dike Doc. 572 Sections 3.0 and 4.0 (Golder 2008b) and Doc. 802 Section 2.0 (Golder 2009a), respectively.

In 2008 the East Dike and West Channel Dikes were constructed to isolate the northwest arm of Second Portage Lake to permit mining of Portage Pit and also to provide an area for the storage of tailings. Dewatering of the northwest arm of Second Portage Lake began in the spring of 2009 and was halted during the summer of 2009. Dewatering recommenced in the fall of 2009. The downstream toe of the East Dike has been exposed continuously since July 2010 although was mostly exposed by July 2009. Dewatering of the basin continued intermittently as other construction and site water was transferred to the basin as part of the operations.

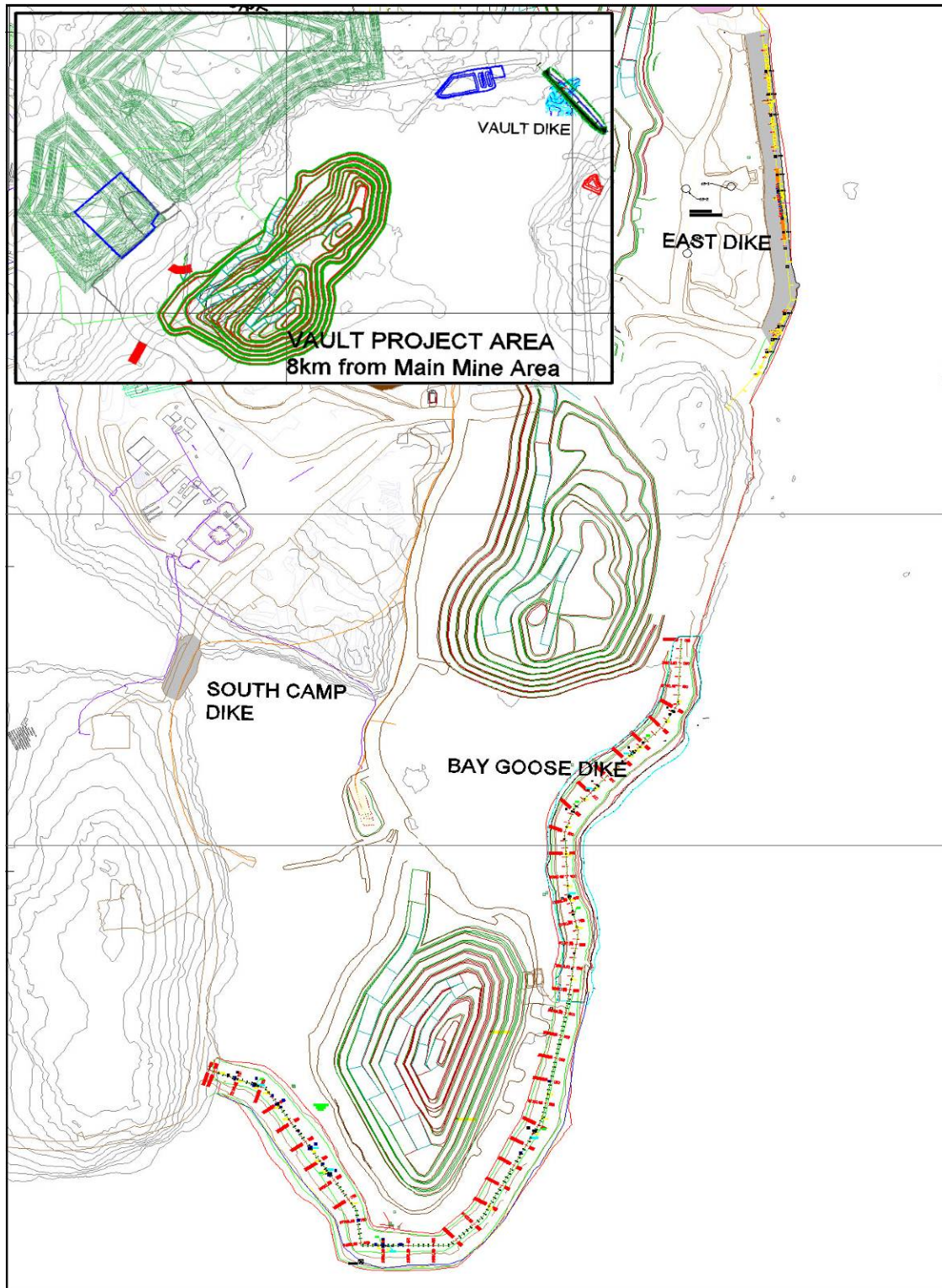
In 2009 the South Camp Dike was constructed. The earthworks component of the Bay-Goose Dike construction occurred over two summer construction seasons. The north portion of the Bay-Goose Dike was constructed in 2009 and the south portion in 2010. Grouting and jet grouting works commenced in 2010 and were completed by mid-July 2011.

Dewatering of the Bay-Goose Basin occurred between July 25 and November 14, 2011 following completion of the Bay-Goose Dike construction and instrumentation installation. In March 2012, the pre-stripping of Goose Pit started and it's now in the operation stage. Goose Pit operations will be complete in February 2015.

The construction of Vault Dike at Meadowbank was conducted from February 2013 to March 2013. Vault Dike is located across a shallow creek which connects Wally Lake and Vault Lake, at the Vault Pit area. Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit during mining activities from Wally Lake. The dewatering of Vault Lake started on June 27th, 2013 and was completed in the summer of 2014.

The following subsections provide additional details for each of the Dewatering Dikes.

Figure 2 Site Plan



3.1 EAST DIKE

The East Dike together with the West Channel Dike isolates the northwest arm of Second Portage Lake. During the operational phase of the mine, the East Dike isolates the Portage Pit from Second Portage Lake. In closure, as the plan will include breaching of the Bay-Goose Dike thereby flooding both Goose and Portage Pits, then the East Dike will separate Third Portage Lake from Second Portage Lake. There are no spillways or water diversion works associated with the East Dike. The East Dike also used to serve as a haul road to connect the North Portage Pit to the ore stockpiles and to the crushing facility within the plant site. The West Channel Dike used to cover a narrow channel and prevent flow from Third Portage Lake to Second Portage Lake. The West Channel Dike together with the East Dike isolated the northwest arm of Second Portage Lake. The West Channel Dike was no longer required and was removed as part of mining operations in the Portage Pit in 2012.

The East Dike was constructed in the summer of 2008 and grouting of the foundation and bedrock occurred in 2008 and during the first quarter of 2009. It is approximately 800 m in length, and was constructed within Second Portage Lake prior to dewatering. The dike consists of a wide rockfill shell, with downstream filters and a soil-bentonite cutoff wall that extends to bedrock. The cutoff wall extends up to 8 m below lake level.

3.1.1 East Dike - Design and Construction

The East Dike design is contained within Doc. 572 (Golder 2008b). A plan view and profile of the constructed dike is presented on Figure 3 and includes the locations of instrumentation installations used for monitoring. A typical cross section through the dike and is shown on Figure 4. Additional as-built information and as-built drawings for the East Dike are provided in Doc. 900 (Golder 2009e).

Dike construction occurred in the following general manner:

Rockfill Embankment:

- A rockfill platform approximately 50 m wide was advanced from the south abutment to the north. The rockfill platform provided construction access and support for the core materials.
- The width of the rockfill platform (embankment) was subsequently increased by placement of additional rockfill on the downstream side, to provide an adequate road width to accommodate two-way haul traffic.

Initial Trench Excavation:

- Rockfill and lakebed soils were excavated from the crest of the rockfill platform to expose bedrock along the cutoff centreline. Loose blocks or slabs from the bedrock surface were removed, as practical.

Backfilling of the Initial Trench:

- A coarse granular filter (150 mm minus) was placed using the bucket of the excavator on the downstream slope of excavation.
- Then the remaining portion of the excavation was backfilled with Core Backfill (19 mm minus) material in the central portion along the cutoff wall centreline and Coarse Filter (150 mm minus) material on the upstream and downstream sides of the Core Backfill. Backfilling of the trench with the Core Backfill and Coarse Filter materials was a simultaneous activity and occurred progressively as the initial trench was the excavation front advanced.
- At the bedrock surface, a minimum of 5 m of Core Backfill material was to be placed.

Compaction of Core Backfill:

- Core Backfill and Coarse Filter were placed to an elevation 2 m above the water level to form a platform from which densification could occur.
- The Core Backfill was densified using multiple passes of dynamic compaction. Craters produced by the dropped weight were backfilled to level the working platform between passes.

Cutoff:

- A 1 m wide trench was excavated through the Core Backfill material and extended to the bedrock surface along the cutoff wall centreline. Bentonite slurry was used to support the trench.
- The trench was backfilled with soil-bentonite.

Grouting:

- Grouting of the bedrock foundation and “contact area” identified as the zone between the base of the cutoff wall and bedrock surface was performed through the centerline of the cutoff wall.

Figure 3 East Dike Plan and Profile

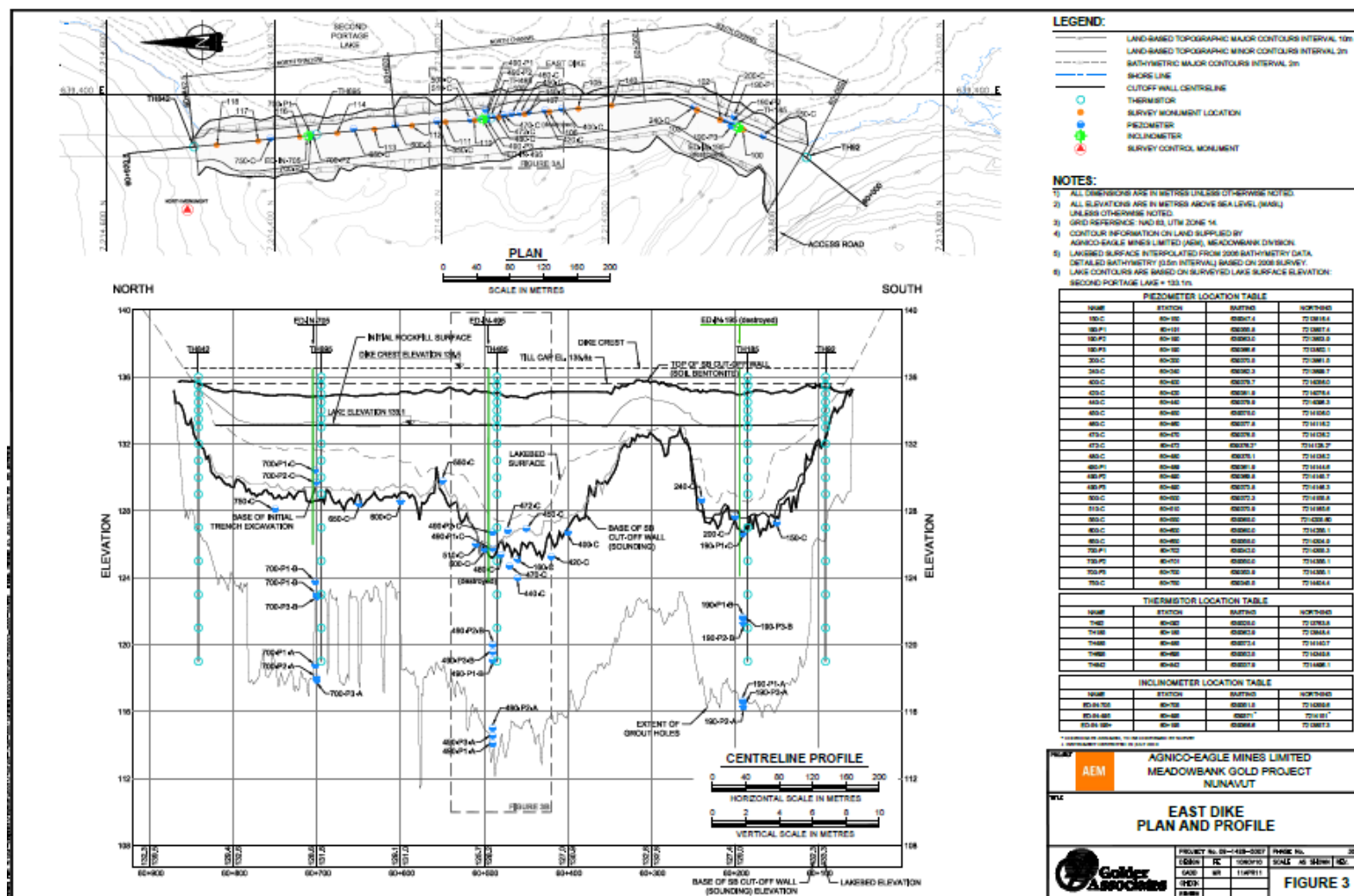


Figure 3A East Dike Plan view Thermistors between Sta. 60+440 to Sta.60+521

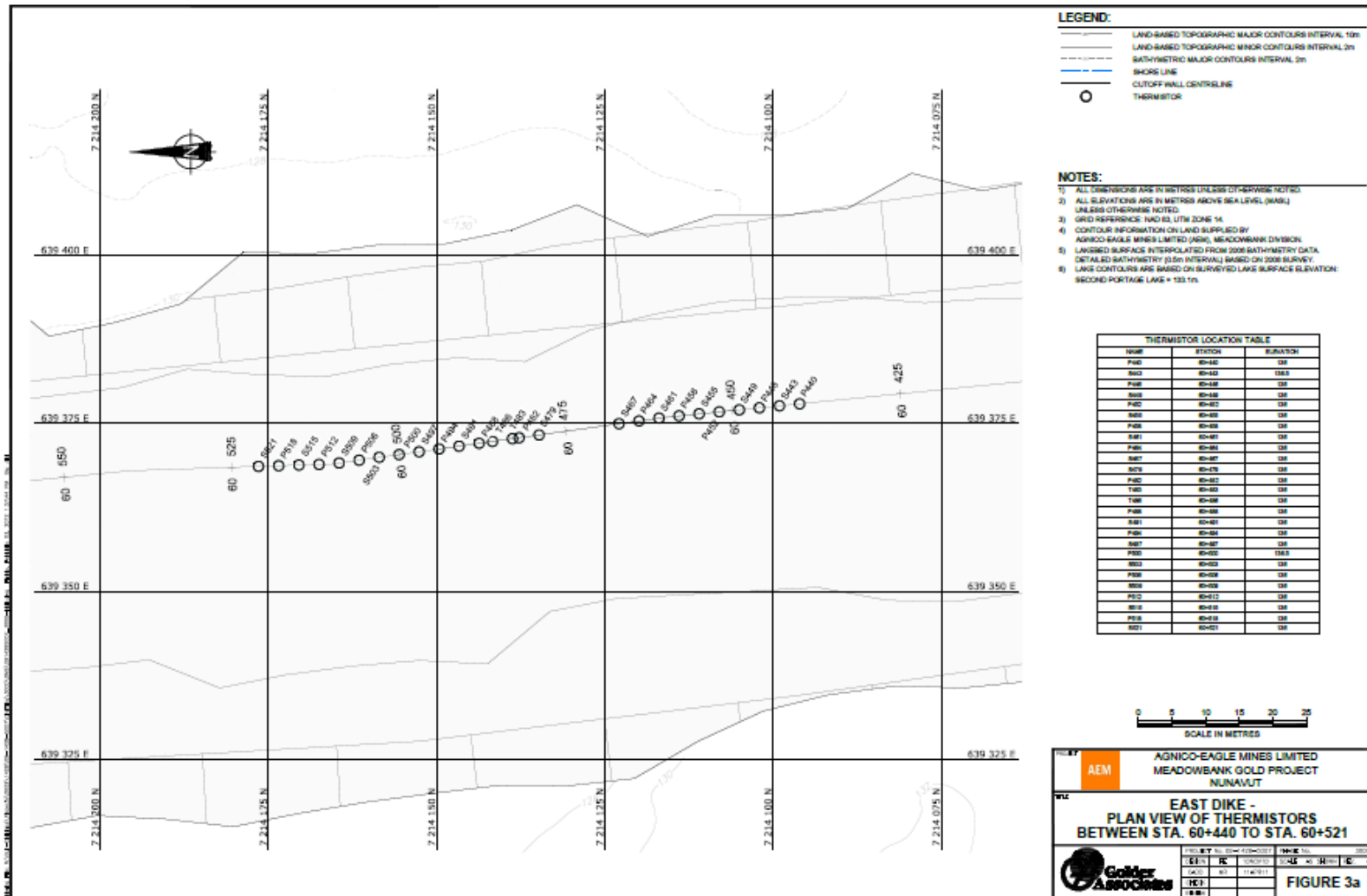


Figure 3B East Dike Profile view Thermistors between Sta. 60+440 to Sta.60+521

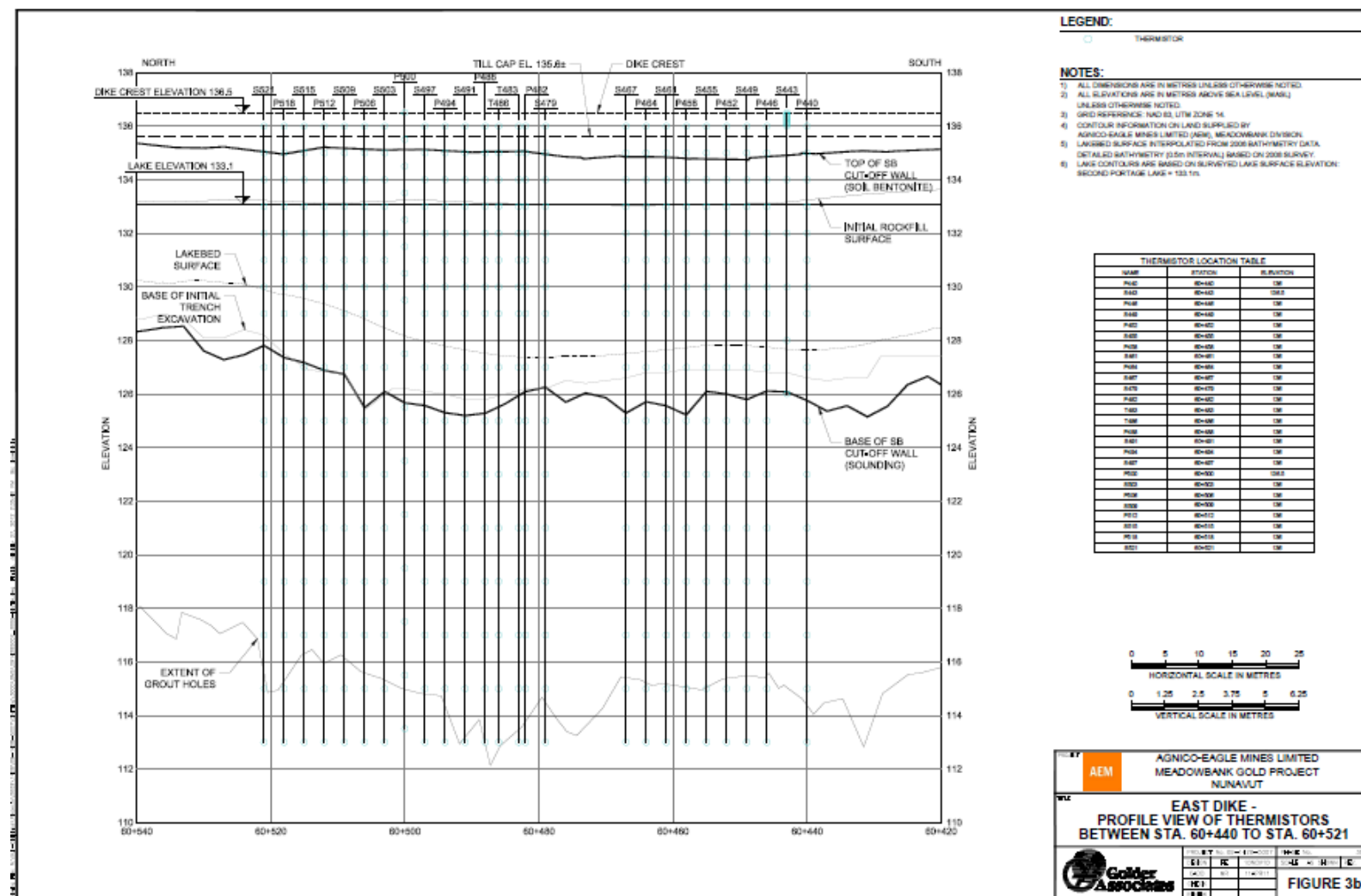


Figure 4 East Dike Typical Section

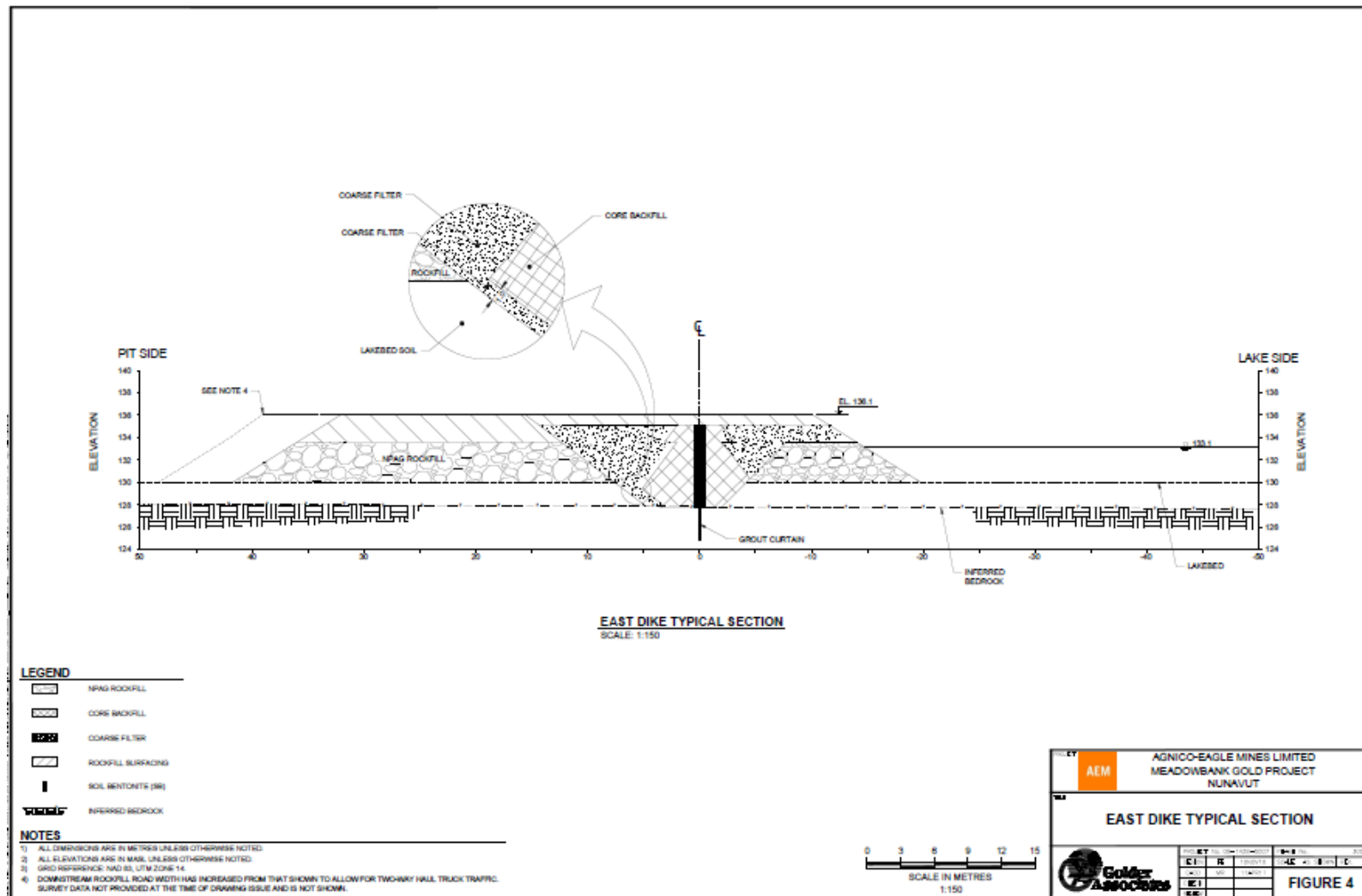
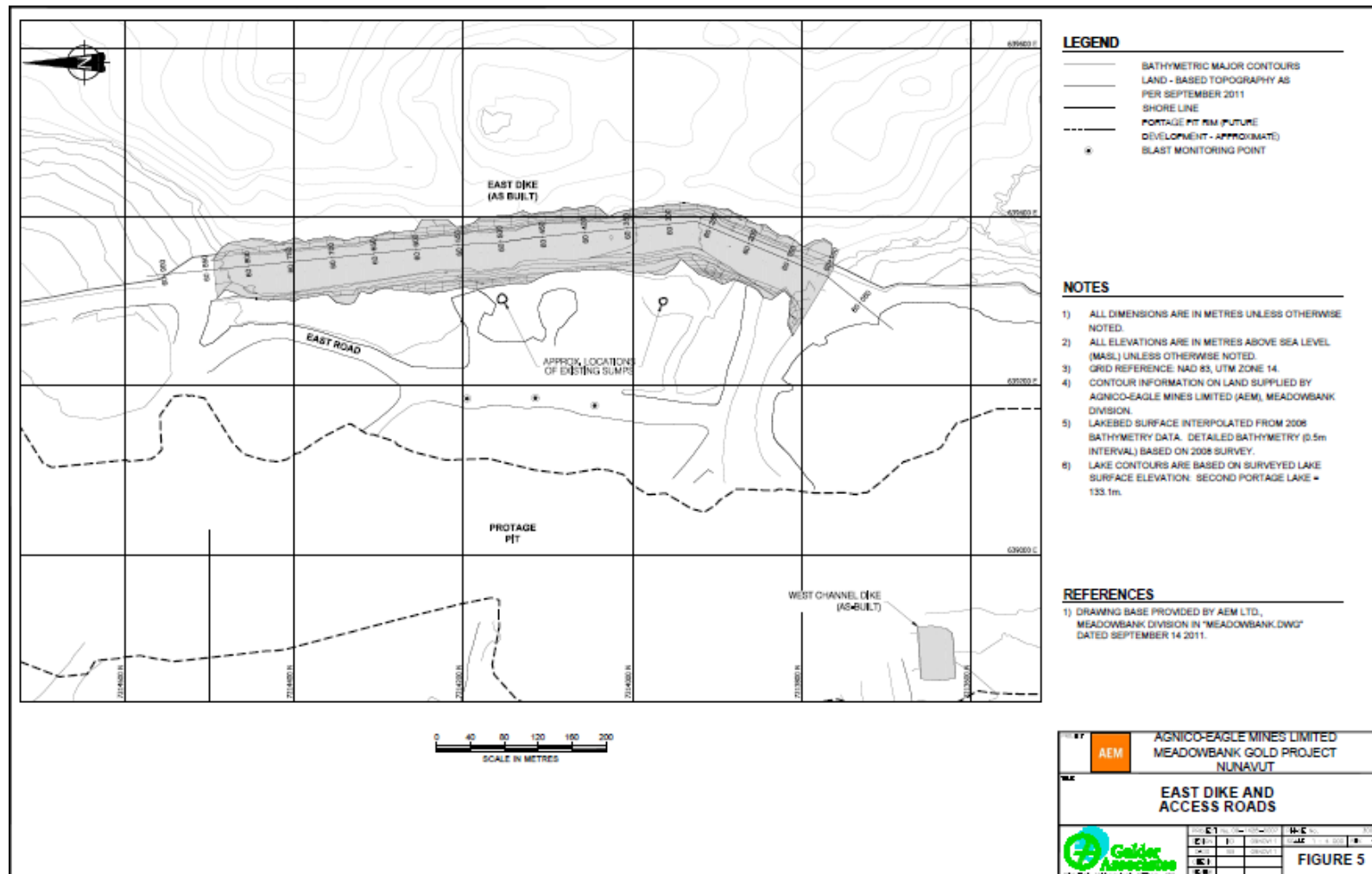


Figure 5 East Dike and Access Roads



3.1.2 East Dike - Instrumentation

Instrumentation was installed prior to dewatering to monitor the behaviour of the dike and dike foundation during dewatering and operation. Instrumentation consisted of:

- Single vibrating wire piezometers located downstream of the cutoff wall;
- Arrays of vibrating wire piezometers, installed at various levels, upstream, immediately downstream of the cutoff wall and further downstream;
- Thermistor strings installed through the centreline of the cutoff wall;
- Inclinometers installed through the centreline of the cutoff wall; and
- Survey monuments along the centreline of the cutoff wall.

The monitoring network was expanded through the installation of additional instruments. Table 3.1 summarizes existing instrumentation.

Table 3.1 Existing Instrumentation Summary

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
Vibrating Wire Piezometer Array	60+190	190-P1-A	10	116.7	190-P1 Top of steel casing: El. 136.39
		190-P1-B	10	121.7	
		190-P1-C	10	126.7	
		190-P2-A	2	116.34	190-P2 Top of steel casing: El. 136.54
		190-P2-B	2	121.34	
		190-P2-C	2	126.34	
		190-P3-A	-2	116.63	190-P3 Top of steel casing: El. 136.54
		190-P3-B	-2	121.63	
Vibrating Wire Piezometer Array	60+490	490-P1-A	11	114.12	490-P1 Top of steel casing: El. 136.20
		490-P1-B	11	119.12	
		490-P1-C	11	125.81	
		490-P2-A	3.1	115.07	490-P2 Top of steel casing: El. 136.15
		490-P2-B	3.1	120.07	
		490-P2-C	3.1	126.76	
		490-P3-A	-0.9	114.62	490-P3 Top of steel casing: El. 136.02
		490-P3-B	-0.9	119.62	
Vibrating Wire Piezometer Array	60+700	700-P1-A	9.9	118.81	700-P1 Top of steel casing: El. 136.27
		700-P1-B	9.9	123.81	
		700-P1-C	9.9	130.5	
		700-P2-A	2	118.08	700-P2 Top of steel casing: El. 136.48
		700-P2-B	2	123.08	
		700-P2-C	2	129.77	
		700-P3-A	-1.9	117.93	700-P3 Top of steel casing: El. 136.40
		700-P3-B	-1.9	122.92	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
Individual Vibrating Wire Piezometers	60+150	150-C	2.1	127.35	Top of steel casing: El. 136.33
	60+200	200-C	2	127.71	Top of steel casing: El. 136.29
	60+240	240-C	2	128.71	Top of steel casing: El. 136.26
	60+400	400-C	2.2	126.76	Top of steel casing: El. 136.27
	60+420	420-C	2	125.32	Top of steel casing: El. 137.10
	60+440	440-C	2	124.66	Top of steel casing: El. 137.14
	60+450	450-C	1.9	127	Top of steel casing: El. 136.22
	60+460	460-C	2	125.15	Top of steel casing: El. 137.60
	60+470	470-C	2	124.76	Top of steel casing: El. 137.43
	60+480	480-C	2	125.44	Top of steel casing: El. 137.65
	60+500	500-C	2	125.78	Top of steel casing: El. 137.34
	60+510	510-C	2	126.06	Top of steel casing: El. 137.10
	60+550	500-C	2	129.85	Top of steel casing: El. 136.24
	60+600	600-C	1.9	128.6	Top of steel casing: El. 136.53
	60+650	650-C	2	128.48	Top of steel casing: El. 136.59
	60+750	750-C	1.5	128.16	Top of steel casing: El. 136.93

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
Thermistor Strings	60+092	TH92	0	136 (1 st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.
	60+185	TH185	0	136 (1 st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.
	60+485	TH485	0	136 (1 st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.
	60+440	P440	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+443	S443	0	136.5 (1 st Bead)	Beads at Elev. 136.50, 136.45, 136.40, 136.35, 136.30, 136.25, 136.20, 136.15, 136.10, 136.05, 136.00, 134.00, 132.00, 130.00, 128.00 and 126.00 masl.
	60+446	P446	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+449	S449	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+452	P452	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+455	S455	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
	60+458	P458	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+461	S461	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+464	P464	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+467	S467	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+479	S479	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+482	P482	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+483	T483	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+486	T486	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+488	P488	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
	60+491	S491	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+494	P494	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+497	S497	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+500	P500	0	136.5 (1 st Bead)	Beads at Elev. 136.50, 136.25, 136.00, 135.00, 134.00, 133.00, 132.00, 131.00, 129.00, 127.00, 125.00, 123.00, 121.00, 119.00, 117.00 and 115.00 masl.
	60+503	S503	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+506	P506	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+509	S509	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+512	P512	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+515	S515	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
	60+518	P518	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+521	S521	0	136 (1 st Bead)	Beads at Elev. 136, 135, 134, 133, 132, 131, 130, 129, 127, 125, 123, 121, 119, 117, 115 and 113 masl.
	60+695	TH695	0	136 (1 st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.
	60+842	TH842	0	136 (1 st Bead)	Beads at Elev. 136, 135.5, 135, 134.5, 134, 133.5, 133, 132, 131, 130, 129, 127, 125, 123, 121 and 119 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline + is d/s; - is u/s	Elevation (masl)	Details
Inclinometer	60+195	ED-IN-195 (A and B Axis)	0.05	137.6 (Collar Elevation)	Azimuth 51.2 degree Destroyed in 2010
	60+495	ED-IN-495 (A and B Axis)	0.05	137.6 (Collar Elevation)	Azimuth 347.9
	60+705	ED-IN-705 (A and B Axis)	0.09	137.6 (Collar Elevation)	Azimuth 20.4 degree
Initial Crest Survey Monuments		100	0	136.9	Most have been destroyed since installation.
		101		136.8	
		102		136.7	
		103		136.6	
		104		136.9	
		105		136.8	
		106		136.9	
		107		136.7	
		108		136.6	
		109		136.5	
		110		136.6	
		111		136.3	
		112		136.5	
		113		136.7	
		114		136.8	
		115		136.7	
		116		136.8	
		117		136.7	
		118		136.7	

As installation of additional instrumentation occurs to broaden the existing monitoring network or to replace damaged instruments, the summary table and figures shall be updated.

Blast monitoring is carried out using portable blast monitoring seismographs that measure both blast induced velocities and accelerations at the point of monitoring (i.e. crest and/or the toe of the dike).

- Instrumentation locations are shown both in plan and profile on Figure 5.
- Records of all instrument installation details, data sheets, and calibration sheets shall be maintained and stored in a central location, such that they are readily available to AEM personnel and external reviewers.

3.1.3 East Dike - Dewatering

During dewatering of the northwest arm of Second Portage Lake, an apparent leak through the East Dike of up to 0.5 m³/s occurred over several days near Sta. 60+490. The leak then appeared to self heal following drilling works for the additional grouting carried out in this sector. A sinkhole cavity of about 18 m³ in the general vicinity of the leak (Sta. 60+472) also appeared in July 2009. The sinkhole was located immediately upstream of the cutoff wall and extended at least partially through the cutoff wall. A Technical Memorandum entitled “Meadowbank East Dike Grouting Response Plan – Completed Works” (Golder 2009b) provides additional information regarding the remedial grouting work and Golder Doc. No. 961 (Golder, 2009d) “East Dike Sinkhole Summary Report” provides more details about the sinkhole.

Following the appearance of the sinkhole, a cone penetration test (CPT) investigation was conducted, and three diamond drill holes and a surface geophysical survey were advanced in the area to obtain additional information. Based on the CPT results, there appeared to be a zone of coarser grained material (area with lower fines content) in the apparent leak area. The drilling investigation indicated that there may be soil between the base of the cut-off wall and underlying bedrock that was not completely excavated and/or grouted. An additional investigation of the sinkhole and apparent leakage area consisting of the temporary installation of thermistor strings and monitoring of the thermal condition was initially conducted in 2010 and repeated in 2011. Based on the thermal results, it appeared that a pervious zone existed within the cut-off wall and shallow bedrock between approximately Sta. 60+440 and 60+504. In the past, AEM considered potential mitigation options to reduce seepage through the dike and to provide contingency protection for the Portage Pit. Based on the stability of the dike and the seepage rate, remediation or implementation of contingency control measures is not considered necessary. The condition of the dike will continually be monitored and if the condition of the dike is judged to be deteriorating then remediation would be reassessed. Details regarding these investigations are provided in East Dike CPT Investigation Report (Golder, 2010b) and East Dike Sinkhole Investigation Program October-November 2009 (Golder 2010a).

The seepage is currently controlled by a seepage collection system and is not impacting the mining operation. The seepage is regularly monitored and appears to have stabilized and does not have a negative effect on the dike stability.

3.1.4 East Dike - Seepage Collection System

The purpose of the seepage collection system is to:

- Collect and convey seepage and runoff away from the downstream toe area; and
- Allow measurement of seepage through the dike.

The downstream toe of the East Dike was mostly exposed by July 2009 and then entirely by July 2010. Three seepage zones have been identified along the toe of the East Dike at approximately Sta. 60+480, Sta. 60+225 and Sta. 60+550. A temporary rectangular weir was installed in 2009 to monitor the seepage observed at approximately Sta. 60+480. Monitoring of the seepage from this location has occurred during the open water season (approximately mid-July through early October) in 2009 and 2010. During 2010, a temporary v-notch weir was installed to measure a second zone of

seepage exposed near Sta. 60+225 following dewatering. This portion of the dike was not exposed for visual inspection in 2009 due to the downstream water elevation. No monitoring system has been installed in the area around Sta. 60+550. Seepage flows have been measured to be between 7 L/s and 11 L/s at Sta. 60+480 and around 4 L/s at Sta. 60+225 and estimated to be about 1 L/s at Sta. 60+550.

The installation of a seepage collection system downstream of East Dike to capture and pump the seepage water started in September 2011 and was completed in 2012. After the system installation, 3 zones of seepage were identified near the downstream toe. The zones at about Sta. 60+247 and Sta. 60+498 each had a collection sump with pump connected to a year round pumping and piping system.

In 2011, the downstream seepage at Sta. 60+498 had been stable at a rate of about 864 m³/day (10 L/s) with no visual signs of turbidity, which was consistent with rates recorded during previous years. In 2011, the seepage downstream at Sta. 60+247 appeared stable at around 345.6 m³/day (4L/s) with no visual signs of turbidity noted, which was consistent with previous rates. Since the installation of the seepage collection system, all seepage is being captured within the sumps and no sign of additional seepage on the ground surface or downstream in the Portage Pit was observed. No active monitoring of the seepage rate at these locations occurred in 2012 but AEM has been visually inspecting the flow in the sumps and no turbidity was noted. AEM performed a pump test after the installation of the sumps, it was noted that the measured flow were consistent with 2010 and 2011 data. Flow meters have been installed in 2013 at the exit of each pump. Since then, the flow is stabilized to approximately 600 m³/day.

3.1.5 East Dike - Access

Access to the East Dike is from the north and south abutments, shown on Figure 2 and Figure 5. In 2010, the East Dike was used as a haul road connecting the North Portage Pit to the Plant Site. East Road was built downstream and used to function as haul road to get access from the east to Portage Pit. No haul trucks use the East Dike or East Road anymore during normal operations.

3.2 BAY-GOOSE DIKE

The Bay-Goose Dike together with the South Camp Dike isolates the Bay-Goose Basin from Third Portage Lake, which permits mining of the Goose Pit and the southern portion of Portage Pit. No spillways or water diversion works are associated with the Bay-Goose Dike. Figure 2 shows the location of Bay-Goose Dike.

The Bay-Goose Dike is approximately 2,200 m in length and was constructed “in the wet”, prior to dewatering. The dike consists of a wide rockfill shell, with downstream filters and a cutoff wall constructed of a mixture of materials dependent on the location along the dike:

- Soil-bentontie (SB);
- Cement soil-bentonite (CSB);
- Jet grouted columns;

- A combination of soil-bentonite and cement soil-bentonite;
- A combination of soil-bentonite and/or cement soil-bentonite and jet grouted columns; and
- With the exception of the south abutment, the cutoff system (including the jet grouted columns) extends to bedrock and is up to 20 m below lake level.

The earthworks component of the Bay-Goose Dike construction occurred over two summer construction seasons. The north portion of the Bay-Goose Dike was constructed in 2009 and the south portion in 2010. Grouting and jet grouting works commenced in 2010 and were completed by mid-July 2011.

Dewatering of the Bay-Goose Basin occurred between July 25 and November 14, 2011 following completion of the Bay-Goose Dike construction and instrumentation installation. In March 2012, the operation of Goose Pit started. Operations in Goose Pit was completed in April 2015.

Further details regarding the dike are provided in the following subsections.

3.2.1 Bay-Goose Dike – Design and Construction

The dike design is provided within Doc. 802 (Golder 2009a). A plan view of the dike along with the instrument locations is shown on Figure 6. Figure 7 provides the profile view along the cutoff wall centreline. Figure 8 provides the profile view of instrumentation details. Typical cross sections are shown on Figure 9. As-built drawings of the dike can be found in Golder 2009a.

Dike construction occurred in the following general manner:

Rockfill Platform / Embankment:

- A rockfill platform of varying width (approximately 60 to 90 m) was advanced from the north abutment to Goose Island, between July and September 2009 to an elevation of about 134 m.
- A rockfill causeway about 25 m wide was advanced from Goose Island to the south abutment between February and June 2010 while ice cover existed on Third Portage Lake. Ice was broken and removed, as practical, in front of the advancing rockfill platform.
- Following ice breakup from the lake in July 2010, additional rockfill was placed to widen the causeway to the full design width of the rockfill platform (approximately 55 to 100 m).
- The rockfill platforms surface elevation was about 134 m and was used to provide a working surface for the subsequent construction activities. The rockfill also provides lateral support for the granular core materials.

Initial Trench Excavation:

- Rockfill and lakebed soils were excavated from the rockfill platform surface to bedrock or competent lakebed soils along the cutoff centreline. As much as practical, loose blocks or slabs from the bedrock surface were removed.
- Ice rich soils beneath the cutoff wall were removed with the exception of at the south abutment where beyond Sta. 32+112 some ice-rich soils remain beneath the base of the initial trench excavation and cutoff wall.
- The required bottom width of the excavation varied based on its depth and varied between 8 and 11 m.

Backfilling of the Initial Trench:

North Portion of Dike

- A layer of Core Backfill (19 mm minus) material was placed along the downstream slope of the excavation such that Core Backfill material would be in contact with the lakebed soils.
- Then the remaining portion of the excavation was backfilled with Core Backfill (19 mm minus) material in the central portion along the cutoff wall centerline, with Coarse Filter (150 mm minus) material simultaneously placed on either side of the Core Backfill. Backfilling of the excavated trench occurred progressively as the excavation front advanced.

South Portion of Dike

- In very limited areas along the alignment, a layer of Core Backfill (19 mm minus) material was placed along the downstream slope of the excavation prior to the primary backfilling of the trench.
- The excavation was backfilled with Core Backfill (19 mm minus) material in the central portion along the cutoff wall centerline, with Coarse Filter (150 mm minus) material simultaneously placed on the downstream side of the Core Backfill and a “Fine Rockfill” material placed on the upstream side. Backfilling of the excavated trench occurred progressively as the excavation front advanced.
- In areas to be compacted using the vibratory-densification method, the width of Core Backfill material was required to be 8 m. Therefore, once the initial backfilling had been completed relatively small V-shaped excavations were made at the surface on either side of the initially placed Core Backfill. These excavations were then refilled with Core Backfill material to provide the required 8 m width of Core Backfill.

Compaction of Core Backfill:

- For all of the North Portion of the dike and a majority of the South Portion of the dike, a 2 m layer of Core Backfill, Coarse Filter, and Rockfill was placed to increase the elevation of the platform to provide a working surface for the dynamic compaction.

- The Core Backfill was densified using multiple passes of dynamic compaction. Craters produced by the dropped weight were backfilled to the level of the working platform between passes.
- For the South Portion of the dike, in zones where the initial excavation was not extended to bedrock, termed “partial cutoff” zones, compaction of the Core Backfill material was done using two methods: vibratory-densification and dynamic-compaction. Vibratory-densification of the Core Backfill material was conducted from the initial rockfill platform working surface (134 m). Vibro-densification was utilized to treat the Core Backfill material at the base of the excavation up to an elevation of about 128 m (i.e. 6 m below the water level). Then the 2 m of additional Core Backfill, Coarse Filter, and Rockfill materials were placed to increase the elevation of the platform to about 136 m creating the working surface for the dynamic compaction. The upper portion of the Core Backfill material was then treated using multiple passes of dynamic compaction. Craters produced by the dropped weight were backfilled to the level of the working platform between passes.

Cutoff:

- A 1 m wide trench was excavated through the Core Backfill material and extended to bedrock or competent till surface along the cutoff wall centreline. Bentonite slurry was used to support the trench.
- The trench was backfilled with:
 - Soil-bentonite (SB);
 - Cement Soil-bentonite (CSB); or
 - A combination of SB and CSB.
- Then a capping layer about 0.5 m thick of SB was placed above the trench to an approximate elevation of 136.5 m.

Jet Grouted Wall

- Jet grouting has been used to extend the low permeability element (cutoff wall) of the dike to the bedrock surface. A double jet system was used with a cement water ratio of 1:1 to construct the jet grouted columns. Jet grouting was completed from a working platform elevation of approximately 137 m.
- Jet grouting beneath the cutoff wall to the bedrock surface was conducted in the “partial cutoff” areas where the cutoff wall was not excavated to bedrock. This occurred in Channel 1 (Sta. 32+007 to 32+110), Channel 2 (Sta. 31+820 to 31+928), and Channel 3 (Sta. 31+575 to 31+611). Jet grouted columns were constructed with a centre to centre spacing of 1.2 m with an overlap with the cutoff wall and extended into the bedrock surface. Columns were constructed in two passes, primary columns at a spacing of 2.4 m with secondary columns subsequently constructed between the primary columns.

- Jet grouting was also conducted in two additional areas of the dike where significant silt accumulated at the base of the initial excavation and prevented the cutoff wall from being successfully constructed to bedrock. These two areas the North Channel (Sta. 30+361 to 30+435) and between Channel 1 and Channel 2 (Sta. 31+928 to 32+007). Jet grouted columns were constructed with a centre to centre spacing generally of 1.5 m, with the exception of the portion between Sta. 31+928 and Sta. 31+966.4 where a spacing of 1.2 m was utilized, following a primary and secondary sequence for installation.

Grouting:

- The working platform along the cutoff wall centerline was raised with Coarse Filter material to an elevation of 137 m, from which grouting work was conducted.
- Grouting of the bedrock foundation and “contact area” identified as the zone between the base of the cutoff wall or jet grout columns and bedrock surface was performed through the centerline of the cutoff wall.

Figure 6 Bay-Goose Dike Instrumentation Plan

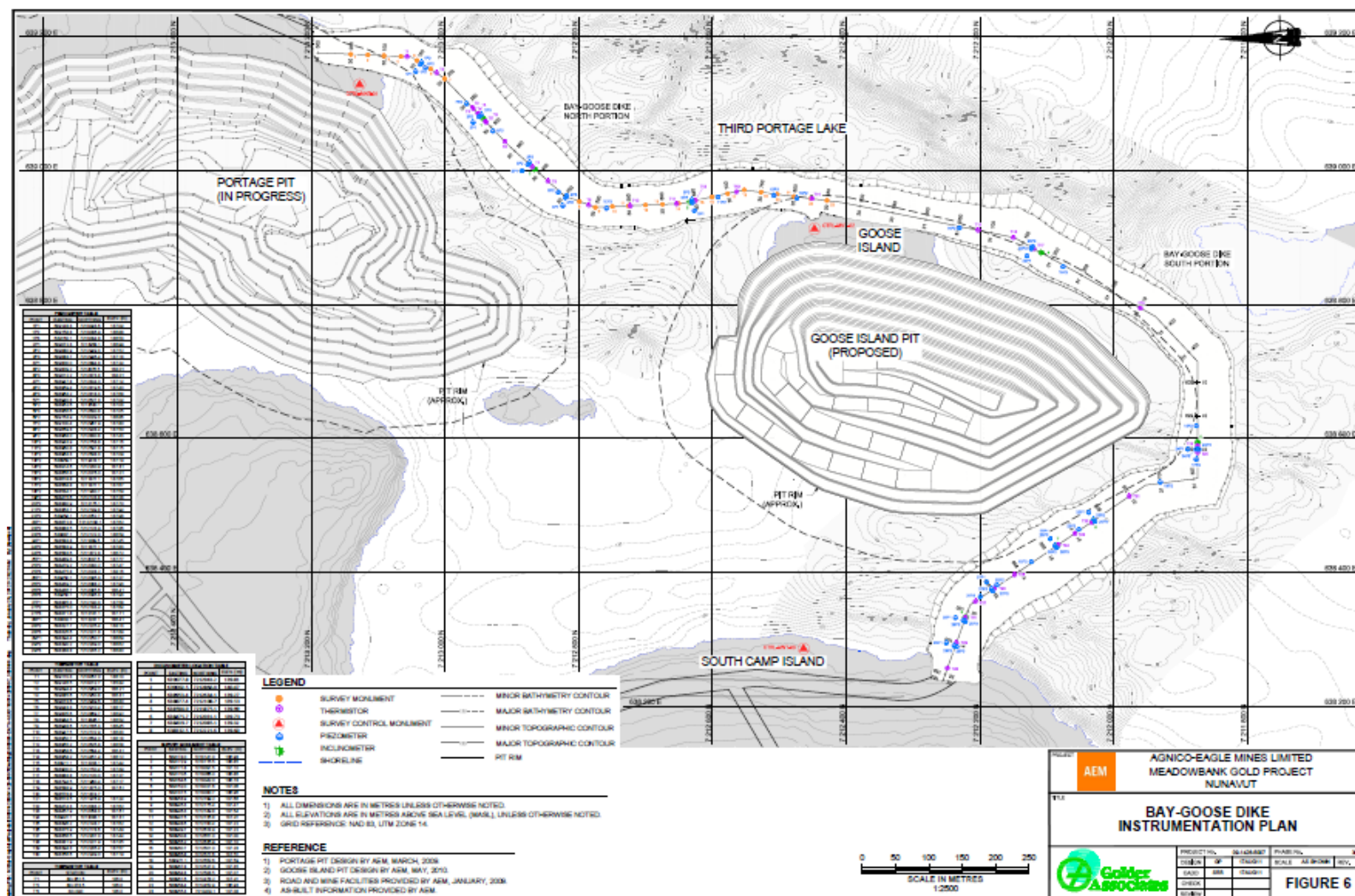


Figure 7 Bay-Goose Dike – Profile View of SB and CSB Placement Zones

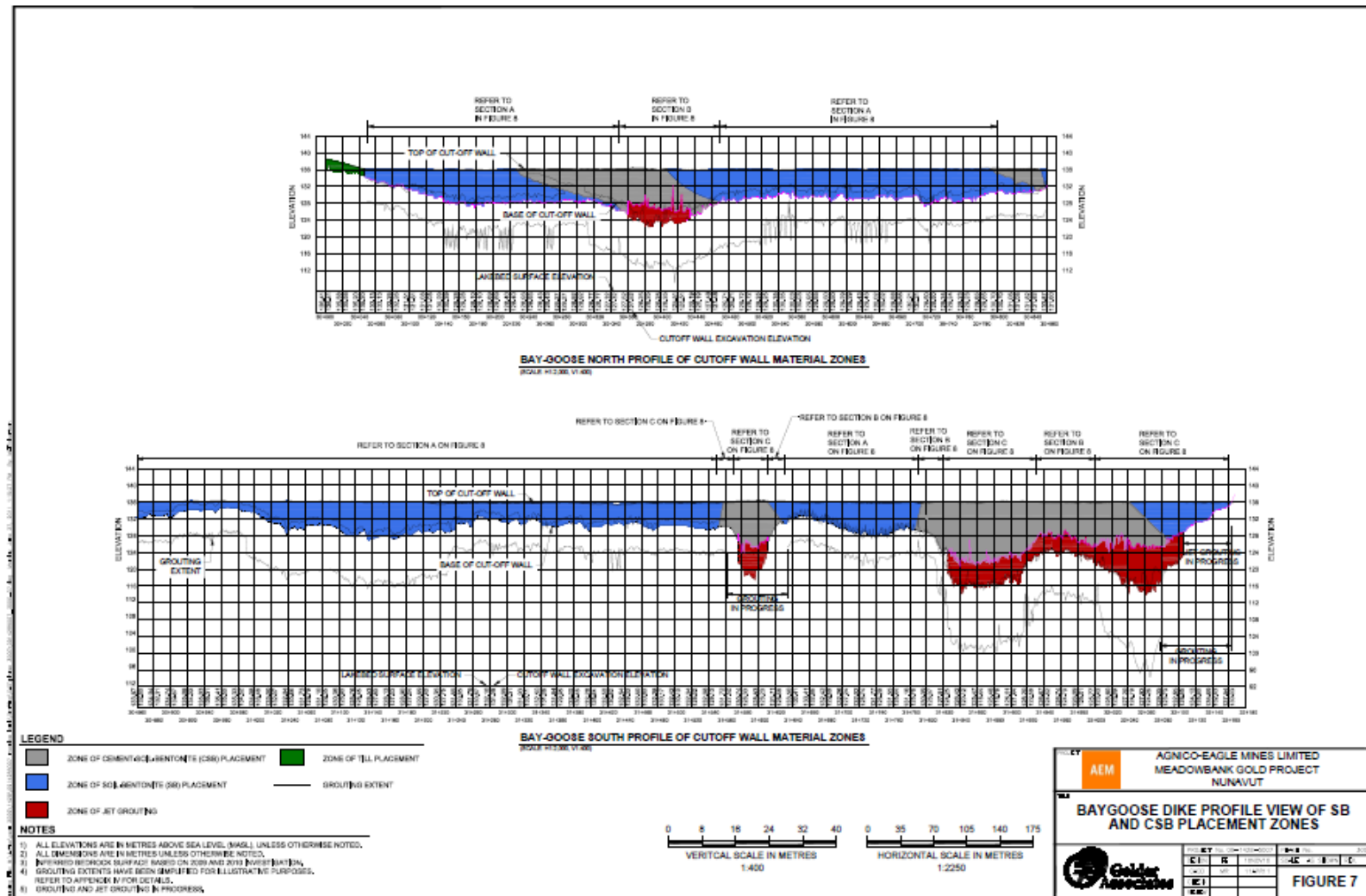


Figure 8 Bay-Goose Dike – Instrumentation Profile

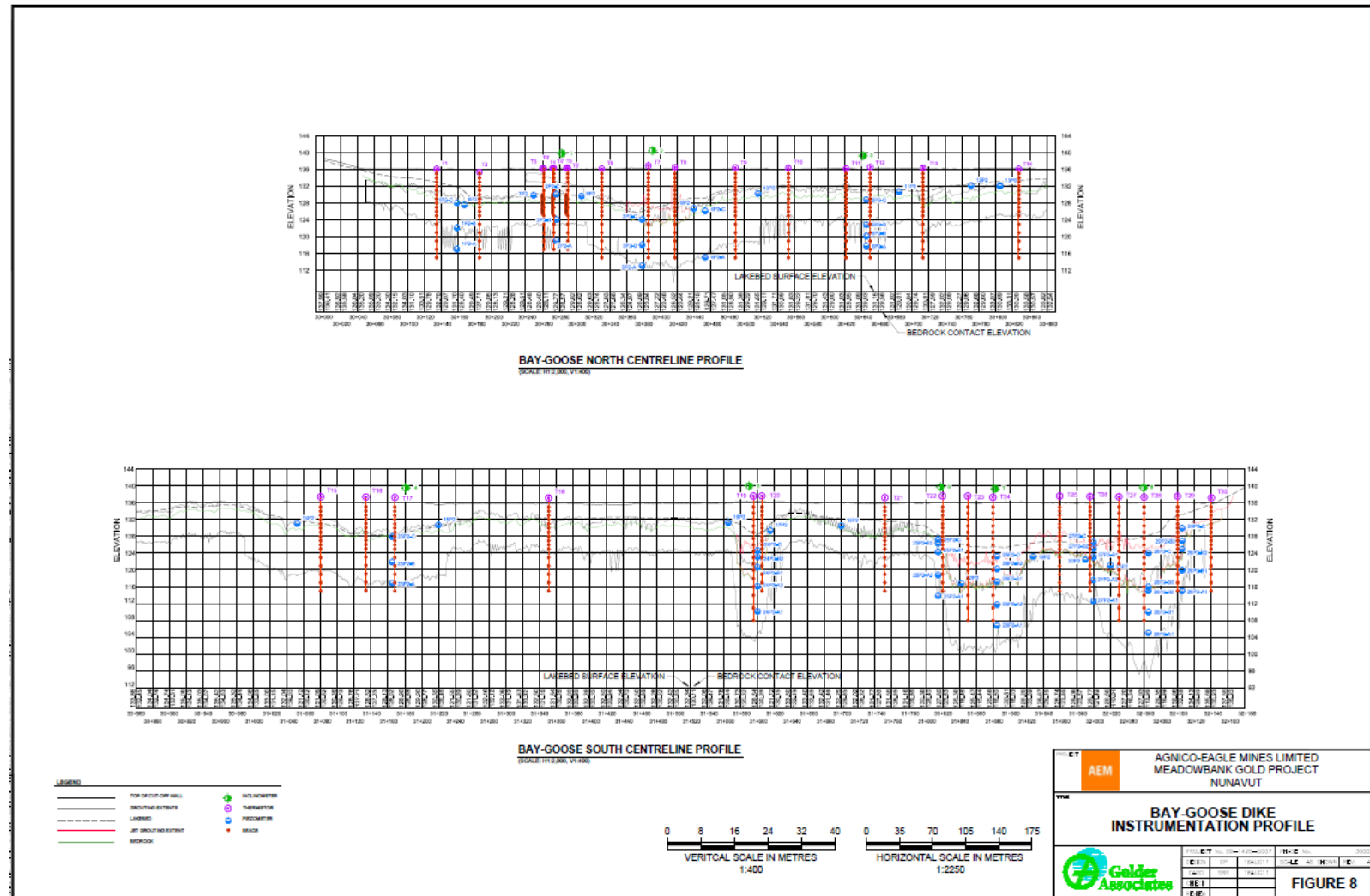
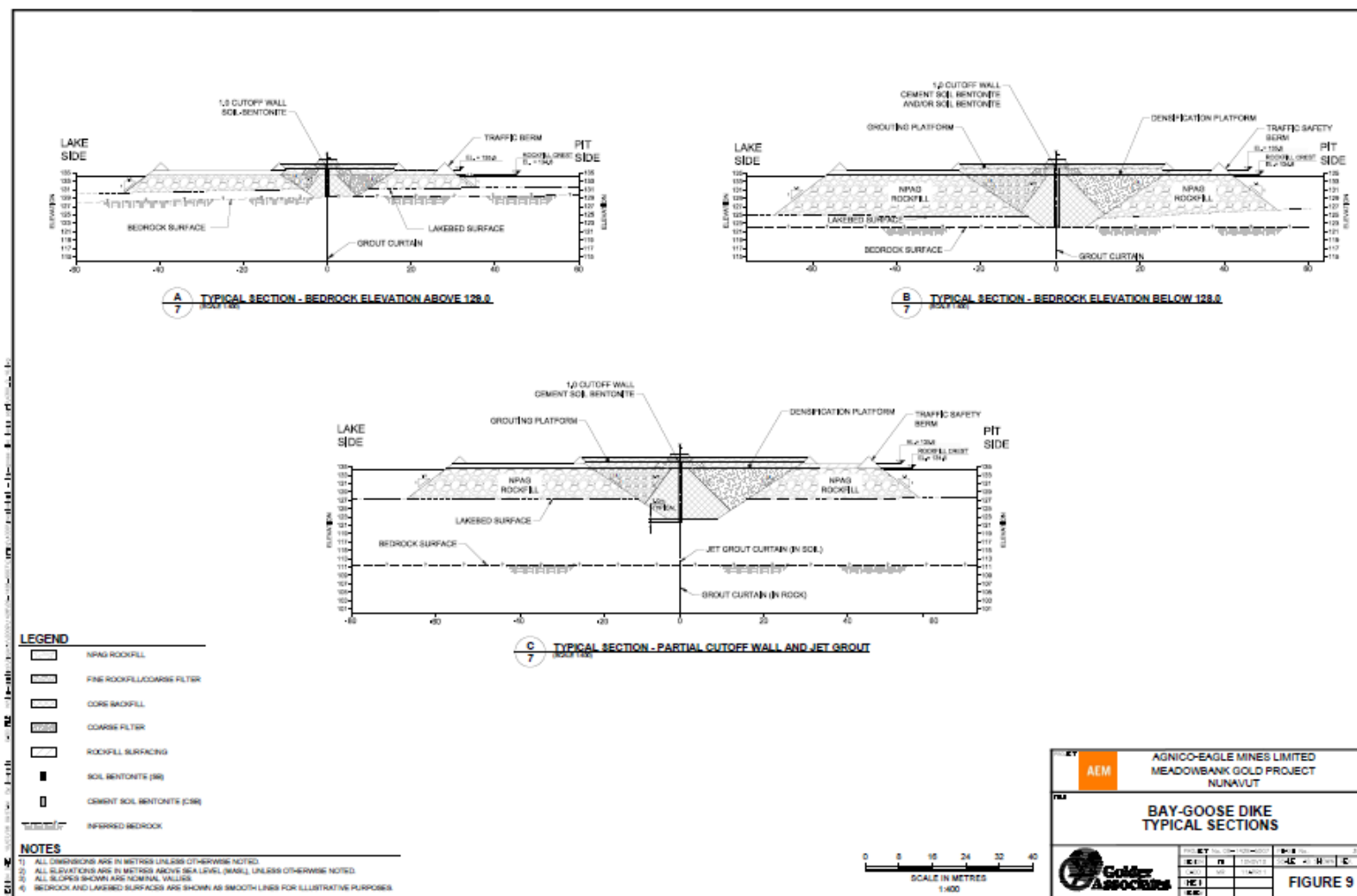


Figure 9 Bay-Goose Dike – Typical Sections



3.2.2 Bay-Goose Dike – Instrumentation

Instrumentation was installed prior to dewatering to monitor the performance of the dike and dike foundation during dewatering and throughout the operational life of the structure.

Instrumentation provides information on the performance of the structure and its foundation and allows comparison with predictions of performance made during the design studies for deformation, seepage and thermal behaviour. Instrumentation may also provide early warnings regarding the development of unexpected pore water pressure responses to dewatering, pit blasting, increasing seepage and increasing deformation.

Several types of instruments have been installed to collect the required information, including the following:

- Single vibrating wire piezometers located downstream of the cutoff wall;
- Arrays of vibrating wire piezometers, installed at various levels, upstream, immediately downstream of the cutoff wall and further downstream;
- Thermistor strings installed through the centreline of the cutoff wall;
- Inclinometers installed through the centreline of the cutoff wall; and
- Survey monuments along the centreline of the cutoff wall.

Table 3.2 summarizes existing instrumentation. The instrumentation locations are shown in plan and section on Figure 6 and Figure 8, respectively.

Table 3.2 Existing Instrumentation Summary

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
Vibrating Wire Piezometer Array	30+158	1P1-A	14.43	116.41	1P1 Top of steel casing: El. 137.04 m
		1P1-B	14.43	121.41	
		1P1-C	14.43	127.41	
		1P2-A	1.97	117.05	1P2 Top of steel casing: El. 136.88 m
		1P2-B	1.97	122.05	
		1P2-C	1.97	128.05	
		1P3-A	1.94	117.13	1P3 Top of steel casing: El. 136.53 m
		1P3-B	1.94	122.13	
Vibrating Wire Piezometer Array	30+276.5	2P1-A	14.4	119.25	2P1 Top of steel casing: El. 136.99 m
		2P1-B	14.4	124.25	
		2P1-C	14.4	130.25	
		2P2-A	2.1	119.10	2P2 Top of steel casing: El. 137.52 m
		2P2-B	2.1	124.10	
		2P2-C	2.1	130.10	
		2P3-A	1.93	119.70	2P3 Top of steel casing: El. 137.18 m
		2P3-B	1.93	124.70	
Vibrating Wire Piezometer Array	30+378.5	3P1-A	14.42	113.12	3P1 Top of steel casing: El. 137.24 m
		3P1-B	14.42	118.12	
		3P1-C	14.42	124.12	
		3P2-A	2.03	113.10	3P2 Top of steel casing: El. 138.01 m
		3P2-B	2.03	118.10	
		3P2-C	2.03	124.10	
		3P3-A	2.01	113.58	3P3 Top of steel casing: El. 138.01 m
		3P3-B	2.01	118.58	
Vibrating Wire Piezometer Array	30+453.5	4P1-A	14.44	116.61	4P1 Top of steel casing: El. 137.14 m
		4P1-B	14.44	118.61	
		4P1-C	14.44	124.61	
		4P2-A	2.03	115.13	4P2 Top of steel casing: El. 137.40 m
		4P2-B	2.03	120.13	
		4P2-C	2.03	126.13	
		4P3-A	1.98	115.25	4P3 Top of steel casing: El. 137.68 m
		4P3-B	1.98	120.25	
Vibrating Wire Piezometer Array	30+645.5	5P1-A	14.58	118.00	5P1 Top of steel casing: El. 137.04 m
		5P1-B	14.58	123.00	
		5P1-C	14.58	129.00	
		5P2-A	1.97	117.85	5P2 Top of steel casing: El. 137.03 m
		5P2-B	1.97	122.85	
		5P2-C	1.97	128.85	
		5P3-A	2.09	115.15	5P3 Top of steel casing: El. 137.05 m
		5P3-B	2.09	122.60	
Vibrating Wire Piezometer Array	31+165	23P1-A	14.51	118.49	23P1 Top of steel casing: El. 137.62 m
		23P1-B	14.51	123.49	
		23P1-C	14.51	129.49	
		23P2-A	2.15	116.91	23P2 Top of steel casing: El. 137.86 m
		23P2-B	2.15	121.91	
		23P2-C	2.15	127.91	
		23P3-A	1.92	116.96	23P3 Top of steel casing: El. 136.59 m
		23P3-B	1.92	121.96	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
Vibrating Wire Piezometer Array	31+600	24P1-A1	14.50	111.30	24P1 Top of steel casing: El. 137.45 m
		24P1-A2	14.50	116.30	
		24P1-B1	14.50	121.80	
		24P1-B2	14.50	124.30	
		24P2-A1	2.10	110.15	24P1 Top of steel casing: El. 137.83 m
		24P2-A2	2.10	116.15	
		24P2-B1	2.10	120.65	
		24P2-B2	2.10	123.15	
		24P2-C	2.10	124.65	24P3 Top of steel casing: El. 136.72 m
		24P3-A1	2.20	110.64	
		24P3-A2	2.20	115.64	
		24P3-B1	2.20	121.16	
Vibrating Wire Piezometer Array	31+815	25P1-A1	14.26	117.02	25P1 Top of steel casing: El. 137.45 m
		25P1-A2	14.26	122.02	
		25P1-B1	14.26	127.52	
		25P1-B2	14.26	129.52	
		25P2-A1	1.80	113.82	25P1 Top of steel casing: El. 137.77 m
		25P2-A2	1.80	118.82	
		25P2-B1	1.80	124.32	
		25P2-B2	1.80	126.32	
		25P2-C	1.80	127.32	25P3 Top of steel casing: El. 138.16 m
		25P3-A1	2.13	115.10	
		25P3-A2	2.13	120.10	
		25P3-B1	2.13	123.10	
Vibrating Wire Piezometer Array	31+885	26P1-A1	14.44	104.44	26P1 Top of steel casing: El. 137.27 m
		26P1-A2	14.44	109.44	
		26P1-B1	14.44	114.94	
		26P1-B2	14.44	117.94	
		26P2-A1	1.85	106.77	26P1 Top of steel casing: El. 137.93 m
		26P2-A2	1.85	111.77	
		26P2-B1	1.85	117.27	
		26P2-B2	1.85	120.27	
		26P2-C	1.85	123.27	26P3A Top of steel casing: El. 136.41 m
		26P3-A1	2.10	105.00	
		26P3-A2	2.10	111.36	26P3B Top of steel casing: El. 137.93 m
		26P3-B1	2.10	117.46	
		26P3-B2	2.10	119.86	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
Vibrating Wire Piezometer Array	32+000	27P1-A1	14.45	113.25	27P1 Top of steel casing: El. 137.58 m
		27P1-A2	14.45	118.25	
		27P1-B1	14.45	123.75	
		27P1-B2	14.45	125.75	
		27P2-A1	2.03	112.61	27P1 Top of steel casing: El. 137.64 m
		27P2-A2	2.03	117.61	
		27P2-B1	2.03	123.11	
		27P2-B2	2.03	125.11	
		27P2-C	2.03	126.61	27P3 Top of steel casing: El. 137.71 m
		27P3-A1	1.91	111.72	
		27P3-A2	1.91	116.72	
		27P3-B1	1.91	122.22	
Vibrating Wire Piezometer Array	32+065	28P1-A1	14.40	102.99	28P1 Top of steel casing: El. 136.41 m
		28P1-A2	14.40	107.99	
		28P1-B1	14.40	112.99	
		28P1-B2	14.40	115.99	
		28P2-A1	1.90	105.02	28P1 Top of steel casing: El. 138.13 m
		28P2-A2	1.90	110.02	
		28P2-B1	1.90	115.02	
		28P2-B2	1.90	118.02	
		28P2-C	1.90	124.02	28P3 Top of steel casing: El. 137.89 m
		28P3-A1	1.86	105.91	
		28P3-A2	1.86	110.91	
		28P3-B1	1.86	115.91	
Vibrating Wire Piezometer Array	32+105	29P1-A1	14.44	115.32	29P1 Top of steel casing: El. 136.69 m
		29P1-A2	14.44	120.32	
		29P1-B1	14.44	125.32	
		29P1-B2	14.44	127.32	
		29P2-A1	2.01	114.99	29P1 Top of steel casing: El. 136.62 m
		29P2-A2	2.01	119.99	
		29P2-B1	2.01	124.99	
		29P2-B2	2.01	126.99	
		29P2-C	2.01	129.99	29P3 Top of steel casing: El. 136.80 m
		29P3-A1	2.04	115.91	
		29P3-A2	2.04	120.91	
		29P3-B1	2.04	125.91	
		29P3-B2	2.04	127.91	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
Vibrating Wire Piezometer Individual	30+167	6P2	1.98	127.57	6P2 Top of steel casing: El. 136.86 m
	30+249.5	7P2	2.02	129.85	7P2 Top of steel casing: El. 137.80 m
	30+306.5	8P2	1.98	129.65	8P2 Top of steel casing: El. 137.50 m
	30+440	9P2	1.98	126.73	9P2 Top of steel casing: El. 137.43 m
	30+516.5	10P2	2.00	130.26	10P2 Top of steel casing: El. 137.16 m
	30+684.5	11P2	2.04	130.65	11P2 Top of steel casing: El. 137.15 m
	30+770	12P2	2.1	132.16	12P2 Top of steel casing: El. 137.09 m
	30+804.5	13P2	1.95	132.05	13P2 Top of steel casing: El. 137.19 m
	31+052	14P2	2.04	131.06	14P2 Top of steel casing: El. 137.81 m
	31+220	15P2	2.07	130.73	15P2 Top of steel casing: El. 137.01 m
	31+565	16P2	2.10	131.28	16P2 Top of steel casing: El. 137.65 m
	31+615	17P2	2.10	129.40	17P2 Top of steel casing: El. 137.67 m
	31+700	18P2	1.87	130.53	18P2 Top of steel casing: El. 137.59 m
	31+842	22P2	2.01	116.80	22P2 Top of steel casing: El. 137.98 m
	31+928	19P2	1.99	123.22	19P2 Top of steel casing: El. 137.28 m
	31+990	20P2	2.22	122.44	20P2 Top of steel casing: El. 137.70 m
	32+020	21P2	1.93	121.13	21P2 Top of steel casing: El. 137.94 m
Thermistor Strings	30+134	T1	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+185	T2	0	135	Beads at Elev. 135, 134, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+260	T3	0	130	Beads at Elev. 130, 129.7, 129.4, 129.1, 128.8, 128.5, 128.2, 127.9, 127.6, 127.3, 127, 126.7, 126.4, 126.1, 125.8 and 125.5 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	30+261.5	T3'	0	136	Beds at Elev. 135.97, 134.97, 133.97, 132.97, 130.97, 128.97, 126.97, 124.97, 122.97, 120.97, 118.97 and 116.97 masl.
	30+272	T4	0	130	Beds at Elev. 130, 129.7, 129.4, 129.1, 128.8, 128.5, 128.2, 127.9, 127.6, 127.3, 127, 126.7, 126.4, 126.1, 125.8 and 125.5 masl.
	30+273.5	T4'	0	136	Beds at Elev. 135.97, 134.97, 133.97, 132.97, 130.97, 128.97, 126.97, 124.97, 122.97, 120.97, 118.97 and 116.97 masl.
	30+288.5	T5	0	130	Beds at Elev. 130, 129.7, 129.4, 129.1, 128.8, 128.5, 128.2, 127.9, 127.6, 127.3, 127, 126.7, 126.4, 126.1, 125.8 and 125.5 masl.
	30+290	T5'	0	136	Beds at Elev. 135.97, 134.97, 133.97, 132.97, 130.97, 128.97, 126.97, 124.97, 122.97, 120.97, 118.97 and 116.97 masl.
	30+330.5	T6	0	135	Beds at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+386	T7	0	135	Beds at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+417.5	T8	0	135	Beds at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+489.5	T9	0	135	Beds at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	30+553.25	T10	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+621.5	T11	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+650	T12	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+713	T13	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	30+827	T14	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+080	T15	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+134.5	T16	0	135.08	Beads at Elev. 135.08, 134.08, 133.08, 132.08, 131.08, 130.08, 129.08, 128.08, 127.08, 126.08, 125.08, 123.08, 121.08, 119.08, 117.08 and 115.08 masl.
	31+170	T17	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+352	T18	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+595	T19	0	135	Beads at Elev. 135, 133.5, 132, 130.5, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	31+605	T20	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+752.5	T21	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+820	T22	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+850	T23	0	135	Beads at Elev. 135, 133.5, 132, 130.2, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.
	31+880	T24	0	135	Beads at Elev. 135, 133.5, 132, 130.2, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.
	31+960	T25	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	31+995	T26	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	32+030	T27	0	135	Beads at Elev. 135, 133.5, 132, 130.2, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.
	32+060	T28	0	135	Beads at Elev. 135, 133.5, 132, 130.2, 129, 127.5, 126, 124.5, 123, 121.5, 120, 118, 116, 114, 111 and 108 masl.
	32+100	T29	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130, 129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
	32+140	T30	0	135	Beads at Elev. 135, 134, 133, 132, 131, 130,

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
					129, 128, 127, 126, 125, 123, 121, 119, 117 and 115 masl.
Inclinometer	30+282	1	0	139.8 (collar elevation)	
	30+390	2	0	140.5 (collar elevation)	
	30+640	3	0	139.3 (collar elevation)	
	31+180	4	0	139.5 (collar elevation)	
	31+590	5	0	140.0 (collar elevation)	
	31+815	6	0	139.7 (collar elevation)	
	31+885	7	0	139.3 (collar elevation)	
	32+065	8	0	139.6 (collar elevation)	
Crest survey monuments	30+050	1	0	139.6	
	30+075	2	0	139.5	
	30+100	3	0	139.7	
	30+125	4	0	139.5	
	30+150	5	0	139.4	
	30+175	6	0	139.7	
	30+200	7	0	139.6	
	30+475	8	0	140.3	
	30+500	9	0	140.1	
	30+525	10	0	140.1	
	30+550	11	0	140.0	
	30+575	12	0	139.8	
	30+600	13	0	139.8	
	30+625	14	0	139.6	
	30+650	15	0	139.7	
	30+675	16	0	139.9	
	30+700	17	0	140.1	
	30+725	18	0	140.2	
	30+750	19	0	139.9	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	30+775	20	0	139.7	
	30+800	21	0	140.0	
	30+825	22	0	139.5	
	30+850	23	0	139.7	
	30+875	24	0	137.0	
	30+900	25	0	139.9	
	30+925	26	0	139.6	
	30+950	27	0	137.0	
	30+975	28	0	139.8	
	31+000	29	0	139.6	
	31+025	30	0	139.6	
	31+050	31	0	139.8	
	31+075	32	0	139.8	
	31+100	33	0	139.8	
	31+125	34	0	139.8	
	31+150	35	0	139.8	
	31+175	36	0	139.7	
	31+200	37	0	139.5	
	31+225	38	0	139.3	
	31+250	39	0	139.4	
	31+275	40	0	139.5	
	31+300	41	0	139.6	
	31+425	42	0	139.4	
	31+450	43	0	139.3	
	31+475	44	0	139.4	
	31+500	45	0	139.6	
	31+525	46	0	139.5	
	31+550	47	0	139.5	
	31+650	48	0	139.6	
	31+675	49	0	139.8	

Instrumentation Type	Station Location	Label / Identification	Offset from Centreline (+ is d/s – is u/s)	Elevation (masl)	Details
	31+700	50	0	139.7	
	31+725	51	0	139.6	
	31+750	52	0	139.6	
	31+775	53	0	139.6	
	32+100	54	0	139.2	
	32+125	55	0	139.9	

3.2.3 Bay-Goose Dike - Seepage Collection System

In 2012, four small seepage areas were identified with a total of 9 seepage channels along the dike. The number of active seepage channels decreases each year, as some channels stop flowing. No turbidity has been observed in the seepage. The total flow coming from these seepages each year has been decreasing. The overall seepage is less than anticipated and is not a concern for now. The area will continue to be monitored to follow the evolution of the seepage in these areas.

Refer to the 2015 Annual Geotechnical Inspection (Golder Associates) for detailed field observations made on the dike. No mitigation measure has been implemented on the dike other than additional geotechnical instrumentation installation and field investigation in certain areas. No seepage collection has been implemented so far as the seepage is not affecting the mine operation or the integrity of the dike. The condition of the dike will continually be monitored and if the condition of the dike is judged to be deteriorating then remediation would be reassessed.

3.2.4 Bay-Goose Dike - Access

Access to the Bay-Goose Dike is from the north and south abutments as shown on Figures 2 and 6. Access to the downstream toe is by foot from the Bay-Goose pit ring road, which is a road that runs around the top circumference of the Bay-Goose pit. The south abutment of the dike is accessible from the main camp, after passing the fuel storage and refuelling station, travelling southward crossing the South Camp Dike. The access road forks, take the access road on the left (east) and continue southward on South Camp Island until reaching the south abutment of the Bay-Goose Dike. The north abutment of the Bay-Goose Dike is accessible from the south abutment of the East Dike.

The Bay-Goose Dike is not intended to be used as a haul road, but merely a structure to dewater the isolated portion and permit open pit mining of the Goose deposit and the southern portion of Portage Pit. Traffic on the dike is restricted to dike and environment personnel only; this measure was taken to protect the dike and the instrumentation.

3.3 SOUTH CAMP DIKE

The South Camp Dike covers a narrow channel within Third Portage Lake and in conjunction with the Bay-Goose Dike isolates the Bay-Goose Basin from Third Portage Lake. No spillways or water diversion works are associated with the South Camp Dike.

The South Camp Dike is located south of the plant site area and is used to connect the mainland to South Camp Island. Figure 2 shows the location of the South Camp Dike. It covers a narrow channel, approximately 60 m in width, where water depths were between 0.5 and 1 m.

The South Camp Dike was primarily constructed between April and June of 2009, prior to ice breakup. During the winter of 2009-2010 additional thermal capping material and rockfill for the haul road was added to the dike. The South Camp Dike has a broad rockfill shell with a bituminous geomembrane liner installed on the upstream side of the shell. The liner was founded on native frozen (permafrost) till material, in a trench approximately 3 to 5 m below the lakebed surface. Compacted granular material mixed with bentonite was placed above the toe of the liner. The haul road is located on the downstream side of the dike.

3.3.1 South Camp Dike – Design and Construction

The South Camp Dike design and as-built drawings are presented within Doc. 802 (Golder 2009a). A plan view and typical section of the as-built dike are shown on Figure 10.

The dike design includes the following components: a rockfill shell, a bituminous geomembrane liner and granular material mixed with bentonite.

3.3.2 South Camp Dike - Instrumentation

Two thermistor strings exist on the upstream side of the South Camp Dike to monitor the thermal behaviour of the foundation soils at the liner key-in trench. Instrumentation is shown in section on Figure 10.

Table 3.3 summarizes existing instrumentation in the South Camp Dike.

Table 3.3 South Camp Dike Existing Instrumentation Summary

Thermistor String	Location		Approx. Offset from Centerline + is d/s; - is u/s	Elevation (masl)	Details
	Northing	Easting			
SD-09-A	7,213,148	638,151	-27 m	133 (1 st bead)	Beads at Elev. 133, 132, 131, 130, 129, 128, 127, 126, 124, 122, 120, 118, 116, 114, 112 and 110 masl
SD-10	7,213,142	638,168	-45 m	132.4 (1 st bead)	Beads at Elev. 132.4, 131.4, 130.4, 129.4, 128.4, 127.4, 126.4, 125.4, 123.4, 121.4, 119.4, 117.4, 115.4, 113.4, 111.4 and 109.4 masl

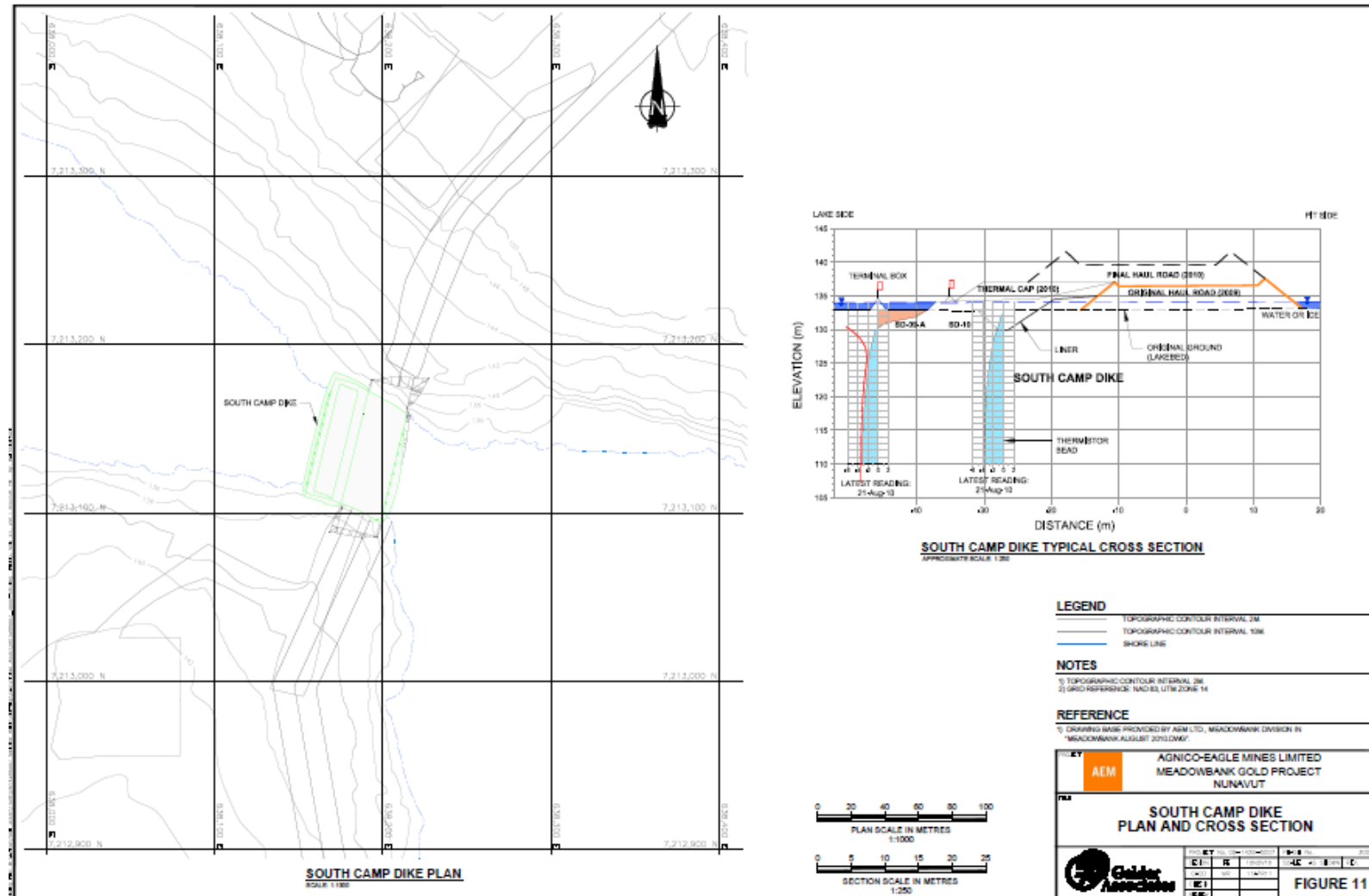
3.3.3 Seepage Collection System

As of summer 2014 no seepage through the South Camp Dike has been discovered. Seepage through the dike will be visually monitored if discovered. Seepage and runoff from the South Camp Dike will be collected in ditches along the downstream toe and directed to topographic lows if required based on the visual monitoring.

3.3.4 South Camp Dike - Access

Access to the South Camp Dike is from the north and south abutments as shown on Figures 2 and 10. The South Camp Dike connects the mainland to South Camp Island.

Figure 10 Plan, cross section and profile of South Camp Dike



3.4 VAULT DIKE

The construction of the Vault Dike at Meadowbank was conducted from February 2013 to March 2013. Vault Dike is located across a shallow creek which connects Wally Lake and Vault Lake, at the Vault Pit area approximately 8 km north of the main Meadowbank site. Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit during mining activities from Wally Lake.

Vault Dike is designed and constructed as a zoned rockfill dam with filter zones, an impervious upstream liner consisting of a bituminous membrane, and an upstream key trench made of aggregate mixed with bentonite. The filter zones minimize seepage and internal erosion and facilitate seepage collection. Vault Dike includes a key trench at the base of the upstream side filled with a 0-25 mm fill amended with bentonite surrounding the liner. Coarse and fine filter material was placed on the upstream slope as geomembrane bedding. The bulk part of the dike consists of coarse rockfill material. The embankment crest is at El. 142.4 m and the upstream toe is at approximately El. 139.4 m. The downstream toe is at approximately El. 139.6 m and the bottom of the key trench ranges from El. 135.6m to El. 142.3m, with an average height of El. 137.0m. The upstream and downstream fill slopes of the dam are 1.5H:1V.

The location of the Vault dike is shown on Figure 2. Dewatering of Vault Lake was completed in the summer of 2014.

3.4.1 Vault Dike – Design and Construction

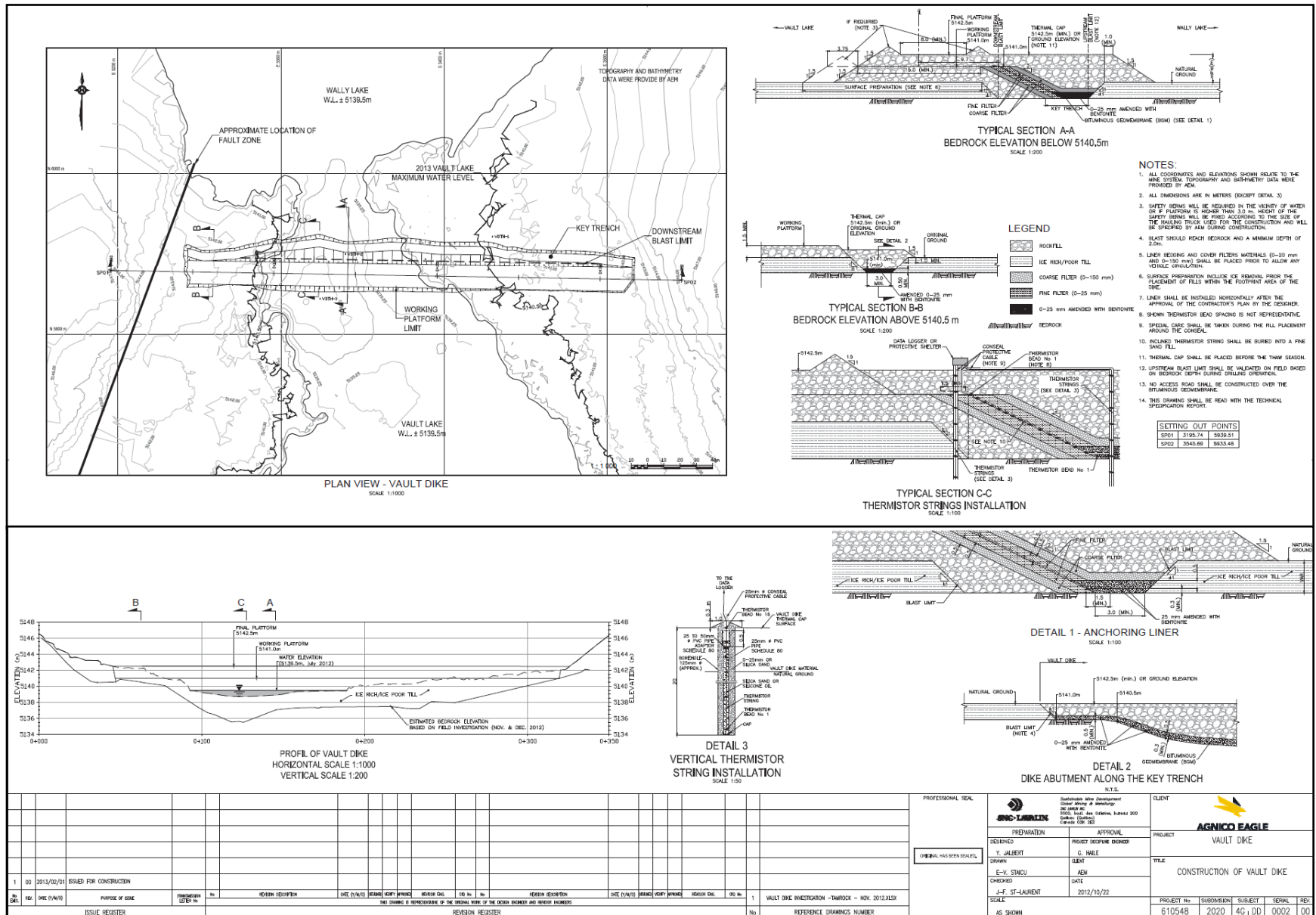
The Vault Dike design is presented in the report “Detailed Engineering of Vault Dike” (SNC, 2013a). A Vault Dike typical section plan view is included in Figure 11. As-built information and as-built drawings of the Vault Dike are provided in Construction Summary Report Vault Dike (AEM, 2013).

Vault Dike is designed and constructed as a zoned rockfill dam with filter zones, an impervious upstream liner consisting of a bituminous membrane, and an upstream key trench made of aggregate mixed with bentonite. The filter zones minimize seepage and internal erosion and facilitate seepage collection.

3.4.2 Vault Dike – Dewatering

Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit during mining activities from Wally Lake. The dewatering of Vault Lake started on June 27th, 2013 and was completed in the summer of 2014. The approximate pool volume to be dewatered was 2 Mm³. The downstream water levels and the upstream water levels need to be closely monitored during dewatering to preserve the integrity of the dike.

Figure 11 Vault Dike Typical Section



3.4.3 Vault Dike - Instrumentation

Installation of the thermistor strings began on February 26, 2013 and was completed April 14, 2013. Installation of the thermistors was completed by AEM with assistance from the Contractor /TCG and complied with the construction specifications.

TH3 was installed on the downstream side of the dike. TH3 was installed in the deepest channel downstream of the dike. TH5 was installed inclined under the liner on February 26, 2013. TH6, TH7, and TH8 were installed after construction was complete using a Rockmaster drill between April 12, 2013 and April 14, 2013. T6 was installed upstream of the dike in the deepest channel upstream of the liner. TH7 was installed east of the deepest channel in the unfrozen till zone found during construction. TH8 was installed upstream of the dike in the deepest channel outside of the key trench. The locations of the five thermistors at Vault Dike are shown on the as-built drawings in plan view in Figure 11 and their details are shown in Table 3-4. The five (5) thermistor strings were installed to monitor Vault Dike and the thermal behaviour of its foundation. At this point, only one critical section has been identified in the deepest section of the dike.

Table 3.4 Vault Dike Existing Instrumentation Summary

Thermistor String	Location		Elevation (masl)	Details
	Northing	Easting		
VD-TH3	5921.97	3324.066	139.5 (1 st bead)	Beads at Elev. 139.5, 138.5, 137.5, 136.5, 135.5, 134.5, 133.5, 132.5, 131.5, 130.5, 128.5, 126.5, 124.5, 122.5, 120.5, and 118.5 masl
VD-TH5	5945.52	3322.511	141.4 (1 st bead)	Beads at Elev. 141.4, 141.4, 141.4, 141.4, 141.1, 141.0, 140.5, 140.0, 139.5, 139.0, 138.4, 137.9, 137.4, 136.8, 136.4, and 136.1 masl
VD-TH6	5943.00	3322.000	140.5 (1 st bead)	Beads at Elev. 140.5, 139.5, 138.5, 137.5, 136.5, 135.5, 134.5, 133.5, 132.5, 131.5, 130.5, 129.5, 127.5, 125.5, 124, and 121.5 masl
VD-TH7	5946.00	3346.00	140.5 (1 st bead)	Beads at Elev. 140.5, 139.5, 138.5, 137.5, 136.5, 135.5, 134.5, 133.5, 132.5, 131.5, 129.5, 127.5, 125.5, 123.5, 122.0 and 119.5 masl
VD-TH8	5957.00	3322.00	140.5 (1 st bead)	Beads at Elev. 140.5, 139.5, 138.5, 137.5, 136.5, 135.5, 134.5, 133.5, 132.5, 131.5, 129.5, 127.5, 125.5, 123.5, 122.0 and 119.5 masl

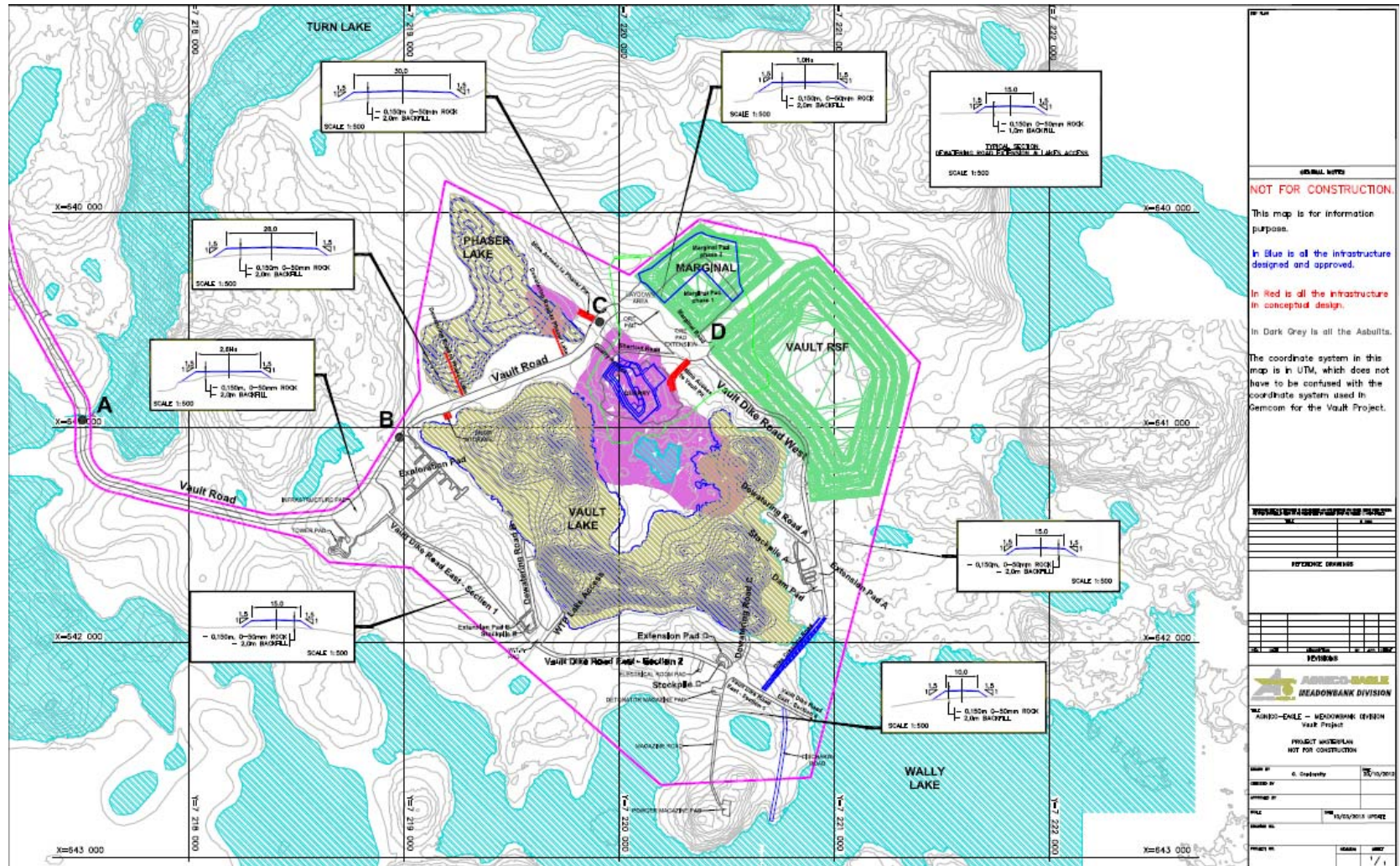
3.4.4 Vault Dike - Seepage Collection System

As of summer 2015 no seepage through the Vault Dike has been discovered. Seepage through the dike will be visually monitored if discovered. Seepage and runoff from the Vault Dike will be collected in ditches along the downstream toe and directed to topographic lows if required based on the visual monitoring.

3.4.5 Vault Dike - Access

Two access roads were constructed to the dike footprint – one from Vault Dike Road West and from Vault Dike Road East. Figure 12 presents a map of the general Vault Pit area with the access roads. Vault Dike Road West begins where Vault Road ends at the Vault Waste Dump, runs northeast to pass Dewatering Road A and ends at the northwest end of the dike (Station 0+000). Vault Dike Road East begins at Vault Road between the Tower Pad and the Office Pad, runs northeast to pass Dewatering Road B and Dewatering Road C and ends at the southeast end of the dike (Station 0+350).

Figure 12 General Vault Pit area with the access roads



SECTION 4 • DEWATERING

The Dewatering Dikes isolate the open pit mining activities from the Second Portage Lake, Third Portage Lake, and Wally Lake. The northwest arm of Second Portage Lake was dewatered upon completion of the East Dike and West Channel Dike in 2009.

The Bay-Goose Dike together with the South Camp Dike isolates the Bay-Goose Basin from Third Portage Lake. Dewatering of the Bay-Goose Basin commenced on July 25, 2011 and was completed on November 14, 2011. As the operational stage of Goose Pit has started and completed, both dikes are no longer under dewatering conditions. The approximate pool volume dewatered is in the order of 3 Mm³. This is referring to the amount of water removed to expose the majority of the downstream toe of the Bay-Goose Dike.

Vault Dike isolates Vault Pit from Wally Lake. Dewatering of Vault Lake started on June 27th, 2013 and was completed during the summer of 2014. The approximate pool volume to be dewatered was in the order of 2 Mm³.

All of the dewatering dikes are now in the operation phase as dewatering is complete. The following outlines the key criteria and constraints that will need to be observed and followed in accordance with the design objectives, concepts, and assumptions for the Dewatering Dikes.

4.1 FREEBOARD

The design criteria for minimum freeboard for the Dewatering Dikes are presented in Table 4.1. The freeboard may change due to fluctuations in Second Portage and Third Portage Lakes or due to settlement in the dikes. Maintenance may be required to restore loss of freeboard due to settlement.

Table 4.1 Design Minimum Freeboard

Structure	Minimum Freeboard	
	Rockfill Structure (Dike Crest) (m)	Low Premeability Element (Cutoff Wall or Liner) (m)
East Dike	3.0	1.0
Bay-Goose Dike	4.0	1.0
South Camp Dike	3.0	1.0
Vault Dike	3.0	1.5

4.2 WATER MANAGEMENT AND QUALITY

Dewatering water from the Vault Lake Basin was pumped and directly discharged to Wally Lake thru a diffuser, or processed through the Water Treatment Plant (WTP) to reduce Total Suspended Solids (TSS). The Nunavut Water Board Water License (No. 2AM-MEA0815) states that the TSS maximum monthly mean value should not exceed 15.0 mg/L and that the short term maximum level is 22.5

mg/L and turbidity maximum monthly mean value should not exceed 15 NTU and the short term maximum level is 30 NTU. The Vault Lake discharge is also considered as an effluent under the Metal Mining Effluent Regulations (MMER) and must meet the criteria of this regulation for arsenic, copper, cyanide, lead, nickel, zinc, TSS and toxicity of trout and daphnia. Under the MMER regulation, the TSS maximum monthly mean value should not exceed 15.0 mg/L and maximum concentration in a grab sample is 30.0 mg/L. In the first stage of the Vault Lake dewatering the WTP was not required because the regulation criteria limit was reached. However, the WTP was used during the latter stages when TSS from bottom sediments was present.

4.3 SURVEILLANCE AND MONITORING REQUIREMENTS

Surveillance and monitoring requirements are defined in Sections 7 and 8 of this manual.

Pore water pressures in the foundation shall be monitored during dewatering as a predictor of possible slope instability. Both pore water pressures and temperature measurements shall be monitored during dewatering as one method of detecting potential zones of seepage. The quantity of water pumped out during dewatering was monitored with flow meters in addition to monitoring the water level downstream of the Vault Dike, within the Vault Lake Basin.

4.4 SAFETY AND SECURITY

Access to the mine site is controlled by AEM security and public access to the area is restricted.

SECTION 5 • OPERATIONS

The following outlines the key criteria and constraints that will need to be observed and followed to operate the dewatering dikes in accordance with the design objectives, concepts and assumptions.

5.1 FREEBOARD

The design criteria for minimum freeboard for the Dewatering Dikes are presented in Table 5-1. The freeboard may change due to fluctuations in lake levels or due to settlement of the dikes. Maintenance may be required to restore loss of freeboard due to settlement.

Table 5.1 Freeboard

Structure	Freeboard	
	To the Dike Crest (m)	To the Dike Cut-off Wall or Liner (m)
East Dike	3.0	1.0
Bay-Goose Dike	4.0	1.0
South Camp Dike	3.0	1.0
Vault Dike	3.0	1.5

5.2 WATER MANAGEMENT

Water from the seepage collection systems of the Dewatering Dikes is to be pumped to the pit sumps and/or directly to the Tailings Storage Facility or Attenuation Pond. Seepage rates may increase with time as the pits are developed downstream of the dikes. As described in Sections 7 and 8 of the document, seepage rates, volumes and the condition of the seepage water (i.e. turbidity, temperature, etc.) are to be monitored.

Table 5.2 summarizes design criteria for the seepage and runoff flow into the seepage collection sumps. The quantity of seepage through the dike is an estimate based on design analyses and should be periodically reviewed during dewatering and operations.

Table 5.2 Sump Design Criteria

Criteria Type of Storage	Description Temporary
Required Storage Capacity	Seepage from the foundation and embankment plus Average daily 10 year freshet volume
Foundation and Embankment Seepage	Design rate: 300 m ³ /day prior to Portage Pit development (East Dike). However, seepage rates in 2009 to 2014 have been between 860 to 1300 m ³ /day Design rate: 700 m ³ /day prior to Goose Island Pit development (Bay-Goose Dike)
Average daily 10 year freshet	Average daily 10 yr snowmelt over 14 day melt period
Design Pump Capacity	Sufficient to pump: Foundation and Embankment Seepage plus 10-year annual snow melt in 14 days

Regular monitoring of the seepage volume is required. Sumps size and pump capacity is to be regularly reviewed and upgrades made if deemed necessary by AEM.

5.3 WATER QUALITY

Water quality of the seepage and runoff collected in the sumps and ditches at the toe of the Dewatering Dikes is to be monitored during operations. Daily inspections during dewatering and weekly inspections during operation are required as an indicator of dike performance to note whether seepage water is clear, cloudy or if fine material is present.

SECTION 6 • MAINTENANCE PROCEDURES

Maintenance is important for the safe operation of the Dewatering Dikes. The Engineering Superintendent is responsible for proper and timely maintenance of the Dewatering Dikes embankments, instrumentation, seepage collection system and access.

6.1 PLANNED AND UN-PLANNED MAINTENANCE

Maintenance is divided into planned and un-planned maintenance. Planned maintenance will be scheduled according to manufacturer's requirements for instrumentation and equipment such as pumps. Planned maintenance may be routine, preventative and/or routine inspection observations including low risk / consequence observations.

Un-planned maintenance shall generally derive from routine inspection observations including medium-high risk / consequence observations and / or extreme events including extreme meteorological events, seismic events, etc. where the maintenance requirement is critical and is required immediately.

All planned and un-planned maintenance will be documented in a database organized and maintained by AEM.

6.2 EMBANKMENT EROSION

Erosion of the rockfill embankments is not expected during dewatering or operations. In the event that the upstream face is eroded by wave action or ice scouring then any gullies or depressions that develop are to be filled in with rockfill material and re-sloped.

6.3 SEEPAGE COLLECTION SYSTEM

Seepage is expected to exit the downstream toe of the Dewatering Dikes, in particular at low points along the alignment of the structure. Seepage should be monitored and ditches and sumps maintained to avoid erosion and deterioration of the seepage collection system. Sediments, snow and ice may accumulate in the ditches and sumps during operation. The ditches and sumps will require ongoing cleaning and maintenance as needed.

Pumps located at the seepage collection system sumps will require maintenance based on the manufacturer's specifications. Pump installations are to be winterized to provide year round capacity for pumping, if necessary.

Heat tracing of the pipelines will require maintenance. It is expected that the feeder pipelines to the main pipelines are sloped sufficiently to drain the pipes and not permit ice or sediment accumulation, but this should be confirmed in the field.

6.4 INSTRUMENTATION

All cables, thermistors, inclinometers, piezometers, and survey/displacement monuments must be adequately protected with barriers, signs, and flagging to prevent accidental damage. The instrumentation installed in the Dewatering Dikes is to remain operational until closure of the facility.

Instrumentation will require regular maintenance based on manufacturer's specification. The slope inclinometer casing will require either frequent bailing or filling with a solution of non-toxic antifreeze to prevent freezing and icing.

Calibration sheets and initial instrumentation readings will be included upon replacement of malfunctioning instrumentation; the OMS Manual will be updated accordingly.

6.5 ACCESS

Access roads to the Dewatering Dikes along the crest of the dikes need to be maintained. Access will also be maintained along the seepage collection system and to the sumps at the toe of the East Dike and Bay-Goose Dike. Maintenance activities for access will be conducted.

SECTION 7 • SURVEILLANCE

A program of regular surveillance is required to ensure that the Dewatering Dikes, instrumentation and seepage collection systems are performing adequately and that problems are detected so that the necessary corrective actions can be implemented in a timely manner.

7.1 SURVEILLANCE REQUIREMENTS

Surveillance is required for early detection of possible failure mechanisms. In 1995, the International Commission on Large Dams (ICOLD) released a study summarizing failure mechanisms for world-wide water retaining dam incidents during the 1800s and 1900s. The potential failure mechanisms applicable to the Dewatering Dikes, primarily East Dike and Bay-Goose Dike, based on the ICOLD study are summarized in Table 7-1.

Table 7.1 Summary of Consequences and Proposed Monitoring/Action for Rare Events Based on Water Retaining Embankment Failure Modes Identified in ICOLD (1998)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Lake level rise because of restricted outflow e.g. Second Portage outlet (excessive inflow is a far less likely scenario).	Water spilling over the crest. The crest is wide and comprises coarse rockfill. Adequate freeboard is provided by the rockfill crest elevation being 3 m above the lake level and the low permeability element 2 m above. Any rise in lake level is anticipated to be less than the freeboard. Significant damage to the dike is unlikely, based on performance of other rockfill structures subjected to overtopping or flow through events. Mining operations might need to be suspended, but there will be considerable warning time given the design freeboard and the storage volume within the lakes.	Lake levels should be part of weekly safety information provided to mine management. Outflow channels should be inspected weekly during the thaw and ice break-up. If overtopping is likely, a temporary spillway could be constructed and armoured to control and localize flow at shallow dike sections (e.g. abutment).
	(2) Dam crest settles more than 2 m over a distance of approximately 50 m. Not a credible failure mechanism. Observed settlement of the East Dike and Bay-Goose Dike crest during construction was on the order of 0.3 m to 0.5 m. Additional settlement is expected to be smaller in magnitude.	Same as (1).	The situation envisaged in this scenario should develop slowly with crest settlement evident. Monitoring of crest settlement is appropriate, and is included in the surveillance program. Rockfill and till are available from the mining operation can be placed to raise the dike crest, if settlement occurs.

Failure Mode	Scenario	Consequence	Monitoring/Action
Internal Erosion	(3) Dike Section: the low permeability element of the dikes Cutoff wall, jet grout columns, shallow foundation is defective, allowing high water flow through the structure. This defect could potentially erode zones of the dike and lead to loss of material from the dam (piping) increase the seepage, sinkholes in the crest.	The East Dike cutoff wall could progressively loose material, thereby increasing the hydraulic conductivity and resulting in an increased rate/volume of seepage through the dike and development of sinkholes in the dam crest. This is not likely to be a catastrophic failure mode as the rockfill shoulders of the dike will be stable and the filters are founded on or near bedrock. At its worst, this would lead to temporary flooding within the open pit of the mine and a cessation of mining. The Bay-Goose Dike cutoff wall system although similar to East Dike, has potential to lose more material from the dike structure, through piping as in the “deep sections” where jet grouting was conducted, downstream filter material does not extend to bedrock and a higher hydraulic head exists. Internal erosion could lead to increased seepage, sinkhole development, settlement of the crest, and although not probable, loss of containment.	Monitor seepage from downstream face for rate and volume, and for presence of sediment in seepage. Would become evident as localized intensive seepage at the dike toe or beyond. May also see settlement in the cutoff wall or dike crest. Will be most likely in deep water sections with higher gradients. Monitor piezometric and thermistor data for signs of increased flow through the cutoff wall and change in piezometric pressures. Selection of a remediation plan would be based on conditions encountered, but could include the installation of a downstream filter blanket and grouting.
	(4) Foundation: Till is non-uniform with more transmissive zones and zones of erodible material (i.e. silt layers) that may not be self-filtering. It is possible that material loss of the foundation tills and/or through the fractured bedrock with silt infillings could occur and result in high rates of seepage and a loss. Seepage could flow along the transmissive zone beneath the downstream rockfill section and erode the foundation tills at the downstream toe or into the downstream rockfill because of the lack of filtering.	Limited seepage at the toe or into the rockfill would accelerate into a larger flow and could lead to the undermining of the dike if no action was taken. This is a credible catastrophic failure mode if increased seepage is not detected in time.	Monitor seepage flow rates and condition and piezometric and thermistor responses for signs of increased seepage. Monitor dike crest for signs of sinkholes, settlement or slope instability. Remedial actions could comprise of grouting, a reverse filter and rockfill buttress depending on location of the flow and configuration of the foundation. In the worst case, the dewatered areas may be deliberately flooded in a controlled manner, the cutoff repaired, and the areas dewatered.
Seepage within Embankment	(5) Seepage on its own is not a credible failure scenario. The downstream rockfill shell has extremely high flow through capacity. The rockfill zone is both	No credible consequences. May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage.	Seepage monitoring program.

Failure Mode	Scenario	Consequence	Monitoring/Action
	large and pervious, so that seepage will not daylight on the downstream face and lead to instability. Any seepage related failures must include internal erosion, see above.		
Seepage within Foundation	(6) Defective construction of cutoff system leading to transfer of unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation, or leading to a piping event as described above (internal erosion).	This failure mechanism has caused embankment failures elsewhere because of pore pressure induced instability. However, at East Dike it is unlikely that it could cause failure of this dike. However, for Bay-Goose Dike this is more of a possibility. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm before the crest roadway could be reinstated.	This mechanism is more likely to arise during dewatering. Monitoring of piezometric heads and thermistor string data.
Internal Conduit Rupture	(7) There are no internal conduits or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(8) Normal Operation: The rockfill shoulders of the dikes have high shear strength, making it a conservative design. For slope failure to be a concern, it requires failure in the foundation which would then extend into the overlying dike. Sliding failure is considered unlikely given the low horizontal forces generated by water and ice forces relative to the normal frictional force due to the weight of the dike and the friction angles of foundation materials.	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rockfill shoulders will not necessarily compromise the water retaining element of the dikes. Failures which reach the core may cause failure.	This mechanism should develop during construction or dewatering, due to increased loads and associated pore water pressure. Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dike by a trained inspector is an appropriate monitoring strategy. Survey of crest, face, and toe is also appropriate. Stabilizing berms can be placed inside the dike or through water along the upstream shoulder.
	(9) Pit Wall instability that extends towards the dike and causes instability of the dike	If the instability impacted the low permeability element of the dike, then failure of the entire structure and loss of mining operations could occur. This is more likely to be a cause of failure for the Bay-Goose Dike as the offset between the low permeability element and pit crest is much	Slope inclinometer monitoring of the cutoff wall. Pit wall stability monitoring. Depressurization of pit walls. Draining of lakebed soils between pit crest and dike and/or removal of these materials.

Failure Mode	Scenario	Consequence	Monitoring/Action
		less than for East Dike.	Adjustment of mine plan, if necessary.
	(10) Earthquake Induced: Occurrence of an extreme earthquake, much in excess of the current understanding of seismicity of the area.	The extreme earthquake loading for this site is a low magnitude. Settlement of the dike could occur in the event of a large earthquake. Dynamic compaction of the core in the East Dike and Bay-Goose Dike during construction may have subjected the rockfill shells to accelerations equivalent to the expected earthquake loading. This would not be a failure situation. The crest is also erosion resistant for any earthquake induced wave action in the impounded water.	Dike inspection following earthquakes felt on site.
Failure of Cutoff Wall Due to Movement of the Dike	(11) Differential horizontal movement of dike due to water or ice loading, or pit wall failure, or blast vibrations. Creates a breach in the cutoff wall system. Ice and water forces are not credible due to the ratio of frictional forces generated by the self weight of the dike versus ice loads and water pressure. Pit wall failure (see above).	Large inflows through the breach. Dewatered areas would flood requiring suspension of mining activities. Potential for loss of life for workers downstream of the dikes. Excessive vibration from overblasting could potentially damage the CSB and/or jet grout columns resulting in cracks or fissure, however the cement content within these portions of the wall should reduce the erodability of the wall and therefore protect the integrity of the dike, even though seepage rates would increase. It is anticipated that the SB material would deform adequately such that cracks would not be produced.	Prism monitoring for pit wall stability. Blast vibration monitoring on the dikes. Monitoring inclinometers within the cutoff wall.
Unexpected Settlements	(12) Unexpected foundation soils consolidate during dike construction. A significant quantity of clay that was not recognized during foundation excavation would be required to generate settlement required for a water release event. Settlement of the core will be limited.	2 m of settlement would be required to allow water flow through the rockfill and over the settled core. This flow would not cause failure of the rockfill shells. It would also be readily repaired by placing more end-dumped till into the settled zone.	Settlement monitoring of the dikes and visual inspection. Excessive settlements may be remediated by excavating rockfill above the core and placing more till.

Table 7-1 to be updated as necessary during operation

7.2 SURVEILLANCE PROTOCOLS

The surveillance program consists of several types of inspections:

During Dewatering:

- Daily Dewatering Inspection – carried out on an on-going basis by designated qualified mine personnel to assess the performance of the dikes during dewatering. Reporting can be daily if routine, or immediately if conditions warrant;
- Weekly Dewatering Inspection – carried out by designated qualified mine personnel, to assess the performance of the dikes during dewatering with reporting occurring weekly or immediately if conditions warrant; and
- Design Engineer Inspection – upon exposure of the downstream toe to view seepage and review the performance of the dike.

During Operations:

- Weekly Routine Inspection – carried out weekly by designated qualified mine personnel to assess operating of the seepage collection systems including the sumps and performance of the structures;
- Monthly Routine Inspection – carried out monthly by a designated qualified mine personnel to assess operating status of the seepage collection systems including the sumps, and performance of the structures;
- Engineering Inspection – carried out annually by a qualified engineer, during open water period, to verify that the facilities are functioning as intended; and
- Dam Safety Review – carried out by an independent engineer every five years to review all aspects of the design, construction, operation, maintenance, processes and other systems affecting the dam's safety, including the dam safety management system. The review defines and encompasses all components of the "dam system" under evaluation including the dam, foundations, abutments and seepage collection works.

7.3 RESPONSIBILITIES AND FREQUENCY

It is anticipated that the Engineering Superintendent and support personnel and/or the Environment Superintendent and support personnel and/or Mine Superintendent and support personnel will be responsible for the inspections of the Dewatering Dikes, seepage collection systems, instrumentation and access routes during dewatering and operation. The inspections by the Design Engineer and for the Dam Safety Review will be conducted by qualified independent engineers. The inspection, monitoring and review requirements are summarized in Table 7-2 and described in the following sections.

Table 7.2 Inspection, Monitoring and Review Requirements

Party Responsible	Required Inspection, Review or Monitoring	Required Frequency
Design Engineer	Dewatering Inspection	During dewatering once downstream toe is exposed
Engineering Superintendent and Geotechnical Coordinator/ Geotechnical Supervisor: and/or Environment Superintendent and support personnel; and/or	Daily Dewatering Inspection	Daily and immediately following earthquakes, high intensity rainfall events and other extreme events
	Daily and Weekly Routine Inspection of Dewatering Dikes, seepage collection system, and access.	Weekly and immediately following blasting, large blasts occurring in close proximity to the structures, earthquakes, high intensity rainfall events and other extreme events
	Monitoring of instrumentation (thermistor strings, vibrating wire piezometers, inclinometers, survey prisms and monuments, pump rates, lake water levels)	Varies – see Section 8.0
Engineering Superintendent and Geotechnical Coordinator and/or designated qualified mine personnel	Weekly Dewatering Inspection	Weekly and immediately following earthquakes, high intensity rainfall events and other extreme events
	Monthly Routine Inspection of Dewatering Dikes, seepage collection system, and access.	Monthly and immediately following large blasts occurring in close proximity to the dikes, earthquakes, high intensity rainfall events and other extreme events
Qualified Engineer	Engineering inspection of the Dewatering Dikes, drainage works, access and instrumentation.	Annually
Independent Engineer	Dam Safety Review	Once every five years

7.3.1 Dewatering Inspections (Daily and Weekly)

Inspections during dewatering form part of the duties and responsibilities of the Engineering Superintendent, Geotechnical Coordinator, Geotechnical Supervisor and support personnel and the Environment Superintendent and support personnel and must be carried out by designated and qualified personnel. It is assumed that daily Inspections may be conducted by less knowledgeable staff and weekly inspections by more knowledgeable staff.

Ideally the inspections should be carried out by the same individual or by a small group in order to maintain continuity in the observations. The main operational and structural parameters should be reviewed and verified by the Engineering Superintendent, Geotechnical Coordinator, Geotechnical Supervisor and Environment Superintendent. Data collected will be summarized on the respective Dewatering Dike Field Inspection Sheets and stored for easy access and long term record keeping.

The following information should be noted and recorded in the inspection to detect signs of wear, damage or potential loss of structural integrity:

Dike Structure:

- compliance with minimum freeboard requirements:
- crest elevation;
- upstream water elevation; and
- downstream water elevation.

Crest:

- surface cracking; and
- local subsidence.

Upstream face conditions above water line:

- cracking;
- distortion or displacement;
- wave erosion; and
- slope angle.

Downstream face conditions:

- cracking;
- distortion or displacement;
- slumping;
- erosion;
- slope angle;
- seepage quantity and quality (turbidity); and
- wet areas.

Area downstream of dike toe:

- Seepage quantity and quality (turbidity);
- cracking;

- erosion;
- bulging; and
- indications of instability.

Abutments:

- indications of instability;
- erosion at dike – ground surface contact; and
- seepage appearing from abutments.

Barges, Dewatering ramps, and pumps:

- pumping rates and dewatering rate;
- water quality being pumped in regards to turbidity;
- conditions of the holding cables and location of the barge in the dewatering pool;
- presence of ice on the barge due to leaks; and
- general condition of the pumps and the presence of leaks (pumps or piping).

The inspection forms are included in Appendix A.

Photographs should be used to augment the inspection forms. As much as possible, these should be taken from the same vantage points during each inspection so that changes in conditions can be readily identified. Photographs shall be captioned or annotated with a date stamp.

The observations and/or events indicating a trend that are considered “triggers” requiring reference to action items and reporting procedures are outlined in the Emergency Preparedness Plan in Section 11. A summary of triggers for the dewatering inspection are:

- Increasing measurements in total suspended solids at dewatering pump intake or outlet;
- Decrease in the rate of dewatering, when not attributed to a decrease in the pumped volume;
- Instrumentation responses indicating seepage; and
- Increasing measurements in dike displacement such as crest heave/settlement or lateral movements.

7.3.2 Daily and Weekly Routine Inspections

Daily and Weekly Routine Inspections are part of the duties and responsibilities of the Engineering Superintendent, Geotechnical Coordinator, Geotechnical Supervisor and their support personnel and the Environment Superintendent and support personnel and must only be carried out by designated and qualified personnel. Ideally the inspections should be carried out by the same individual or small group in order to maintain continuity in the observations. The main operational and structural parameters should be reviewed and verified by the Engineering Superintendent, Geotechnical Coordinator, Geotechnical Supervisor and the Environment Superintendent.

Daily Routine Inspections are carried out by the geotechnical technicians as they perform their data readings and other daily duties on the dewatering dikes. Technicians are trained to watch for changes in the condition of the dewatering dikes, and report anything out of the ordinary to the geotechnical engineers/geologists so it can be investigated further. Technicians look for any signs of damage to the dikes and monitor seepage conditions daily. Data collected during the Daily Routine Inspections will be summarized on the respective Dewatering Dike Field Inspection Sheets (see Appendix A), and stored in a suitable location for easy accessibility and long-term record keeping.

Weekly Routine Inspections are carried out by the geotechnical engineers and are more detailed than the Daily Routine Inspections. A Weekly Routine Inspection will also occur if a Daily Routine Inspection discovers anything that needs to be investigated further.

The following information should be noted and recorded in the weekly inspection forms to detect signs of wear, damage, or potential loss of structural integrity:

Dike Structure:

- Compliance with minimum freeboard requirements:
- crest elevation; and
- upstream water elevation.

Crest:

- Any indication of cracking or settlement/subsidence;
- Upstream face conditions:
- surface cracking;
- distortion or displacement; and
- wave erosion.

Downstream face conditions:

- cracking;

- distortion or displacement;
- slumping;
- erosion; and
- seepage quantity and quality (turbidity) and wet areas.

Abutments:

- indications of instability;
- erosion at dike – ground surface contact; and
- seepage appearing from abutments (quantity and quality).

Downstream toe of dike:

- seepage quantity and quality (turbidity);
- changes on surface;
- cracking;
- erosion;
- bulging;
- soft wet zones;
- accumulation of fines/silts; and
- ice.

Ditches / Seepage Collection System:

- changes in surface;
- indication of cracking;
- erosion;
- bulging;
- soft wet zones;
- accumulation of fines/silts; and

- ice blockage.

Sumps:

- changes in surface;
- indication of cracking;
- erosion;
- bulging;
- soft wet zones;
- accumulation of fines/silts; and
- ice blockage.

Pumping structures and pipelines:

- leaks; and
- function at capacity.

Seepage:

- rates and location;
- water quality, specifically the presence of fines (turbidity); and
- access.

Other:

- Review of general condition of the access to the Dewatering Dikes, along the Dewatering Dikes crest surface and access to seepage collection system, including sumps and pumping system at the downstream toe;
- Indications of instability (e.g. potholes, slumping or cracks, in the road or path or the cut slopes above them); and
- Accumulations of debris or other materials on the road or paths.

Sample inspection forms are included in Appendix A.

Photographs shall be used to augment the inspection form. As much as possible, these are to be taken from the same vantage points during each inspection so that changes in conditions can be readily identified. Photos should be annotated or captioned and should include a date stamp.

The observations and/or events indicating a trend that are considered “triggers” requiring reference to action items and reporting procedures are outlined in the Emergency Preparedness Plan (see Section 11).

7.3.3 Monthly Routine Inspections

Monthly Routine Inspections form part of the duties and responsibilities of the Engineering Superintendent, Geotechnical Coordinator and Geotechnical Supervisor and must only be carried out by designated and qualified personnel. It is assumed that Monthly Routine Inspections will be carried out by more experienced personnel than the Daily/Weekly Routine Inspections. Ideally the monthly inspections should be carried out by the same individual in order to maintain continuity in the observations. The main operational and structural parameters should be reviewed and verified by the Engineering Superintendent, Geotechnical Coordinator, Geotechnical Supervisor and the Environment Superintendent. Data collected will be summarized on the respective Dewatering Dike Field Inspection Sheet, and stored for easy accessibility and long term record keeping.

The monthly inspection will require the inspector review the same items as in the weekly inspections described above, with the following additional items:

- Review and comment on results of performance monitoring instrumentation; and
- Review operational performance and confirm that the original design assumptions are still valid.

7.3.4 Engineering Inspection

An annual inspection of each of the Dewatering Dikes should be carried out by a qualified engineer. During this inspection, the following dewatering structures will be visited:

- BayGoose Dike;
- East Dike;
- South Camp Dike; and
- Vault dike.

The objective of the inspection is to carry out a detailed review of the conditions of the facilities and facility operations. This will provide information to be used to revise the operation, maintenance and surveillance programs as necessary and to assist in planning for future operation of the facility.

Each inspection should address the following:

- Review of inspections performed during dewatering;
- Review and comment on results of weekly and monthly inspection reports;
- Review and comment on results of performance monitoring instrumentation;

- Review operational performance criteria and confirm that the original design assumptions are still valid; and
- Review and provide recommendations regarding operation, maintenance and monitoring for the following year.

7.3.5 Dam Safety Review

An independent engineer should carry out a dam safety review of the Dewatering Dikes and associated facilities at five year intervals or after:

- Major modifications to the design or design criteria;
- Discovery of unusual conditions that can endanger the dikes;
- After extreme hydrological or seismic events; and
- Decommissioning.

The high consequence failure rating based on the Dam Safety Guidelines (CDA, 2007) suggests a review every seven years. A five year interval is recommended given that the operational life of the East Dike and Bay-Goose Dike is approximately 9 and 8 years, respectively. The review shall be carried out according to the recommendations laid out in the Dam Safety Guidelines (CDA, 2007).

This review will include, but is not be limited to:

- Review of the dikes classification;
- Site inspection;
- Review of design and construction records;
- Review of monitoring practices and the instrumentation records
- Update of the stability assessment based on the results of the instrumentation readings obtained to that time, construction records and site observations;
- Assessment of the operation of the facilities;
- Review of OMS Manual; and
- Review of emergency plan and response plans.

SECTION 8 • MONITORING AND INSTRUMENTATION

Monitoring of the Dewatering Dikes is carried out for the purpose of:

- Environmental monitoring during dewatering and operation;
- Assessing physical stability of the structure during dewatering and operation;
- Assessing overall performance of the dikes; and
- Aiding in design of future dikes.

Monitoring complements the Surveillance of the Dewatering Dikes and should be taken into account in combination with the routine surveillance described in Section 7.0.

Monitoring is divided into the following aspects:

- Drawdown rate and water quality during dewatering;
- Geotechnical instrumentation including piezometers, thermistors, inclinometers, survey prisms, etc.; and
- Seepage rates and water quality during operation.

8.1 DEWATERING – DRAWDOWN RATE AND WATER QUALITY

The water quality criteria for discharge are listed in Nunavut Water Board Water License 2AM-MEA0815 Part D, item 16 and into the Metal Mining Effluent Regulation. The water quality data collection protocols and schedule are included in the Water Management Plan.

8.2 GEOTECHNICAL MONITORING

The existing geotechnical instrumentation is shown in the as-built drawings for each dewatering dike.

Section 3.0 of this document describes the existing geotechnical instrumentation of the Dewatering Dikes.

8.2.1 Data Collection Protocols and Schedule

Upstream and downstream elevations of Second Portage Lake and Third Portage Lake water and ice levels, if applicable, should always be recorded when piezometer readings are recorded and when the survey prisms and monuments are monitored.

The following sections describe the routine geotechnical monitoring program of permanent instrumentation and are summarized in Table 8.1 below.

Table 8.1 Geotechnical Instrumentation Monitoring Program

Instrumentation	Monitored By	Reported To	Frequency during Dewatering	Frequency during Operations
Piezometers	Manually by Engineering Personnel during dewatering; and Automatically during operations (overseen by Engineering Personnel)	Engineering Superintendent	Daily / every 3 hours	Daily / every 3 hours
Slope Incliner Casings	Manually by Engineering Personnel during dewatering; and Manually during operations (overseen by Engineering Personnel)	Engineering Superintendent	Monthly	Monthly in winter, bi-monthly for the rest of the year
Thermistors	Manually by Engineering Personnel during dewatering; and Automatically and Manually during operations (overseen by Engineering Personnel)	Engineering Superintendent	Automatically: Daily / every 3 hours. Manually: Every 3 days in Summer & Weekly in Winter	Automatically: Daily / every 3 hours. Manually: Every 3 days in Summer & Weekly in Winter
Surface Monuments and Surface Prisms	Manually by Engineering Personnel during dewatering; and Manually during operations (overseen by Engineering Personnel)	Engineering Superintendent	Not Operational	Bi-Weekly
Seismographs	Manually by Engineering Personnel during dewatering; and Manually during operations (overseen by Engineering Personnel)	Engineering Superintendent	During blasting at the Portage Pit or Goose Island Pit adjacent to the dikes	During blasting at the Portage Pit or Goose Island Pit adjacent to the dikes

The frequency of monitoring will depend, to some degree, on preceding data and on the state of operation. Thus the data is reviewed regularly and the Engineering Superintendent may change the program and amend the OMS Manual as necessary.

Measurements and a review of all instrumentation shall be carried out immediately after significant seismic or climatic events.

An automatic data acquisition system is used to collect data from the piezometers and thermistors. The automatic data acquisition system includes data loggers and instrumentation cabins along the dikes crest. The data collected is downloaded every three hours. Each cabin is supplied with electricity through solar panels and a backup battery.

The equipment for monitoring is maintained by designated mine personnel. Data analysis, review and correction are carried out by the Engineering personnel and reported to the Engineering Superintendent.

8.2.1.1 Thermistors

Data presentation for the thermistors should include:

- temperature vs. time plots (presenting all thermistor beads on each string); and
- temperature vs. depth plots over time.

The plots should indicate the thermistor string reference number and dates of the measurements. Additionally the plots should also indicate air temperature and, if relevant, lithology and both elevations and depths.

8.2.1.2 Survey Monuments and Prisms

The lake elevation is recorded at the same time the survey monuments and prisms are measured. All survey work must be carried out to a minimum precision of 3 mm.

Data presentation for the survey monuments should include:

- total net movement plots (to present total displacement);
- vertical displacement plots; and
- lateral displacement plots parallel and perpendicular to the dike axis.

The plots should indicate the survey monument number, what is considered positive and negative movement (for example, downstream/upstream, heave/settlement) and the dates of the measurements.

8.2.1.3 Slope Inclinator Casings

The vertical and horizontal position of the top of the inclinometer casing will be recorded by surveying when the slope inclinometers readings are taken. All survey work must be carried out to a minimum precision of 3 mm.

Data presentation for the slope inclinometers should include:

- cumulative displacement plots (to view total displacement);
- incremental displacement plots (to present increasing or accelerating movements between readings);
- cumulative displacement at crest versus time; and

- time plots at zones of identified displacement.

The plots should indicate the slope inclinometer number, what is considered positive and negative movement (for example, downstream/upstream, heave/settlement) and the dates of the measurements. Both elevations and depths should be presented together with the lithology.

8.2.1.4 Vibrating Wire Piezometers

Data presentation for the vibrating wire piezometers should include:

- plots of total head as elevation versus time; and
- plots of temperature versus time for piezometers.

The plots should indicate the vibrating wire piezometers number and dates of the measurements. Additionally the plots should also indicate upstream lake elevation or ice level and, if relevant, lithology and both elevations (referred to the mine datum) and depths.

8.2.1.5 Seismographs

Data presentation for the seismographs should include:

- Weekly summary graph showing peak accelerations registered versus the time when they occurred.

The plots should also indicate the seismograph readout identification, date and location.

8.2.2 Anomalous Instrumentation Data

Anomalous instrumentation data includes the following:

Thermistors:

- Increase or decrease in measurements (over two or more readings) that cannot be explained by seasonal temperature variations;

Survey monuments and prisms:

- Accelerating displacement rate of the survey monuments
(x, y, z directions) (over two or more readings);

Inclinometers:

- Cumulative increases in displacement (greater than 3 cm);

Piezometers:

- Increases or decreases in pore water pressure measurements that cannot be explained by seasonal lake level variations; and

Seismographs:

- Vibrations during a blast are not observed.

If anomalous readings are observed, the following actions should be taken:

- Inspect the dike where possible and appropriate;
- Check data, reductions and calculations for accuracy and correctness;
- Re-read to check the reading;
- Check readout equipment to verify that it is functioning correctly;
- Verify calibration;
- If instrument has stopped functioning, notify the Engineering Superintendent immediately. If considered critical, a replacement instrument should be installed;
- If the anomalous reading is confirmed, a detailed review of the effects of the reading should be carried out and design or remedial actions should be implemented if determined necessary by the Engineering Superintendent; and
- Increase monitoring frequency to assess progression of anomaly.

8.3 SEEPAGE MONITORING - OPERATIONS

Seepage and runoff will be collected and conveyed in drainage ditches at the downstream toe of the East Dike and Bay-Goose Dike to sumps located at topographic lows. The rate of seepage and quality of seepage should be monitored during operations.

8.3.1 Data Collection Protocols and Schedule

The rate of seepage and run-off will be monitored indirectly by monitoring and recording pumping rates. The seepage location and elevation along the face should be noted during inspections. The water quality should be monitored daily by visual observations for sediments (turbidity). Visual inspection should document sediment, ice or snow deposits in the ditches and sumps. The data shall be collected by designated mine personnel and reviewed by the Engineering Superintendent. The Engineering Superintendent may change the sampling frequency and amend the OMS Manual as necessary.

8.3.2 Anomalous Measurements

Anomalous measurements of the seepage may occur and include the following:

- Increase or decrease in pump rates that are inconsistent with rainfall or runoff events;
- Sediments present in the seepage water; and
- Changes in seepage location, flow, and quality.

If anomalous readings are observed, the following action should be taken:

- Inspect the seepage collection area;
- Check data, reductions, and calculations for accuracy and correctness;
- Re-read to check the reading;
- Check readout equipment to verify that it is functioning correctly;
- Verify calibration;
- If instrument has stopped functioning, notify the Engineering Superintendent immediately. If considered critical, a replacement instrument should be installed;
- If the anomalous reading is confirmed, a detailed review of the effects of the increased seepage should be carried out and design or remedial actions should be implemented if determined necessary by the Engineering Superintendent; and
- Increase monitoring frequency to assess progression of anomaly.

SECTION 9 • REPORTING PROCEDURES AND DATA MANAGEMENT

9.1 REPORTING PROTOCOLS

9.1.1 Inspection Documents

All inspection documents and reviews shall be reported to the General Mine Manager, Engineering Superintendent and the Environment Superintendent.

9.1.2 Instrumentation Measurements

All geotechnical instrumentation measurements shall be reported to the Engineering Superintendent. Pumping rates during dewatering and operation shall be reported to the Engineering and Environment Superintendents.

9.1.3 Emergencies

All documents regarding instrumentation and inspections prior to an emergency and during an emergency shall be provided to all parties involved including the General Mine Manager, Engineering Superintendent, Environment Superintendent, and Design Engineer.

9.2 DATA MANAGEMENT

An electronic library or database, which is easily accessible, shall be set up to catalogue and store inspection documents, maintenance reports and instrumentation measurements. Hard copies shall also be catalogued and stored on site. The following will be stored in the hard copy and electronic format:

Dewatering:

- Daily dewatering inspection report; and
- Instrumentation measurements.

Operations:

- Daily routine operating and structural inspection;
- Monthly routine operating and structural inspection;
- Engineering inspection;
- Dam Safety Review;
- Planned and un-planned maintenance reports; and

- Instrumentation measurements.

SECTION 10 • DECOMMISSIONING

10.1 GENERAL

The decommissioning of the dikes will take place progressively as the Dewatering Dikes are breached and the northwest arm of Second Portage Lake and Bay-Goose Basin are allowed to flood.

The main objectives of the decommissioning are:

- Maintain dike stability;
- Meeting applicable water quality objectives;
- Sequential pit flooding in a controlled manner; and
- Maintain 1 m head difference across the East Dike at closure.

10.2 EAST DIKE EMBANKMENTS

The East Dike will remain intact during the controlled flooding of the Portage Pit and Goose Island Pit areas in order to isolate flooded pit waters from Second Portage Lake. The pit areas are flooded gradually over the course of several years. Once the water levels have stabilized within the flooded pit and water quality is considered acceptable for mixing with neighbouring lakes, parts of the other dewatering dikes will be decommissioned to allow circulation of pit water and lake water.

The East Dike will remain, preserving the 1 m difference in elevation between Third Portage Lake and Second Portage Lake.

10.3 SEEPAGE COLLECTION SYSTEM

The sumps and ditches at the downstream toe of the Dewatering Dikes will be flooded at closure. All pumps, pipes, and equipment shall be removed prior to flooding.

10.4 INSTRUMENTATION AND MONITORING

Long-term inspection shall be carried out to ensure the adequate performance of the post-closure facility.

SECTION 11 • EMERGENCY PREPAREDNESS PLAN

The Dam Safety Guidelines prepared by the Canadian Dam Association (2007) states that “A dam which does not impose an unacceptable risk to people or property, and which meets safety criteria that are acceptable to the government, the engineering profession and the public is a safe dam”.

This guiding principle has been taken into account for the design of the dewatering dike embankments and the emergency procedures.

The East Dike and Bay-Goose Dike are rated as “High Consequence of Failure” (CDA 2007) as discussed in Section 1.3. The South Camp Dike and Vault Dike are rated as a “Significant Consequence of Failure” (CDA 2007) as discussed in Section 1.3.

To respond to possible hazards and emergencies involving the dewatering dikes, emergency response plans have been designed. This section provides a summary of the actions, triggers and measures in the event of an emergency.

In case of an emergency, the documents listed in Table 12.1 shall be referenced. The Emergency Response Plan (ERP) shall also be referenced. The Dike Failure Scenario Appendices from the ERP are included in Appendix B.

11.1 EMERGENCY PROCEDURES

The purpose of the Emergency Preparedness Plan (EPP) is to present a basic procedure for responding to potential failure mechanisms. The procedure identifies various measurable or observable effects or causes of the failure mechanisms and identifies the appropriate people to notify. Potential failure mechanisms are summarized in Table 12.2 with potential measurable and observable causes and effects.

11.1.1 Operation

Table 12.3, 12.4, 12.5 and 12.6 summarizes the triggers for implementing the EPP for each of the dewatering dikes with respect to the potential measurable and observable effects or causes of the various failure mechanisms.

Table 12.7 indicates the chain of communication to follow so persons in charge are notified for different states of emergency.

Table 12.8 indicates the responsibilities of persons for each emergency level in terms of who performs the decision making, mobilization, and action to be taken.

Table 12.9 indicates the names and contact numbers of the persons in charge during an emergency event.

11.2 EMERGENCY DETAILS

In the unlikely event of a catastrophic dike breach that could endanger workers the Code 1 procedure described in Section 11.2.4 would be followed to warn all workers of the situation. Then an evacuation of the affected areas and pits would be carried out and directed by the ERT Team in person and over the emergency channel. In the event of an embankment failure, the following information should be used during the emergency response:

<i>Project Name:</i>	Meadowbank Gold Project
<i>Dike Names:</i>	East Dike, Bay-Goose Dike, South Camp Dike, Vault Dike
<i>Owner's Name:</i>	Agnico Eagle Mines Limited (867) 793-4610
<i>Lake Name:</i>	Second Portage Lake /Third Portage Lake /Wally lake
<i>Site Location:</i>	Latitude: 65°01'07"N Longitude: 96°04'26"W

11.2.1 Access to the Project Site

- 80 km north of the Hamlet of Baker Lake
- Site accessible by all-weather private road from Baker Lake.
- Site accessible by aircraft and helicopter.

	Name	Phone Number
Local Charter Company:	Calm Air International Ltd.	Baker Lake : (867) 793-2873
Local Helicopter Company:	Kitikmeot Helicopters Ltd	(867) 983-2544
Charter Aircraft Company:	Nolinor Aviation	(450) 476-0018

11.2.2 Emergency Assessment and Risk Assessment

In case of an event, emergency assessment will be done first by AEM Geotechnical Engineering personnel and the Engineering Superintendent on site. Assessment will be done according to the criteria stated in the Table 12.2 and Table 12.3, 12.4, 12.5, 12.6.

11.2.3 Emergency Communication and Actions

In case of an event, after the emergency assessment, the persons involved in the emergency response team need to be notified following the chain of command stated in Table 12.7. Contact details of each person are available in Table 12.9.

According to the state of the event, decision and action plan will be taken by the persons notified. Action plan will be defined according to the level of emergency and the cause of the event. Immediate action plan will be taken with material and equipment available on site, as listed in Section 11.4.

Table 12.10 is based on Appendix A of the AEM Emergency Response Plan, which describes the risk of failure for East Dike and Bay-Goose Dike and provides contingency or corrective actions for possible failure mechanisms.

Table 12.12 is the risk assessment for East Dike, Bay-Goose Dike, South Camp Dike and Vault Dike. The ratings for the likelihood and consequence of failure have been included for the risk assessment in Table 12.11. The overall risk rating is the product of the likelihood and consequence ratings. The overall risk rating of the structure for the identified failure mechanism can then be determined. The controls which are in place can potentially reduce the overall risk rating.

11.2.4 Site Emergency Procedure

As specified in the Emergency Response Plan, Ver. 9, Section 4:

In the event of an immediate emergency that is or could impact persons or equipment, the employee will have to follow our emergency procedure:

- Emergency is initiated - by calling **6911** on desk type phones, or calling on two-way radio on **"Working Channel" – Code 1 – Code 1 – Code 1**.
- All communication stops except for those involved with the Emergency – i.e.: First Aid Room attendants, Medics, ERT as required.
- All work stops in First Aid Room / Clinic – and in affected area – depending on seriousness of Emergency – the whole site.
- First Aid Room Attendant / Medic will answer the phone and/or radio.
Note: if the First Aid Room Attendant / Medic do not answer, then Security Guard will answer and/or a Supervisor on radio will answer so that Emergency Response can be initiated.
- **Responder** – will ask where the medic is required.
- **Caller** – will give a brief description of the Emergency – name, location and what is wrong and/or required.
- **Responder** – will confirm location and details of incident and activate the **ERT** team. Security will be notified by responder and a page will be sent out to all **ERT** team members on site. (All **ERT** team members on site now carry pagers).
- The person at the casualty(s) will administer First Aid if trained to do so.
- Incident Commander Center will be immobilized as to ensure that communications, transportation, and effective deployment of **ERT** resources are conducted. It is mandatory that the Official In-Charge be notified immediately.
 - ❖ Transportation will be arranged to meet at the **ERT** hall by the two large doors for medical gear and **ERT** team members.

The **ERT** team (minimum of 6 team members) will assemble as quickly as possible. (Expectation – when the pager goes off – all **ERT** team members will make their way expediently to the **ERT** hall).

11.2.5 Communication Equipment Location

Communication equipment can be found at the following locations *(to be updated if required)*:

- 3 phone land lines are located in the main office;
- Base station radios are located in the main office;
- Drills will have either base station radios or handhelds—depending on their distance from camp and will have satellite phones available; and
- Emergency Communication Plans (including emergency contact numbers) are located adjacent to all phones and radios and in each drill.

11.3 MEDICAL AND FIRST AID SERVICES

In case of injury the medic and First Aid station are located in the Service Building. The first aid channel on the radio is 1. The nearest hospital is located in Baker Lake.

Health Center: Baker Lake Health Center Phone #: (867) 793-2816
(867) 793-2817

11.4 ON SITE EQUIPMENT AND MATERIAL

11.4.1 Pumping Equipment

The following is a list of onsite pumping equipment available for use during an emergency event:

Unit Number	Description	Model
61PWA01	Dewatering pump #1	Godwin model HL250M
61PWA02	Dewatering pump #2	Godwin model HL250M
61PWA03	Dewatering pump #3	Godwin model HL250M
61PWA04	Dewatering pump #4	Godwin model HL250M
61PWA05	Dewatering pump #5	Godwin model HL250M
61PWA06	Dewatering pump #6	Godwin model HL250M
61PWA07	Pit Dewatering pump #7	Godwin model CD80M
61PWA08	Pit Dewatering pump #8	Godwin model CD80M
61PWA09	Dike Dewatering pump #9	Godwin model CD100M
61PWA10	Dike Dewatering pump #10	Godwin model CD103M
61PWA11	Dike Dewatering pump #11	Godwin model CD103M

61PWA12	Dike Dewatering pump #12	Godwin model CD103M
61PWA13	Pit Dewatering pump #13	Godwin model HL5MS
61PWA14	Pit Dewatering pump #14	Godwin model HL5MS
61PWA15	Bay-Goose Seepage dewatering pump #9	Godwin model CD103M
61PWA16	Bay-Goose Seepage dewatering pump #10	Godwin model CD103M
61PWA17	Bay-Goose Seepage dewatering pump #11	Godwin model CD103M
61PWA18	Bay-Goose Seepage dewatering pump #12	Godwin model CD103M

Note: To be updated as required

11.4.2 Mobile Equipment

The following are lists of onsite mobile equipment of AEM and SANA available for use during an emergency event:

AEM Mobile Equipment List (to be updated as required)

MODEL	EQUIP #	MODEL	EQUIP #	MODEL	EQUIP #	MODEL	EQUIP #	MODEL	EQUIP #	MODEL	EQUIP #	MODEL	EQUIP #
LOADING		HAULING		DEWATERING PUMP		PICKUP		PICKUP		FROST FIGHTER		TRAILER	
307 (SS)	BAC03	777F	HTR01	HL250M	PWA01	F-350	PCK01	F-250	PCK53	IDF-350	HEA01	TANKER (SS)	TRL01
330D (SS)	BAC04	777F	HTR02	HL250M	PWA02	F-350	PCK03	F-250	PCK54	ALMAND MH-1000	HEA02	B DUMP (SS)	TRL03
345D	BAC05	777F	HTR03	HL250M	PWA03	F-350	PCK04	F-250	PCK55	ALMAND MH-1000	HEA03	LOW BED (SS)	TRL04
385C	BAC06	777F	HTR04	HL250M	PWA04	F-350	PCK05	F-250	PCK56	ALMAND MH-1000	HEA04	LOW BED (SS)	TRL05
345DL	BAC07	777F	HTR05	HL250M	PWA05	F-350	PCK06	F-250 (SS)	PCK57	ALMAND MH-1000	HEA05	F. TANK (SS)	TRL06
PC1250	BAC08	777F	HTR06	HL250M	PWA06	F-350	PCK08	F-250	PCK58	IDF-350	HEA06	F. TANK (SS)	TRL07
390	BAC09	777F	HTR07	CD80M	PWA07	F-350	PCK09	F-250	PCK59	IDF-350	HEA07	L BODY (SS)	TRL08
RH120	BAC10	777F	HTR08	CD80M	PWA08	F-350	PCK10	F-250	PCK60	IDF-350	HEA08	FIRE PUMP TRL	TRL09
RH120	BAC11	773E	HTR09	CD100M	PWA09	F-350	PCK11	F-250 (SS)	PCK61	IDF-350	HEA09	DISPATCH COM	TRL10
CAT6030	BAC13	777F	HTR11	CD103M	PWA10	F-350	PCK12	F-250	PCK62	IDF-350	HEA10	DISPATCH COM	TRL11
IT14G (SS)	LOA01	777F	HTR12	CD103M	PWA11	F-350	PCK14	F-250	PCK63	IDF-350	HEA11	DISPATCH COM	TRL12
IT14G	LOA02	777F	HTR14	CD103M	PWA12	F-350	PCK15	F-250	PCK64	IDF-350	HEA12	DISPATCH COM	TRL13
992G	LOA03	773D	HTR15	HL5MS	PWA13	F-350	PCK16	F-350	PCK65	IDF-350	HEA13	DISPATCH COM	TRL14
992G	LOA04	785B	HTR20	HL5MS	PWA14	F-350	PCK17	F-550	PCK66	IDF-350	HEA14	DISPATCH COM	TRL15
420E (SS)	LOA05	785B	HTR21	HL125M	PWA16	F-350	PCK18	F-250	PCK67	IDF-350	HEA15	DISPATCH COM	TRL16
966H (SS)	LOA06	785B	HTR22	HL125M	PWA17	F-250	PCK19	F-250	PCK69	IDF-350	HEA16	DISPATCH COM	TRL17
TC44H (SS)	LOA08	785D	HTR23	FUSION		F-250	PCK20	F-250 (SS)	PCK70	IDF-350	HEA17	DISPATCH COM	TRL18
966H (SS)	LOA09	785D	HTR24		FUS01	F-250	PCK21	F-250	PCK71	IDF-350	HEA18	DISPATCH COM	TRL19
980H (SS)	LOA10	785D	HTR25		FUS02	F-350	PCK22	F-250	PCK72	IDF-350	HEA19	DISPATCH COM	TRL20
420E	LOA11	785C	HTR26	TRUCK		F-350	PCK23	F-250	PCK73	IDF-350 (SS)	HEA20	DISPATCH COM	TRL21
980H	LOA12	785C	HTR28	T800	TRK01	F-250	PCK24	F-250	PCK74	IDF-350 (SS)	HEA21	STEAMER (SS)	TRL22
992K	LOA13	785D	HTR29	TRUCK (SS)	TRK05	F-250	PCK25	F-450	PCK75	IDF-350 (SS)	HEA22	TOWHAUL TRL	TRL25
980K	LOA15	785D	HTR30	FRD WATER (SS)	TRK07	F-250 (SS)	PCK26	F-250	PCK76	IDF-350 (SS)	HEA23	F. TANK	TRL27
IT14G	LOA16	DRILL		SEPTIC (SS)	TRK08	F-250 (SS)	PCK27	FORK LIFT		IDF-350 (SS)	HEA24	GENIE	
DOZER		DM45E	RBD01	CEMENT (SS)	TRK11	F-250	PCK28	HYSTER RH35 (SS)	FKL02	IDF-350 (SS)	HEA25	GS3232	SCIO5
D8T	DOZ01	DM45E	RBD02	Truck (SS)	TRK12	F-250	PCK29	CAT (WH)	FKL03	IDF-350 (SS)	HEA26	S85 (SS)	SCIO6
D9T	DOZ02	DM45E	RBD03	TRUCK (SS)	TRK13	F-250 (SS)	PCK30	CAT	FKL05	MOBILE TANK	MFT01	Z-45/25	SCIO7
D8R (SS)	DOZ03	DM45E	RBD04	FUEL	TRK14	F-250	PCK31	CAT (SHOP)	FKL06	LIGHT TOWER		Z-45/25 (SS)	SCIO8
D9T	DOZ05	CM785	RBD05	GARBAGE (SS)	TRK15	F-250 (SS)	PCK32	740DR321T	FKL07	AL5080D	LGT01	S85 (REN07)	SCIO9
D9T	DOZ06	DML	RBD06	FIRE TRUCK	TRK16	F-250	PCK33	ETDR40TT	FKL08	L-20	LGT02	S85	SCIO11
D9T	DOZ07	DML	RBD07	FUEL	TRK17	F-250	PCK34	HYSTER	FKL09	L-20	LGT03	S85	SCIO12
834H	DOZ08	DML	RBD08	S.Plw (SS)	TRK18	F-250 (SS)	PCK35	CAT 1255C	FKL10	L-20 (SS)	LGT04	S125	SCIO13
D6T (SS)	DOZ09	BUS		S.Plw (SS)	TRK19	F-250 (SS)	PCK36	CAT R80	FKL11	L-20	LGT05	S125 (SS)	SCIO14
GRADER		H77 (SS)	BUS01	Fountain Tire	TRK20	F-250	PCK37	CRANE		L-20	LGT06	32' (SS)	SCIO15
16H (SS)	GRA01	E-350 (SS)	BUS02	Service	TRK21	F-250	PCK38	120T (SS)	MCR01	L-20	LGT07	32' (SS)	SCIO16
160H (SS)	GRA02	E-350 (SS)	BUS03	LUBE TRUCK	TRK22	E-350	PCK39	80T (SS)	MCR02	L-20	LGT08	SKID STEER	
16M	GRA03	VAN E350	BUS04	SHOP	TRK23	F-250	PCK40	35T (SS)	MCR03	LTC4	LGT09	262C	SKD01
16M	GRA04	32006-S (SS)	BUS05	FUEL	TRK24	F-250 (SS)	PCK41	25T (SS)	MCR05	LTC4	LGT11	753	SKD02
16M	GRA05	(SS)	BUS09	Service Truck	TRK25	F-250	PCK42	200T (SS)	MCR06	LTC4	LGT12	262C	SKD03
HAMMER		E-350	BUS06	LUBE TRUCK	TRK26	F-350	PCK43	MULE		LT5000-4MH SS	LGT18	262C	SKD04
V56	HAM01	27-May-10	BUS08	CEMENT	TRK27	F-250	PCK44	OBSOLETE	VSE01	HYSTER HANDLER		SNOW BLOWER	
V56	HAM02	INTER PB105	BUS10	PUMP	TRK28	F-350	PCK45	Mule	VSE02	GTH844	TPA01	SNOW BLOWER	SBL01
GENSET			BUS11	FUEL	TRK29	F-250	PCK46	Mule (SS)	VSE05	GTH844	TPA02	SNOW BLOWER	SBL02
GEH220-2	GEN26		BUS12	WATER	TRK30	F-250	PCK47	Mule	VSE06	HR45 (SS)	TPA03	SNOW BLOWER	SBL03
D200P3	GEN27	COMPACTOR		Service Truck	TRK31	F-250	PCK49	Kubota	VSE08	1056C (SS)	TPA04	COMPRESSOR	
ATV			CPT01	LUBE TRUCK	TRK32	F-250	PCK50	Kubota (SS)	VSE12	1056D (Hw)	TPA05		COM01
	ATV02	(SS)	CPT02	FIRE TRUCK	TRK33	F-250 (SS)	PCK51	Kubota	VSE13	BOAT ENGINE		SULLAIR	COM02
	ATV03	EMERGENCY VEHICLE		MECHANICAL SERVICE TRUCK		F-450 WH	PCK52	WELDING MACHINE			ENG56	QGD25 QINCY	COM03
	ATV05	SNOWCAT	SNC01	SERVICE	WMM02			400D	SMD01		ENG57	2545 IR	COM04
								WITH AIR PACK	SMD02			2545 IR	COM05
								500P W/T AIR	SMD03				

SANA Mobile Equipment List (to be updated as required)

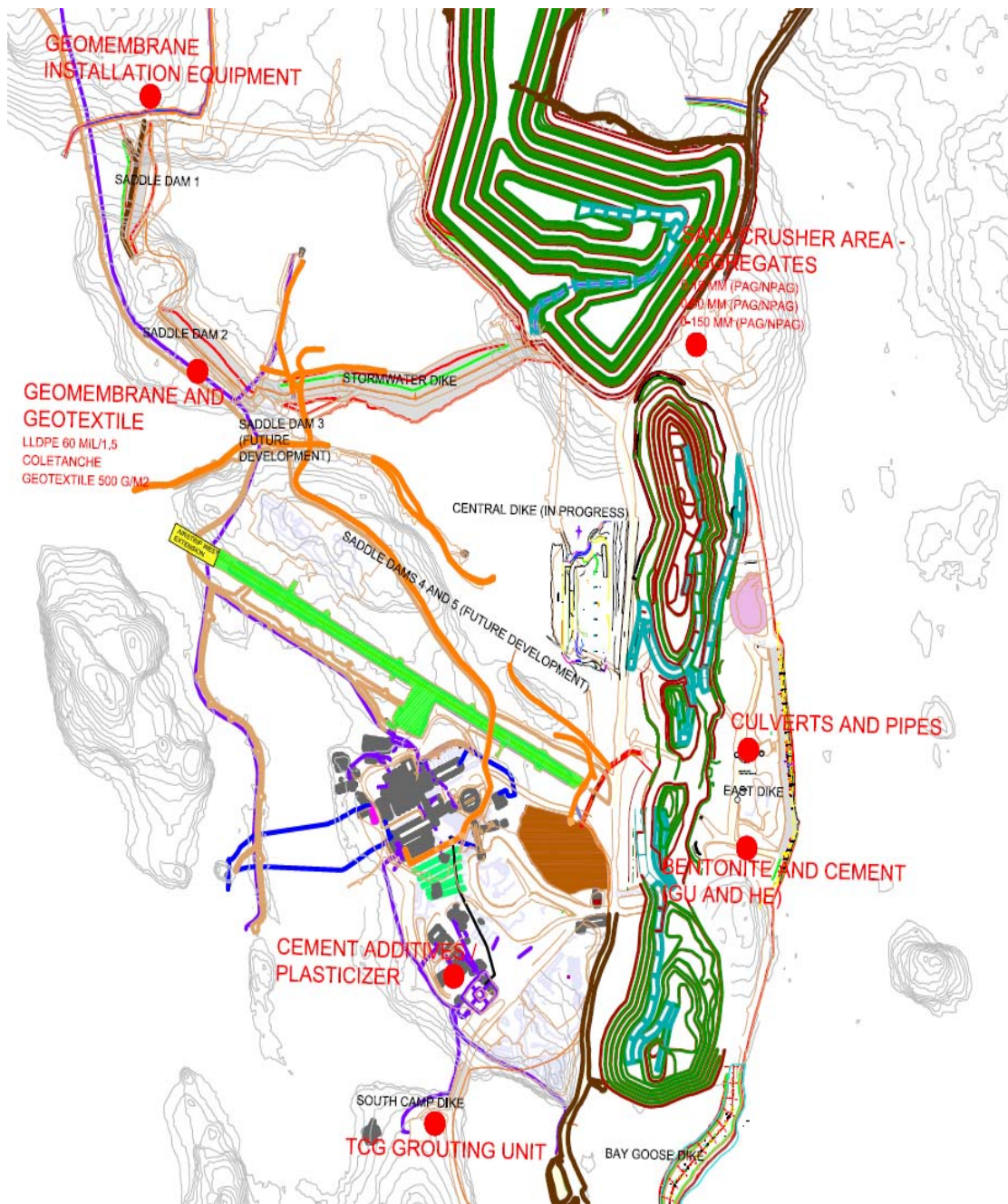


Equipment	Model	Number
Excavator	CAT 345	3
Excavator	Komatsu 1250	1
50 T Haul trucks	CAT 773F	5
Bulldozer	D8	1
Loader	CAT 980	3
Loader	CAT 906	1
Loader	Komatsu Wa600	2
Compactor	CAT 10T	1
Compactor	Hamm 20T	1
Fuel trucks		2
Water trucks		2
Drills	Novamac	2
Compressors	Various	5
Welding machine	Various	3

11.4.3 Earthwork Material and Equipment

The following map presents the earthwork material, including geomembrane and cement, available on site in case of an emergency.

Figure 13 Earthwork Material and Equipment Location



SECTION 12 • EMERGENCY RESPONSE REFERENCE DOCUMENTS

Table 12.1 Emergency Response Reference Documents

Document	Current Revision
Emergency Response Plan	Updated by AEM. Version 9, November 2014
Emergency Preparedness Plan	In Dewatering Dikes OMS Manual, Version 5, January 2016

Note: To be updated as required

Table 12.2 Potential Effects or Causes of Failure Mechanisms

Failure Mechanism	Potential Measurable and Observable	
	Causes	Effects
Overtopping	(1) Lake level rise. (2) Dam crest settlement	Increase of seepage leading to erosion of downstream foundation soils and associated crest settlement.
Internal Erosion	(1) Loss of cut-off wall/liner at construction defects in cut-off wall/liner, Core Backfill and filter. (2) Loss of bentonite from cut-off wall at defect in construction (3) Loss of till foundation at defect in dike section.	Sinkhole observable at crest Slower lake drawdown during dewatering Increase in seepage pumping rate during operations Increase in pore water pressures downstream of cut-off wall/liner Increase in turbidity / suspended solids of seepage
Seepage Within Embankment	Increase in seepage rate due to cut-off wall/liner failure	Increased seepage water handling. Not likely to compromise stability of dike.
Seepage Within Foundation	Un-observable defects in cut-off/liner construction.	High flow during initial dewatering or shortly thereafter.
Internal Conduit Rupture	Not applicable	Not applicable
Slope Instability	(1) ice or wave forces, or traffic on crest, seepage, weakness of foundation soils (2) Earthquake seismic event or blasting (3) Pit wall failure	Increase in settlement and/or settlement rate Increase in displacement and/or displacement rate of dike toe Cracks along the dike crest Sloughing of the face Bulging of dike toe Disruption of seepage collection ditch

Failure Mechanism	Potential Measurable and Observable	
	Causes	Effects
Failure of Cut-off Wall/Liner Due to Movement of the Dike (Cut-off wall/liner lateral movement)	Differential horizontal movement of dike due to water or ice loading, pit wall stability, excessive dike settlement Seepage.	Large inflows associated with a breach in the dike. Increase in lateral deformation or increase in rate of deformation in slope inclinometer reading Increase in pore water pressure downstream of cut-off wall/liner Increase in pumping rate Dislocation, cracks, settlement localized above or adjacent to cut-off wall/liner
Unexpected settlements	Consolidation of foundation soils or dike fills	Overtopping in extreme case large settlement of cut-off wall/liner.

Table 12.3 Threshold Criteria during Operation for East Dike

		Threshold Criteria During Operation			
		Green Acceptable Situation	Yellow Areas of concern	Orange High Risk Situation	Red Emergency Situation
Criteria	Downstream toe displacement, sloughing or bulging	None visible	Visible displacement or bulging	Toe displacement related to a sloughing slide from near downstream crest to 5 m from centreline Bulging > 1 m in height	Toe displacement related to a sloughing slide reaching 5 m from centreline Bulging greater than 4m in height
	Tension crack along downstream rockfill embankment (more than 3 m from centreline)	Within 7 m of the downstream crest edge and < 0.1 m deep and < 3 m length along the dike	Within 10 m of the downstream crest edge and > 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack along upstream rockfill embankment (more than 3 m from centreline)	< 0.1 m deep and < 3 m length along the dike	> 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack within 3 m each side of the cutoff wall at crest (upstream or downstream)	None visible	< 0.1 m deep or < 0.1 m wide	> 0.1 m deep or > 0.1 m wide	> 0.1 m deep or > 0.1 m wide
	Sinkhole on crest	Not visible	> 5 m outside from centreline	Within 5 m from centreline	Within 5 m from centreline
	Cut-off wall lateral cumulative deformation (based on survey monument)	None	<0.05 m	> 0.05 and 0.10 m	> 0.10 m
	Cut-off wall lateral cumulative deformation (based on inclinometer)	None	< 0.05 m	> 0.05 m and < 0.10 m	> 0.10 m
	Lake elevation	< 134.1 masl	> 134.1 and < 134.8 masl	> 134.8 and < 135.6 masl	> 135.6 masl
	Pore water pressure (based on piezometers)	Pore water pressure measurements stable or decreasing.	Increasing trend in pore water pressure downstream of cut-off wall.	Anomalous trends (sharp increase) in pore water pressure downstream of cut-off wall.	Anomalous trends (sharp increase) in pore water pressure downstream of cut-off wall.
	Temperature variation along centreline (based on thermistors and piezometers)	Temperature measurement stable and similar variation at surface from previous years.	Increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer
	Seepage through dike (excluding Freshet water)	< 3,000 m ³ /day	>3,000 m ³ /day and <6,000 m ³ /day and / or turbidity in the water	> 6,000 m ³ /day and < 20,000 m ³ /day and / or turbidity in the water	> 20,000 m ³ /day <i>Condition where the seepage inflow is rapidly increasing and projected to soon exceed pumping capacity</i>
Action Required		- Instrumentation monitoring and visual inspection according to frequency set out in OMS manual. - Possibility of a mitigation plan to be evaluated by Engineering Department.	- Increased instrumentation monitoring frequency, particularly in area of concern. - Document location, photograph, survey, and increase inspection and monitoring in area of concern. - Identify potential cause - Implement engineering review.	- Suspend activities on dike crest at area of concern - Increased instrumentation monitoring frequency, particularly in area of concern. - Document location, photograph, survey, and increase inspection and monitoring in area of concern. - Plan and take appropriate mitigation measures with engineering review. (Use as reference contingency measures for different scenarios proposed by AEM (See Table 12-9)). - Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items.	- Temporary evacuation of personnel and equipment from pit and suspension of activities. - Update planning and take appropriate mitigation with engineering review.
Personnel Notified		Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 12.4 Threshold Criteria during Operation for Bay-Goose Dike

		Threshold Criteria During Operation			
		Green Acceptable Situation	Yellow Areas of concern	Orange High Risk Situation	Red Emergency Situation
Criteria	Downstream toe displacement, sloughing or bulging	None visible	Visible displacement or bulging	Toe displacement related to a sloughing slide from near downstream crest to 5 m from centreline and bulging > 1 m in height	Toe displacement related to a sloughing slide reaching 5 m from centreline Bulging greater than 4m in height
	Tension crack along downstream rockfill embankment (more than 3 m from centreline)	Within 7 m of the downstream crest edge and < 0.1 m deep and < 3 m length along the dike	Within 10 m of the downstream crest edge and > 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack along upstream rockfill embankment (more than 3 m from centreline)	< 0.1 m deep and < 3 m length along the dike	> 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack within 3 m of either side of the cutoff wall at crest	None visible	< 0.1 m deep or < 0.1 m wide	> 0.1 m deep or > 0.1 m wide	> 0.1 m deep or > 0.1 m wide
	Sinkhole on crest	Not visible	> 5 m outside from centreline	Within 5 m from centreline	Within 5 m from centreline
	Cut-off wall lateral cumulative deformation (based on survey monument)	None	<0.05 m	> 0.05 and 0.10 m	> 0.10 m
	Cut-off wall lateral cumulative deformation (based on inclinometer)	None	< 0.05 m	> 0.05 m and < 0.10 m	> 0.10 m
	Lake elevation	< 135.1 masl	> 135.1 and < 135.8 masl	> 135.8 and < 136.1 masl	> 136.1 masl
	Pore water pressure (based on piezometers)	Pore water pressure measurements stable or decreasing.	Increasing trend in pore water pressure downstream of cut-off wall.	Anomalous trends (sharp increase) in pore water pressure downstream of cut-off wall.	Anomalous trends (sharp increase) in pore water pressure downstream of cut-off wall.
	Temperature variation along centreline (based on thermistors and piezometers)	Temperature measurement stable and similar variation at surface from previous years.	Increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer
	Seepage through dike at toe (excluding Freshet water)	< 300 m ³ /day	>300 m ³ /day and <1,000 m ³ /day and / or turbidity in the water	> 1,000 m ³ /day and < 2,000 m ³ /day and / or turbidity in the water	> 2,000 m ³ /day <i>Seepage inflow is rapidly increasing and projected to soon exceed pumping capacity</i>
	Seepage through dike in North Channel area	< 150 m ³ /day	>150 m ³ /day and <500 m ³ /day and / or turbidity in the water	> 500 m ³ /day and < 1,000 m ³ /day and / or turbidity in the water	> 1,000 m ³ /day <i>Seepage inflow is rapidly increasing and projected to soon exceed pumping capacity</i>
	Seepage through dike in pit (excluding Freshet water, estimated visually)	Slow trickle of water along pit walls, easily handled by regular pit sumps	Steady stream of water along pit walls, easily handled by regular pit sumps	Large quantity of water flowing down the pit walls, cannot be easily handled by regular pit sumps, mining activities are impacted	Water flowing down the walls cannot be handled by regular pit sumps and has markedly increased in flow rate and quantity, mining activities are disrupted.
Action Required		- Instrumentation monitoring and visual inspection according to frequency set out in OMS manual. - Possibility of a mitigation plan to be evaluated by Engineering Department.	- Increased instrumentation monitoring frequency, particularly in area of concern. - Document location, photograph, survey, and increase inspection and monitoring in area of concern. - Identify potential cause - Implement engineering review.	- Suspend activities on dike crest at area of concern - Increased instrumentation monitoring frequency, particularly in area of concern. - Document location, photograph, survey, and increase inspection and monitoring in area of concern. - Plan and take appropriate mitigation measures with engineering review. (Use as reference contingency measures for different scenarios proposed by AEM (See Table 12-9)). - Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items.	- Temporary evacuation of personnel and equipment from pit and suspension of activities. - Update planning and take appropriate mitigation with engineering review.
Personnel Notified		Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 12.5 Threshold Criteria during Operation for South Camp Dike

		Threshold Criteria During Operation			
		Green Acceptable Situation	Yellow Areas of concern	Orange High Risk Situation	Red Emergency Situation
Criteria	Downstream toe displacement, sloughing or bulging	None visible	Visible displacement or bulging	Toe displacement related to a sloughing slide from near downstream crest to 5 m from centreline Bulging > 1 m in height	Toe displacement related to a sloughing slide reaching 5 m from centreline Bulging greater than 4m in height
	Tension crack along downstream rockfill embankment (more than 3 m from centreline)	Within 7 m of the downstream crest edge and < 0.1 m deep and < 3 m length along the dike	Within 10 m of the downstream crest edge and > 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack along upstream rockfill embankment (more than 3 m from centreline)	< 0.1 m deep and < 3 m length along the dike	> 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Sinkhole on crest	Not visible	> 5 m outside from centreline	Within 5 m from centreline	Within 5 m from centreline
	Lake elevation	< 135.6 masl	> 135.6 and < 136.3 masl	> 136.3 and < 136.6 masl	> 136.6 masl
	Temperature variation within foundation (based on thermistors)	Temperature measurement stable and similar variation at surface from previous years.	Increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer
	Seepage through dike (excluding Freshet water)	< 300 m ³ /day	>300 m ³ /day and <1,000 m ³ /day and / or turbidity in the water	> 1,000 m ³ /day and < 2,000 m ³ /day and / or turbidity in the water	> 2,000 m ³ /day <i>Condition where the seepage inflow is rapidly increasing and projected to soon exceed pumping capacity</i>
Action Required		- Instrumentation monitoring and visual inspection according to frequency set out in OMS manual. - Possibility of a mitigation plan to be evaluated by Engineering Department.	- Increased instrumentation monitoring frequency, particularly in area of concern. - Document location, photograph, survey, and increase inspection and monitoring in area of concern. - Identify potential cause - Implement engineering review.	- Suspend activities on dike crest at area of concern - Increased instrumentation monitoring frequency, particularly in area of concern. - Document location, photograph, survey, and increase inspection and monitoring in area of concern. - Plan and take appropriate mitigation measures with engineering review. - Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items.	- Temporary evacuation of personnel and equipment from pit and suspension of activities. - Update planning and take appropriate mitigation with engineering review.
Personnel Notified		Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Dike Review Board, Discuss at MDRB Meeting.	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 12.6 Threshold Criteria during Operation for Vault Dike

		Threshold Criteria During Operation			
		Green Acceptable Situation	Yellow Areas of concern	Orange High Risk Situation	Red Emergency Situation
Criteria	Downstream toe displacement, sloughing or bulging	None visible	Visible displacement or bulging	Toe displacement related to a sloughing slide from near downstream crest to 5 m from centreline Bulging > 1 m in height	Toe displacement related to a sloughing slide reaching 5 m from centreline Bulging greater than 4m in height
	Tension crack along downstream rockfill embankment (more than 3 m from centreline)	Within 7 m of the downstream crest edge and < 0.1 m deep and < 3 m length along the dike	Within 10 m of the downstream crest edge and > 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Tension crack along upstream rockfill embankment (more than 3 m from centreline)	< 0.1 m deep and < 3 m length along the dike	> 0.1 m and < 1.0 m deep	> 1.0 m deep	> 1.0 m deep
	Sinkhole on crest	Not visible	> 5 m outside from centreline	Within 5 m from centreline	Within 5 m from centreline
	Lake elevation	< 141.5 masl	> 141.5 and < 142.2 masl	> 142.2 and < 142.5 masl	> 142.5 masl
	Temperature variation within foundation (based on thermistors)	Temperature measurement stable and similar variation at surface from previous years.	Increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer	Continuous increasing trend in temperature below the active layer
	Seepage through dike (excluding Freshet water)	< 300 m ³ /day	>300 m ³ /day and <1,000 m ³ /day and / or turbidity in the water	> 1,000 m ³ /day and < 2,000 m ³ /day and / or turbidity in the water	> 2,000 m ³ /day <i>Condition where the seepage inflow is rapidly increasing and projected to soon exceed pumping capacity</i>
Action Required		- Instrumentation monitoring and visual inspection according to frequency set out in OMS manual. - Possibility of a mitigation plan to be evaluated by Engineering Department.	- Increased instrumentation monitoring frequency, particularly in area of concern. - Document location, photograph, survey, and increase inspection and monitoring in area of concern. - Identify potential cause - Implement engineering review.	- Suspend activities on dike crest at area of concern - Increased instrumentation monitoring frequency, particularly in area of concern. - Document location, photograph, survey, and increase inspection and monitoring in area of concern. - Plan and take appropriate mitigation measures with engineering review. - Reassess thresholds and conditions for red category (emergency situation) taking into account the changing conditions presently observed and interactions of various items.	- Temporary evacuation of personnel and equipment from pit and suspension of activities. - Update planning and take appropriate mitigation with engineering review.
Personnel Notified		Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Geotechnical Supervisors, Geotechnical Coordinator, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 12.7 Communication Charts for Each Emergency Level

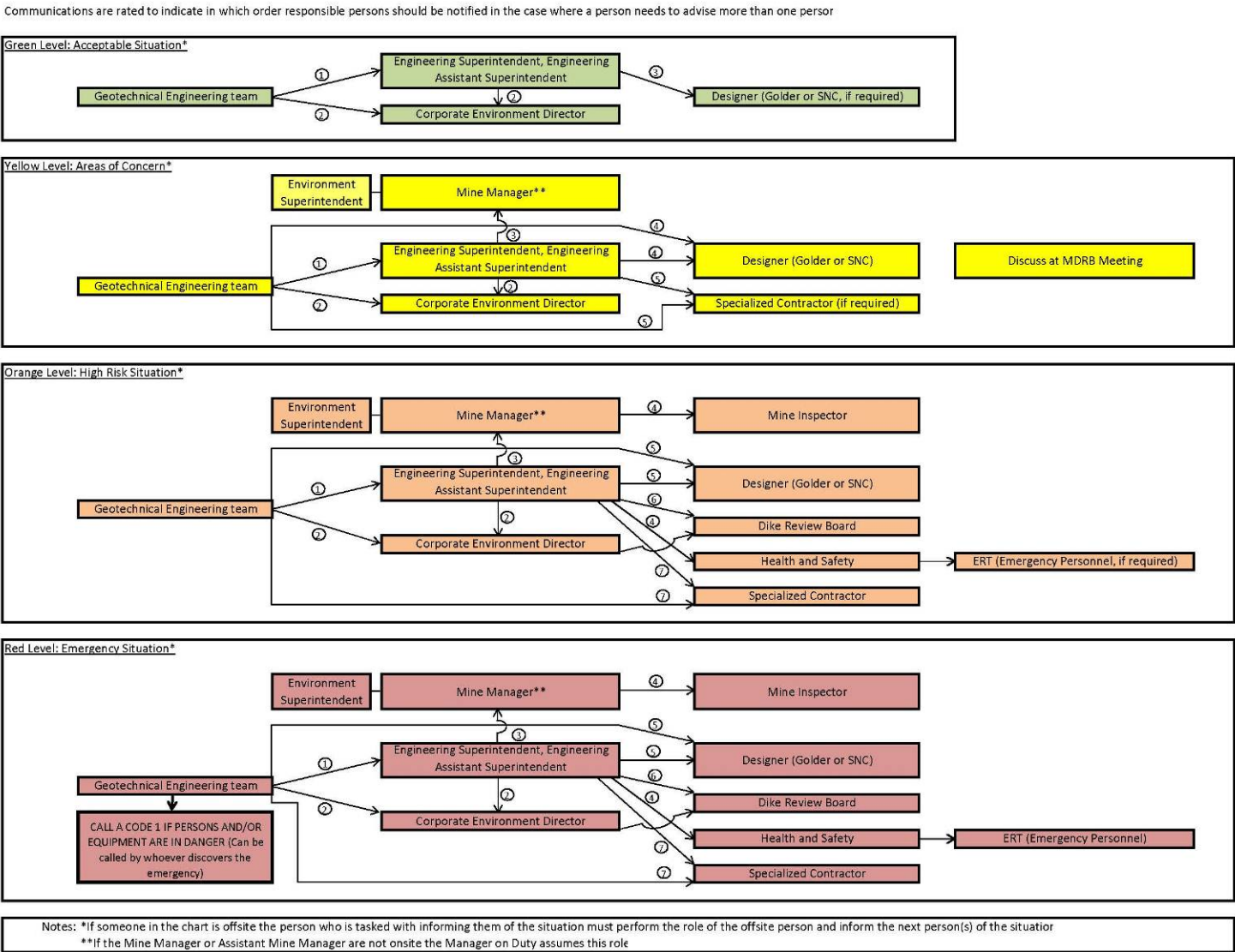


Table 12.8 Responsibilities of Persons for Each Emergency Level

	Decision Making	Mobilization	Performing the Action to be Taken
Green Acceptable Situation	Geotechnical Supervisors	Geotechnical Supervisors	Geotechnical Team*
Yellow Areas of Concern	Geotechnical Supervisors, Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC)	Geotechnical Supervisors, Geotechnical Coordinator	Geotechnical Team* Specialized Contractor (if required)
Orange High Risk Situation	Geotechnical Supervisors, Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety (if required)	Geotechnical Supervisors, Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent	Geotechnical Team* Specialized Contractor ERT (if required)
Red Emergency Situation	Geotechnical Supervisors, Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety	Geotechnical Supervisors, Geotechnical Coordinator Engineering Superintendent Engineering Assistant Superintendent Superintendent Mine Manager Health and Safety	Geotechnical Team* Specialized Contractor ERT

*The Geotechnical Team consists of the Geotechnical Coordinator, Geotechnical Supervisors, the Dewatering and Pit Geotechnical Engineer/Technician, Tailings & Water Management Engineers, and the Geotechnical Technicians.

Table 12.9 Names and Contact Details

Internal Emergency Response Contact Information Chart		
Position	Name/Location	24-Hour Contact #
Geotechnical Supervisors	Patrice Gagnon	Ph: 819-759-3555 ext. 6726 cell: 418-376-0975
	Rebecca Cousineau	Ph: 819-759-3555 ext. 6726 cell: 647-888-7856
Geotechnical Coordinator	Thomas Lepine	Ph: 819-759-3555 ext. 6837 cell: 418-473-8077
Engineering Superintendent	Julie Belanger	Ph: 819-759-3555 ext. 6721 cell: 819-856-1667
Engineering Assistant Superintendent	Pierre McMullen	Ph: 819-759-3555 ext. 6721 cell: 819-860-2556
General Superintendent – Mine Operations	Martin Beausejour	Ph: 819-759-3555 ext. 6767 cell: 819-355-2913
Corporate Environment Director	Gonzalo Rios	Ph: 604-608-2557 ext. 6537 cell:
Designer (Golder or SNC)	Golder Burnaby: Dan Walker, Fiona Esford Golder Montreal: Yves Boulianne, Annie Beaulieu	Burnaby Office: 604-296-4200 Montreal Office: 514-383-0990
	SNC: Jean-Francois St-Laurent, Yohan Jalbert, Simon Beaulieu	Quebec City Office: 418-621-5500
Specialized Contractor	SANA (FGL Group)	Onsite Ph: 819-759-3555 ext. 6963 Ph: 418-615-0559
Environment Superintendent	Kevin Buck / Jamie Quesnel	Ph: 819-759-3555 ext 6838 Cell: 819-651-2974
Mine Manager	Bertin Paradis	Ph: 819-759-3555 ext. 6725 cell: 819-355-9348
	Luc Chouinard (asst.)	Ph: 819-759-3555 ext. 6725 cell:
Dike Review Board	Anthony Rattue Norbert Morgenstern Don Hayley	anthony.rattue@bell.net norbertm@ualberta.ca don.hayley@icloud.com
Mine Inspector	Martin VanRooy	Martin.vanRooy@wscc.nu.ca
Health and Safety	Normand Ladouceur	Ph: 819-759-3555 ext. 6720 cell: 819-860-6258
	Yves Levesque (asst.)	Ph: 819-759-3555 ext. 6720 cell: 819-856-9051
ERT (Emergency Personnel)	Emergency response personnel available on site to assist with spill and emergency response activities	Coordinated by the Emergency Measures Counsellor
Incident Commander	André Rouleau	Ph: 819-759-3555 ext. 6809 cell: 819-355-2191 Code 1

	Normand Ladouceur	Ph: 819-759-3555 ext. 6720 cell: 819-860-6258 Code 1
Emergency Measures Counsellor	André Rouleau	Ph: 819-759-3555 ext. 6809 cell: 819-355-2191
Health Professionals / Medical Clinic	Medical Clinic 1	Ph: 819-759-3555 ext. 6734
	Medical Clinic 2	Ph: 819-759-3555 ext. 6751
AEM Management Representative	Bertin Paradis	Ph: 819-759-3555 ext. 6725 cell: 819-355-9348
Human Resource Superintendent	Dominic Richard	Ph: 819-759-3555 ext 6723 cell:

Table 12.10 Emergency Response Summary for East Dike and Bay-Goose Dike

Concern	Area		Failure Likelihood	Comments/Monitoring	Contingency or Corrective Action
Overtopping and Subsidence	1a	Lake level rise because of restricted outflow from Third Portage or Second Portage Lake (excessive inflow is a far less likely scenario)	Low	Lake levels and crest elevations should be monitored as part of daily safety information provided to mine management. Outflow channels should be inspected during thaw, open water season and during ice break-up.	The crest is wide and comprises coarse rockfill. Significant damage to the dike is not credible, based on performance of other rockfill structures subjected to overtopping or flow through events. Mining operations may need to be suspended, but there will be considerable warning time given the design freeboard and the storage volume within the lakes.
	1b	Dam crest settles more than 2 m	Low	This scenario requires extensive loss of support in the foundation since the rockfill of the dikes is essentially not settlement prone itself after construction and dewatering. For foundation settlement of this magnitude to occur, a piping event must develop or there is unexpected layer of compressible soil in the foundation. A foundation investigation was carried out prior to construction. The situation would develop slowly with crest settlement evident at least several weeks before a run-away event develops. Easily observed cracks should be evident. Monitoring of the crest settlement should be conducted routinely.	The crest is wide and comprises of coarse rockfill. Significant damage to the dike is not credible, based on performance of other rockfill structures subjected to overtopping or flow through events Rockfill and till available from the mining operations can be placed to raise the dike crest. Mining operations may need to be suspended, but there will be considerable warning time given the slow development of the scenario.
	1c	Wave action	Low	Wide beach, large freeboard and wide rock dam crest zone makes this a low concern	If large wave action is observed, can add rip-rap and/or raise dam crest
Internal Erosion	2a	Dike Section: Cut-off wall is defective, allowing high water flow. This defect occurs at a location where the core allows high flows and where the fills are defective; the combination allows erosion of the cut-off and/or the Core Backfill.	Low	The cut-off wall and/or core backfill will develop a progressively increasing void ratio, thereby increasing the rate of water flow through the dike. This is not a catastrophic failure mode as the rockfill will be stable and at its worst would lead to temporary suspension of mining.	Monitor seepage from downstream face for rate of seepage and for presence of sediment in seepage. Will become evident as localized intensive seepage at dike toe and can be repaired. May also see settlement in the core or cut-off wall near the filter. Will be most likely in deepest section. Gradients across the core in shallow water may not be high enough to cause piping.
	2b	Dike Section: Cut-off wall loses bentonite because of improper construction	Low	The cut-off wall will develop progressively increasing voids, thereby increasing the rate of water flow through the dike. This is not a catastrophic failure mode as the rockfill will be stable and at its worst would lead to temporary suspension of mining.	Monitor seepage from downstream face for rate of seepage and for presence of sediment in seepage. Will become evident as localized intensive seepage at dike toe and can be repaired. May also see settlement in the core near the filter. Will be most likely in deepest section. Gradients across the core and cut-off in shallow water may not be high enough to cause piping.
	2c	Foundation till is possibly non-uniform with more transmissive zones and not self-filtering. It is possible that one of these zones may align with defective construction of the cut-off wall allowing high flows. Seepage would lead to erosion of the cut-off into the downstream rockfill. Seepage could also erode the foundation tills at the downstream toe or into the downstream rockfill because of the lack of filtering.	Low	Limited seepage at the toe or into the rockfill would accelerate in to a large inflow, and could lead to the undermining of the dike if no action was taken. This is a credible catastrophic mode if increased seepage is not detected in time. No particular instrumentation is needed as this failure mode will show itself as localized and increasing seepage. It could be detected by walk-over inspection by an experienced engineer or technician.	Remedial action could comprise a reverse filter and rockfill buttress depending on location of the flow and configuration of the foundation, freezing or grouting, if identified in time. In the worst case, the pit may be deliberately flooded in a controlled manner, the cut-off repaired and the pit dewatered. Build additional dike downstream increasing pumping.

Concern	Area		Failure Likelihood	Comments/Monitoring	Contingency or Corrective Action
Seepage	3a	Within the Embankment	Low	Seepage on its own is not a credible failure scenario. The downstream rockfill shell has extremely high flow through capacity. The rockfill zone is both large and pervious, so that seepage will not daylight and lead to instability. Any seepage related failures must include internal erosion.	No credible consequences. May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage.
	3b	Within the Foundation	Medium	Defective construction of cut-off leading to transfer of unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation, or leading to a piping event as described in internal erosion(2c). If this mechanism arises it should show itself during initial dewatering or very shortly thereafter.	This failure mechanism has caused embankment failures elsewhere because of straightforward pore water pressure induced instability. However it is unclear that it could cause failure of the dike because of the large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm before the crest could be reinstated.
Structural - Slope Instability	4a	Normal Operation: Slope Failure	Low	The rockfill shoulders of the dike are wide and have high shear strength, making it a conservative design. Slope failure requires failure in the foundation and which would extend into the overlying dike. Sliding failure is considered unlikely given the low horizontal forces generated by the water and ice relative to the normal frictional force due to the weight of the dikes and the frictional angles of foundational materials. This mechanism should develop during construction or dewatering, due to the increase in load and associated pore water pressure development. Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dike by trained inspector is an appropriate monitoring strategy in addition the instrumentation. Survey of crest face and toe should also be conducted.	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rockfill should not necessarily compromise the water retaining function of the dike. Slope failures which reach the core may cause dam failure. Stabilizing berms can be placed at the downstream toe of the dike.
	4b	Earthquake Induced: Slope Failure	Low	Site is located in a low seismic zone. Dam consisting of massive rock zone has a low sensitivity to seismic motion.	In the event a seismic event produced cracks, construction material and equipment will be available for rapid response.
	4c	Erosion; washout, ice scour	Low	Crest – minimum 50 m section, Downstream – large quarry rock face.	Monitor – if any erosion is observed place additional mine rock
Structural – Lateral Movement	5a	Failure of Cut-off Wall	Low	Differential horizontal movement of the dike due to dewatering, water or ice loading or pit wall failure may create a breach in the cut-off wall. Ice and water forces are not credible due to the ratio of frictional forces generated by the self weight of the dike versus ice loads and water pressure. Pit wall failure unlikely based on assessments of pit wall stability. Large inflows through the breach may occur as a consequence if the cut-off wall breached. Pit would flood requiring suspension of mining activities. Potential for loss of life of workers inside dikes. Inclinometer, settlement prism and monument monitoring should be done routinely.	If the pit floods, then repairs to cut-off would be done prior to dewatering.
Subsidence	6	Foundation Soils	Low	Unexpected foundation soils consolidated during dike construction or dewatering. A significant quantity of clay would be required to generate settlement resulting in a water release event. Settlement of the core zone will be limited by dynamic compaction. Prism and monument monitoring should be done routinely.	A 2 m core settlement would be required to allow water to flow through the rockfill and over the settled cut-off. This flow would not cause failure of the rockfill shells. It would also be readily repaired by excavating rockfill above the cut-off wall and placing more till. Soil conditions will be observed during dewatering to accommodate actual conditions.

Concern	Area		Failure Likelihood	Comments/Monitoring	Contingency or Corrective Action
Premature Closure	7	Corporate Bankruptcy or Early Resource Depletion	Low	Bond is provided for this eventuality. Design of rehabilitation is the same as rehabilitation at closure of project.	Pumping will be suspended and the downstream area allowed to flood. The East Dike and Bay-Goose Dike will be monitored to meet closure requirements.
Pump and Pipeline Failure	8	Pumping from Sumps to Process Plant	Medium	Freezing protection is provided by heat tracing and insulation. Pipelines monitored pump pressures at plant and frequent site inspection.	Sump designed for expected seepage capacity. Pumping equipment designed for 1 in 25 year storm events and average freshet. Redundant lines (Minimal interruption to Process Plant operation).

Table 12.11 Risk Matrix

Likelihood:			Consequence :						
			HIGH						
			Catastrophic 5	MEDIUM		LOW			
				Major 4	Significant 3	Minor 2	Insignificant 1		
Almost Certain	HIGH	5	25 (very high risk)	20	15	10	5		
Likely			MEDIUM	4	20 (high risk)	16 (high risk)	12	8	4
Possible					LOW	3	15	12	9 (medium risk)
Unlikely	2	10	8	6			4 (low risk)	2	
Rare		1	5	4			3	2	1 (very low risk)

Table 12.12 Risk assessment for East Dike, Bay-Goose Dike, South Camp Dike and Vault Dike

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
Overtopping	Lake level rise because of restricted outflow (e.g., blockage of outlet from Second Portage Lake).	LOW – 2 Temporary ice jam occurring at the outlet is possible for a short duration in the spring. The cutoff wall and liner system provide adequate freeboard above normal lake level.	Water spilling over the crest. Erosion of the dike abutment and / or downstream foundation	LOW - 2 The crest is wide and comprises coarse rockfill. Significant damage to the dike is unlikely based on design.	Routine monitoring of lake levels. Outflow channels should be inspected regularly just before and during the thaw and ice break-up (freshet).	If an obstruction is present, clear blockage at outlet. Develop action plan based on conditions encountered.	4
	Lake level rise because of excessive inflow.	LOW – 2 Due to the large surface area of the lakes, a large volume of water is required to cause a significant increase in the lake elevation. The cutoff wall and liner system provide adequate freeboard above normal lake level.	Water spilling over the crest. Erosion of the dike abutment and / or downstream foundation	LOW - 2 The crest is wide and comprises coarse rockfill. Significant damage to the dike is unlikely based on design.	Routine monitoring of lake levels.	Develop action plan based on conditions encountered.	4
	Settlement of the cutoff wall system. (NOT APPLICABLE TO SOUTH CAMP DIKE OR VAULT DIKE)	MED – 3 The cutoff wall system is founded on or close to bedrock reducing potential for the foundation, and in turn the cutoff wall, to settle. Some settlement of the soil bentonite may be expected. The maximum depth of the soil bentonite cutoff wall is typically such that settlement exceeding the minimum freeboard is unlikely.	Water spilling over the crest. Erosion of the dike abutment and / or downstream foundation.	MED - 3 The crest is wide and comprises coarse rockfill. Significant damage to the dike is unlikely based on design.	Survey of cutoff wall to detect and quantify settlement. Routine monitoring of lake levels.	Till available from the mining operation could be placed above the cutoff wall if significant settlement occurred. (Note – all material over cut-off wall would need to be excavated (i.e. thermal cap, grouting platform))	9
	Settlement of the rockfill embankment over a significant width of the crest.	EAST DIKE BAY-GOOSE DIKE LOW – 2 Adequate rockfill freeboard has been provided such that settlement in excess of the freeboard is not anticipated. Settlement can only occur where lakebed soils were left underneath the rockfill embankment but the majority of the settlement is anticipated to have occurred during construction since additional fill was placed to bring to design elevation. The East Dike has had additional maintenance as it was operated as a haul road.	Potential erosion of upstream filters and cutoff for BG and ED. Potential exposure to wave action (see below in wave action section).	MEDIUM - 3 The hydraulic barrier, cutoff wall system, remains in place. Wave erosion of the cutoff system unlikely due to the presence of surrounding granular material.	Monitoring of Rockfill settlement	Rockfill available from the mining operation can be placed to raise the crest height, if settlement occurs.	6
	Settlement of the rockfill embankment over a significant width of the crest.	SOUTH CAMP DIKE VAULT DIKE LOW – 1 Existing monitoring of the dike within the foundation shows that it remains frozen throughout the year; therefore, thawing of foundation material is unlikely to happen, but in the event it does happen, it will allow settlement of the rockfill.	Potential exposure to wave action (see below in wave action section).	LOW - 2 The hydraulic barrier, liner system, remains in place. Additional water will flow towards the open pit and mining infrastructures.	Routine monitoring of the foundation's temperature.	Develop an action plan to add low hydraulic conductivity barrier if flow is not manageable.	2
	Wave Action	LOW – 2 Adequate freeboard is provided by the rockfill crest elevation. A wide rockfill crest which is erosion resistant reduces potential impact to the cut-off wall/liner.	Water spilling over the crest. Erosion of the dike abutment and / or downstream foundation	LOW - 2 Wave erosion of the cutoff wall system unlikely due to the presence of surrounding granular filter system.	Monitor wave height during storm events or periods of strong winds.	Rockfill can be placed to raise the crest height, if necessary.	4

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
Internal Erosion (piping)	Erosion of the cutoff wall. If a component of the cutoff wall is defective allowing high water flow through the structure. This defect could potentially erode the cutoff wall. (NOT APPLICABLE TO SOUTH CAMP DIKE OR VAULT DIKE)	MEDIUM HIGH – 4 The soil bentonite has the potential to be eroded under high hydraulic gradients. Although erosion of the downstream foundation soils could potentially occur in association with erosion of the cutoff wall, the width of the rockfill embankment, thickness of soils, and hydraulic head significantly reduce the likelihood of failure. The granular materials within the dike have been designed to be filter compatible reducing the risk for erosion. This mechanism is more likely to occur during dewatering or shortly thereafter. EAST DIKE: As the East Dike has been dewatered since 2010, the likelihood of further deterioration is less. BAY-GOOSE DIKE: The cement content of the cement soil bentonite and jet grout should reduce its potential for erosion. A layer of erodible material (e.g. silt) at the base of the cutoff wall / bedrock contact, was identified and jet grouted to reduce erosion potential. Other areas of erodible material may still exist beneath the cutoff wall. Two areas at Bay-Goose Dike (Sta. 30+230 to 03+350 and Sta. 30+795 to 30+850) have a higher risk for flow through the cutoff wall because the more rigid cement soil bentonite was placed over softer, more deformable soil bentonite. A gap at the interface due to differential settlement or cracking of the cement soil bentonite is possible. The zone between Sta. 30+230 and 30+350 is considered at greater risk. The Bay-Goose design has included a filter blanket downstream of the cutoff wall to reduce internal erosion of the cut-off wall.	Increased seepage, through the dike core evident as localized intensive seepage at the dike toe or beyond. Settlement of the cutoff wall or dike crest, most likely in deep water sections with higher gradients.	MEDIUM HIGH - 4 This is not likely to be a catastrophic failure mode as the filter material and rockfill embankments of the dike will remain stable. Additional seepage would come into the pit as the seepage collection system is not designed for such inflow. Could lead to the undermining of the dike if no action was taken and significant erosion of the foundation soils on the downstream side of the dike occurred. Loss of containment may result. Potential economic loss due to cessation/suspension of mining. BAY-GOOSE DIKE: High seepage leading to erosion is more likely to occur during dewatering when the pit has not been developed. The high seepage rate would delay the start of mining, with financial implication. With no pit development, minimal health and safety risk to personnel are expected.	Monitor seepage flow for rate and volume, and for presence of sediment in seepage (turbidity). Monitor piezometric and thermistor data for signs of increased flow through the cutoff wall and change in piezometric pressures. Monitor dike crest for signs of sinkholes or settlement. Increased seepage, evident as localized flow at the dike toe or beyond, in particular in topographic lows along the dike alignment	Based on conditions encountered, develop an action plan. This could include grouting, compaction grouting, and/or the installation of a downstream filter blanket.	16
	BAY-GOOSE DIKE ONLY: Erosion of the foundation (primarily applies where initial excavation was terminated above bedrock). Seepage flows through / between the jet grout columns, along sand and gravel zones within the till, and through potential erodible material. The foundation tills may be eroded into the downstream rockfill or through fractures in the bedrock.	MEDIUM-4 The potential for gaps within the jet grout columns exist and allow for flow. The cement content of the jet grout columns should reduce the columns potential for erosion. Till is non-uniform with discontinuous layers / lenses of sand and gravel, and erodible material (i.e. silt layers) that may not be self-filtering. For erosion to occur, the seepage through or between the jet grout columns would need to connect with a permeable zone (e.g. zone of sand and gravel) which in turn needs to be in close proximity to a zone of erodible material that can be removed and the seepage forces need to be sufficient to cause the erosion. If this mechanism arises, it should show itself during initial dewatering or very shortly thereafter. May result in slower lake drawdown.	Increased seepage, evident as localized intensive seepage at the dike toe or beyond.	MEDIUM HIGH-4 This is a significant failure mode if increased seepage is not detected in time. Undermining of the dike could lead to overall failure of the structure and flooding within the open pit resulting in cessation of mining and economic loss. Could lead to the undermining of the dike if no action was taken and significant erosion of the foundation soils on the downstream side of the dike occurred. Loss of containment may result.	Monitor seepage flow for rate and volume, and for presence of sediment. Monitor piezometric and thermistor data for signs of increased flow through the foundation and change in piezometric pressures. Monitor dike crest for signs of sinkholes, settlement or slope instability. Monitor inclinometers.	Remedial action could comprise grouting, a reverse filter on downstream and rockfill buttress, depending on location of the flow and configuration of the foundation. In the extreme, the dewatered areas may be deliberately flooded in a controlled manner, the cutoff wall repaired, and then dewatered.	16

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
	Interconnected open fractures in the bedrock that permit foundation material or cutoff wall material to be lost. (NOT APPLICABLE TO SOUTH CAMP DIKE OR VAULT DIKE)_	MEDIUM – 3 High hydraulic gradients exist at the base of the cutoff wall and potentially within the bedrock, especially along deeper areas of the dike. Grouting was conducted to reduce the permeability of the bedrock and contact zone. There is, however, a potential that bedrock fractures were initially infilled with silt prior grouting. This silt may erode once a hydraulic gradient is imposed and thereby form a pathway for either foundation soil or soil bentonite cutoff wall material to erode. Large setback of dike from pit crest in some parts increases the seepage path thereby reducing the hydraulic gradient imposed. BAY-GOOSE DIKE The cement content of the cement soil bentonite and jet grout reduces potential erodability and was used in the deepest portions of the dike.	Increased seepage, initially evident downstream of the dike or within the pit wall.	HIGH - 5 This is a catastrophic failure mode if increased seepage is not detected in time. Could lead to the undermining of the dike if no action was taken and significant erosion of the foundation soils on the downstream side of the dike occurred. Loss of containment may result. This could lead to flooding within the open pit of the mine and a cessation of mining.	Monitor seepage flow for rate and volume, and for presence of sediment (turbidity). Monitor piezometric and thermistor data for signs of increased flow through the foundation and change in piezometric pressures. Monitor dike crest for signs of sinkholes, settlement or slope instability. Monitor inclinometers.	Grouting of the fractured bedrock. Deep bedrock grouting. In shallower areas, grouting or freezing. Installation of downstream filter blanket, stability berm.	15
	Erosion along instrumentation installed within the cutoff wall system. (NOT APPLICABLE TO SOUTH CAMP DIKE OR VAULT DIKE)	LOW – 1 Preferential flow paths may exist along the edge of vertical instrumentation conduits (thermistors, inclinometers, grout casings) due to inadequate sealing. Preferential seepage path of precipitation and melt water are potential sources of water which can flow down along the edge of the conduits. Erosion caused by precipitation and melt water is very unlikely due to the small volume of water. If this mechanism arises, it should show itself during initial dewatering or very shortly thereafter.	Gradual erosion of the SOIL BENTONITE material adjacent to the instrumentation.	LOW – 2 This is not a catastrophic failure mode as the filter material and rockfill embankments of the dike will remain stable.	Monitor seepage flow for rate and volume, and for presence of sediment. Monitor piezometric and thermistor data for signs of increased flow through the foundation and change in piezometric pressures. Monitor dike crest for signs of sinkholes, settlement or slope instability.	Replacement of the instrumentation and sealing of the annular space.	2
High Seepage rates with no internal erosion	Through the Dike Section (including bedrock contact) : <u>EAST DIKE DIKE:</u> Increase in hydraulic conductivity of the dike's cutoff wall system resulting in high seepage flow through the structure. <u>BAY-GOOSE DIKE:</u> Increase in hydraulic conductivity of the dike's cutoff wall system (cutoff wall and jet grout columns) resulting in high seepage flow through the structure. <u>SOUTH CAMP DIKE AND VAULT DIKE:</u> Punctured or torn liner which will likely increase flow through the structure.	MEDIUM – HIGH– 4 This seepage on its own is not a failure scenario. Seepage-related failures must include internal erosion (see above). Interface between different material exist and could lead to seepage with preferential paths (bedrock contact and for Bay-Goose dike: cement soil bentonite over soil bentonite material and potential gaps between jet grouting columns) If this mechanism arises it should show itself during initial dewatering or very shortly thereafter.	Increased seepage water handling.	MEDIUM -3 May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage. The downstream rockfill shell is both large and pervious and has an extremely high flow through capacity. <u>EAST DIKE AND BAY-GOOSE DIKE:</u> The large filter zone combination of core backfill and coarse filter are filter compatible and would maintain the structural integrity of the dike.	Monitor seepage flow for rate and volume, and for presence of sediment (turbidity).	Upgrade seepage collection system and increase pump capacity. Investigate and delineate high permeability zone. Installation of downstream filter blanket, stability berm	12

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
	Through the bedrock: Fractures in the bedrock results in increased seepage into the pit.	MEDIUM - 3 Seepage on its own is not a failure scenario. <u>EAST DIKE AND BAY-GOOSE DIKE:</u> Extensive bedrock grouting within the dike foundation reduces the likelihood for seepage at shallow depths. If this mechanism arises it should show itself as the pit advances with depth. <u>SOUTH CAMP DIKE AND VAULT DIKE:</u> Existing monitoring show that foundation material and bedrock beneath the structure is frozen throughout the year.	Increased seepage through the pit wall.	LOW – 1 No significant consequences for the dike itself. May require upgrade of the seepage collection system. May result in increased inflows into the pit, and the potential cessation of mining with resulting financial loss.	Monitor seepage flow for rate and volume, and for presence of sediment (turbidity).	Installation of dewatering / depressurization wells to remove water before it reaches the pit. Deep bedrock grouting. In shallower areas, grouting or freezing.	3
Slope Instability (rotational or slip or sliding failure on the upstream and downstream side)	Failure through the dike and/or foundation. Concentrated seepage and elevated pore pressures may result in weakening of the foundation.	LOW -2 The rockfill embankments have high shear strength. For slope failure to be a concern, it requires failure in the foundation which would then extend into the dike. Failure through the rockfill embankments will not necessarily compromise the water retaining element of the dike. Sliding failure is considered unlikely given the low horizontal forces generated by water and ice forces relative to the normal frictional force due to the weight of the dike and the friction angles of foundation materials. Limited available information on soil properties for dike stability analysis. This mechanism should develop during construction or dewatering, due to increase loads and associated pore water pressure.	Sloughing of the face Large seepage / inflow only if instability resulted in loss of the cutoff wall system.	HIGH - 5 If failure were to occur it is likely to be through the lakebed soils affecting the rockfill embankments Failure which reaches the core may cause overall failure of the structure, leading to flooding within the open pit of the mine and a cessation of mining. Potential for loss of life for workers downstream of the dike. Limited access along the dike until repaired.	Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dike by a trained inspector. Monitoring for bulging of dike toe. Survey of the dike crest, face, and toe. Slope inclinometer monitoring of the cutoff wall. Monitor piezometric and thermistor data for signs of increased flow through the foundation and change in piezometric pressures.	Stabilizing berms can be placed upstream and/or downstream of the dike. Installation of downstream filter blanket, buttress	10
	Excessive Vibration Due to blasting within the pit; or due to the occurrence of an extreme earthquake.	LOW -2 The extreme earthquake loading for this site is of low magnitude. The East Dike setback of dike from pit crest reduces the vibration caused by blasting. The Bay-Goose Dike setback of dike from pit crest reduces the vibration caused by blasting. Rockfill structures are designed to resist against wave created by earthquake. <u>EAST DIKE AND BAY-GOOSE DIKE:</u> Dynamic compaction of the core during construction likely subjected the rockfill shells to accelerations equivalent to the expected earthquake loading and blasting vibration. Excessive vibration is unlikely to cause failure through the rockfill. The vibration may result in increased pore pressures within the foundation soils, weakening the foundation. This may cause failure in the rockfill but is unlikely to extend into the cutoff wall system.	Settlement of the dike could occur in the event of large vibrations. Increase in displacement and/or displacement rate of dike toe Sloughing of the face. Large seepage / inflow only if instability resulted in loss of the cutoff wall system.	MEDIUM - 4 If failure were to occur it is likely to be through the lakebed soils affecting the rockfill shell. Limited access along the dike until repaired. Although unlikely, failure which reaches the core / liner may cause overall failure of the structure, leading to flooding within the open pit of the mine and a cessation of mining. Potential for loss of life for workers downstream of the dikes.	Survey of the dike crest, face, and toe. Dike inspection following larger than anticipated vibrations and earthquakes. Blast vibration monitoring Monitoring for bulging of dike toe. Look for cracks along the dike crest.	In the event the vibration produced cracks, monitor and assess the situation, and develop a remediation plan.	8

Failure Mechanism	Cause	Likelihood Rating	Effect	Consequence Rating	Controls		Overall Risk Rating
					Monitoring	Corrective Action	
	Pit wall instability that extends towards the dike and causes instability of the dike (NOT APPLICABLE TO SOUTH CAMP DIKE AND VAULT DIKE)	EAST DIKE: LOW -2 BAY-GOOSE DIKE: MEDIUM -3 Pit wall failure unlikely based on assessments of pit wall stability and setback. East Dike setback is greater than Bay-Goose Dike setback; therefore, it is viewed that the likelihood rating would be different for each structure. The respect of the setback established from pit crest. East Dike has a large setback from the pit crest, and therefore a low probability that pit instability will affect the dike. The Bay-Goose Dike setback from the pit crest is less than East Dike, and therefore has a higher probability that pit instability will affect the dike.	Increase in displacement and/or displacement rate of dike toe. Large seepage / inflow only if instability resulted in loss of the cutoff wall system.	HIGH-5 If the instability impacted the cutoff wall system of the dike, then failure of the entire structure could result. Cessation /suspension of mining operations would have already occurred due to significant pit wall instability or failure.	Slope inclinometer monitoring of the cutoff wall. Survey of the dike crest and visual inspection. Pit wall stability monitoring. Visual observation related to cracks along the dike crest.	Depressurization of pit walls. Draining of lakebed soils between pit crest and dike and/or removal of these materials. Cut back slopes of pit wall and soils to unload the crest. Adjustment of mine plan, if necessary. Develop action plan to stabilize the instable pit wall area.	EAST DIKE 10
		BAY-GOOSE DIKE 15					
Failure of cutoff wall	BAY-GOOSE DIKE ONLY: Excessive vibration from overblasting or earthquake above design could potentially damage the cement soil bentonite and/or jet grout columns resulting in cracks or fissures.	LOW-2 The vibration may result in increased pore pressures within the foundation soils, weakening the foundation. This may cause failure in the rockfill but is unlikely to extend into the cutoff wall system. Refer to internal erosion as a failure mechanism if cracks lead to internal erosion. It is anticipated that the soil bentonite material would deform such that cracks would not be produced.	Increased seepage water handling.	MEDIUM HIGH-4 May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage. The cement content within these portions of the wall should reduce the erodability of the wall and therefore protect the integrity of the dike, even though seepage rates would increase.	Monitor seepage flow for rate and volume, and for presence of sediment (turbidity). Blast vibration monitoring on the dikes. Monitoring inclinometers within the cutoff wall.	Upgrade seepage collection system and increase pump capacity. Develop action plan related to potential grouting in cutoff wall fractured zone.	8
Failure of the liner system	SOUTH CAMP DIKE AND VAULT DIKE ONLY: Settlement of the foundation material	LOW-2 In the unlikely event of thawing of the foundation material beneath the liner, settlement of the dike's foundation material will increase tension in liner, and potentially tear the liner	Increased seepage water handling.	LOW-2 No significant consequences for the dike itself. May require upgrade of the seepage collection system.	Monitor seepage flow for rate and volume. Monitor thermistor data for signs of increased flow through the foundation.	Upgrade seepage collection system and increase pump capacity. Installation of downstream filter blanket, buttress Develop mitigation plan to decrease seepage through the structure	4
Premature Closure	Corporate Bankruptcy or Early Resource Depletion	LOW-2	Pumping will be suspended allowing the downstream area to flood (Note – long term closure plan is for flooding to occur). No or limited monitoring of dikes.	LOW-2 Bond is provided for this eventuality. Design of rehabilitation is the same as rehabilitation at closure of project. Before mining operations could resume any water downstream would need to be pumped out and assessment of performance would need to be done.	Environmental monitoring to ensure closure requirements are met.		4

SECTION 13 • REFERENCES

Table 13.1 References

No.	Title	Document Centre Reference
1	AEM 2012. South Camp Dike Construction Summary Report. March 2012.	
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8	Golder 2003. Summary Report on Spring 2003 Field Geotechnical Studies, Meadowbank Project, Nunavut. September 8. Doc. No. 208	
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13	Golder 2009a. Bay-Goose Dike and South Camp Dike Designs. Meadowbank Gold Project, Nunavut. February 2. Doc. No. 802 Ver. 0.	
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15	Golder 2009c. 2009 Annual Geotechnical Inspection - Meadowbank Gold Project. November 30. Doc. No. 969 Ver. 0.	
16	Golder 2009d. East Dike Additional Details for Work Carried Out Between Stations 60+452 and 60+500. Meadowbank Gold Project. November, 2009. Doc. No. 961 Ver. 0.	
17	Golder 2009e. East Dike Construction As-Built Report Meadowbank Gold Project, Nunavut. December 15. Doc. No. 900 Ver. 0 Rev. 1.	
18	Golder 2009f. West Channel Dike Construction As-Built Report Meadowbank Gold Project, Nunavut. December 16. Doc. No. 980 Ver. 0.	
19	Golder 2010a. East Dike Sinkhole Investigation Program, October-November 2009, Meadowbank Gold Project. March 5 2010. Doc. No. 986 Ver. 0.	
20	Golder 2010. Draft of South Camp Construction As-built report. No. 1037 Ver. B. Meadowbank Gold Project. 22 April 2010	
21	Golder 2010b. East Dike CPT Investigation - Meadowbank Gold Project, Nunavut. July 22. Doc. No. 953 Ver. 0.	
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No.	Title	Document Centre Reference
23	Golder 2011a. Draft of 2011 Annual Geotechnical Inspection. Meadowbank Gold Project, Nunavut. November 21 2011. Doc. No. 1305 Ver. B.	
24	Golder 2013. Bay Goose Dike Construction As-Built Report Meadowbank Gold Project. Meadowbank Gold Project, Nunavut. April 2013. Doc. No. 1328 Ver. 0.	
25	ICOLD (International Congress of Large Dams) 1998. Dam Failures and Statistical Analysis. Bulletin 99.	
26	MAC (Mining Association of Canada) 2005. Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities.	
27	MMC (Meadowbank Mining Corporation) 2014. Emergency Response Plan. November. Ver. 9	
28	SNC 2013a. Detailed Engineering of Vault Dike. Meadowbank Gold Project, Nunavut. January 14. Doc. No. 610548-2020-4GER-0001 Ver. 0.	
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Appendix A

Inspection Forms

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



All parts of this inspection form should be completed. Adverse conditions should be described and location stated. Additional information and relevant photographs should be attached.

Inspecting Officer	Choose an item.
Report No.	
Inspection Date	12/12/2014

Dam	☐	
Dike	☐	
Crest Elevation (m)		
Reclaim Water Elev. (m)		

Last Inspection Date											
Weather during the current inspection	C°	Sunny	☐	Overcast	☐	Rain	☐	Snow	☐	Wind	☐
Main changes occurred since the last inspection	Comments:										

TABLE OF CONTENT

DOWNSTREAM SLOPE AREA	2
UPSTREAM SLOPE AREA	3
DOWNSTREAM BERMS:	4
UPSTREAM BERMS	5
CREST SURFACE	6
DAM / DIKE INSTRUMENTATION	7
GENERAL CONDITION SUMMARY	8
RECOMMENDATIONS	8
APPENDIX I : PLAN	9
APPENDIX II : PHOTOGRAPHS	10

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



DOWNSTREAM SLOPE AREA

	<i>Presence</i>	<i>Crest</i>	<i>Slope</i>	<i>Toe</i>	<i>Pictures</i>
A) Erosion	☐	☐	☐	☐	☐
B) Settlements	☐	☐	☐	☐	☐
C) Bulging	☐	☐	☐	☐	☐
D) Sloughing	☐	☐	☐	☐	☐
E) Slope Protection	☐	☐	☐	☐	☐
F) Vegetation	☐	☐	☐	☐	☐
G) Animals Burrows	☐	☐	☐	☐	☐
H) Seepage*	☐	☐	☐	☐	☐
I) Ice	☐	☐	☐	☐	☐
J) Snow	☐	☐	☐	☐	☐

* Seepage

Location 1					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					
Location 2					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					

☐ Sand boils presence	Type	
	Location(s)	

Comments :

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



UPSTREAM SLOPE AREA

	<i>Presence</i>	<i>Crest</i>	<i>Slope</i>	<i>Toe</i>	<i>Pictures</i>
<i>A) LLDPE</i>	☐	☐	☐	☐	☐
<i>B) Bituminous Membrane</i>	☐	☐	☐	☐	☐
<i>C) Sink Holes</i>	☐	☐	☐	☐	☐
<i>D) Water on Liner</i>	☐	☐	☐	☐	☐
<i>E) Objects over the Liner</i>	☐	☐	☐	☐	☐
<i>F) Damages on Liner</i>	☐	☐	☐	☐	☐
<i>G) Erosion</i>	☐	☐	☐	☐	☐
<i>H) Settlements</i>	☐	☐	☐	☐	☐
<i>I) Bulging</i>	☐	☐	☐	☐	☐
<i>J) Sloughing</i>	☐	☐	☐	☐	☐
<i>K) Slope Protection</i>	☐	☐	☐	☐	☐
<i>L) Vegetation</i>	☐	☐	☐	☐	☐
<i>M) Animals Burrows</i>	☐	☐	☐	☐	☐
<i>N) Ice</i>	☐	☐	☐	☐	☐

Comments:

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



DOWNSTREAM BERMS:

	<i>Presence</i>	<i>Pictures with scale</i>
A) Cracks	☐	☐
B) Erosion	☐	☐
C) Settlements	☐	☐
D) Bulging	☐	☐
E) Sloughing	☐	☐
F) Vegetation	☐	☐
G) Animals Burrows	☐	☐
H) Seepage*	☐	☐
I) Drainage Trench	☐	☐
J) Snow	☐	☐

* Seepage

Location 1					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					
Location 2					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					

☐ Sand boils presence	Type	
	Location(s)	

Comments:

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



UPSTREAM BERMS

	<i>Presence</i>	<i>Pictures with scale</i>
A) Cracks	☐	☐
B) Erosion	☐	☐
C) Settlements	☐	☐
D) Bulging	☐	☐
E) Sloughing	☐	☐
F) Vegetation	☐	☐
G) Animals Burrows	☐	☐
H) Seepage*	☐	☐
I) Drainage Trench	☐	☐
J) Snow	☐	☐

* Seepage

Location 1					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					
Location 2					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					

☐ Sand boils presence	Type	
	Location(s)	

Comments:

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



CREST SURFACE

	<i>Presence</i>	<i>Pictures with scale</i>
A) Cracks	☐	☐
B) Erosion	☐	☐
C) Settlements	☐	☐
D) Bulging	☐	☐
E) Sloughing	☐	☐
F) Vegetation	☐	☐
G) Animals Burrows	☐	☐
H) Seepage*	☐	☐
I) Drainage Trench	☐	☐
J) Rutting	☐	☐
K) Mud	☐	☐
L) Pond (Puddle)	☐	☐
M) Saturated Soil	☐	☐
N) Snow	☐	☐

* Seepage

Location 1					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					
Location 2					
Rate	Damp ☐	Trickle ☐	Steady ☐		(L/s)
Clarity	Clear ☐	Muddy ☐	Comments :		
Sample taken					

☐ Sand boils presence	Type	
	Location(s)	

Comments:

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



DAM / DIKE INSTRUMENTATION

(Plot any newly installed instrumentation on relevant plans and cross-sections)

<i>Instruments</i>	<i>Operational</i>	<i>Damaged</i>	<i>Measurement Taken</i>
☒ <i>Inclinometers</i>	☐	☐	☐ Bi-monthly
☒ <i>Piezometers</i>	☐	☐	☐ Daily 3hrs interval
☐ <i>Thermistors</i>	☐	☐	☐ Daily 3hrs interval
☐ <i>Survey Prisms</i>	☐	☐	☐ Bi-monthly
☐ <i>Thermistors (manual) (4)</i>	☐	☐	☐ Every 7 Days (winter)

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



GENERAL CONDITION SUMMARY

- A
- B

RECOMMENDATIONS

- A
- B

☐ Action required	☐ <i>None</i>	☐ <i>Further monitoring</i>	☐ <i>Immediate remediation</i>
☐ Plan or Sketch Attached	See Appendix I		
☐ Photographs (13)	See Appendix II		

Review Officer: _____ Review Agency: _____ Date Reviewed: [Click here to enter](#)
(DD/MM/YR)

REVIEW COMMENTS:

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



APPENDIX I : PLAN

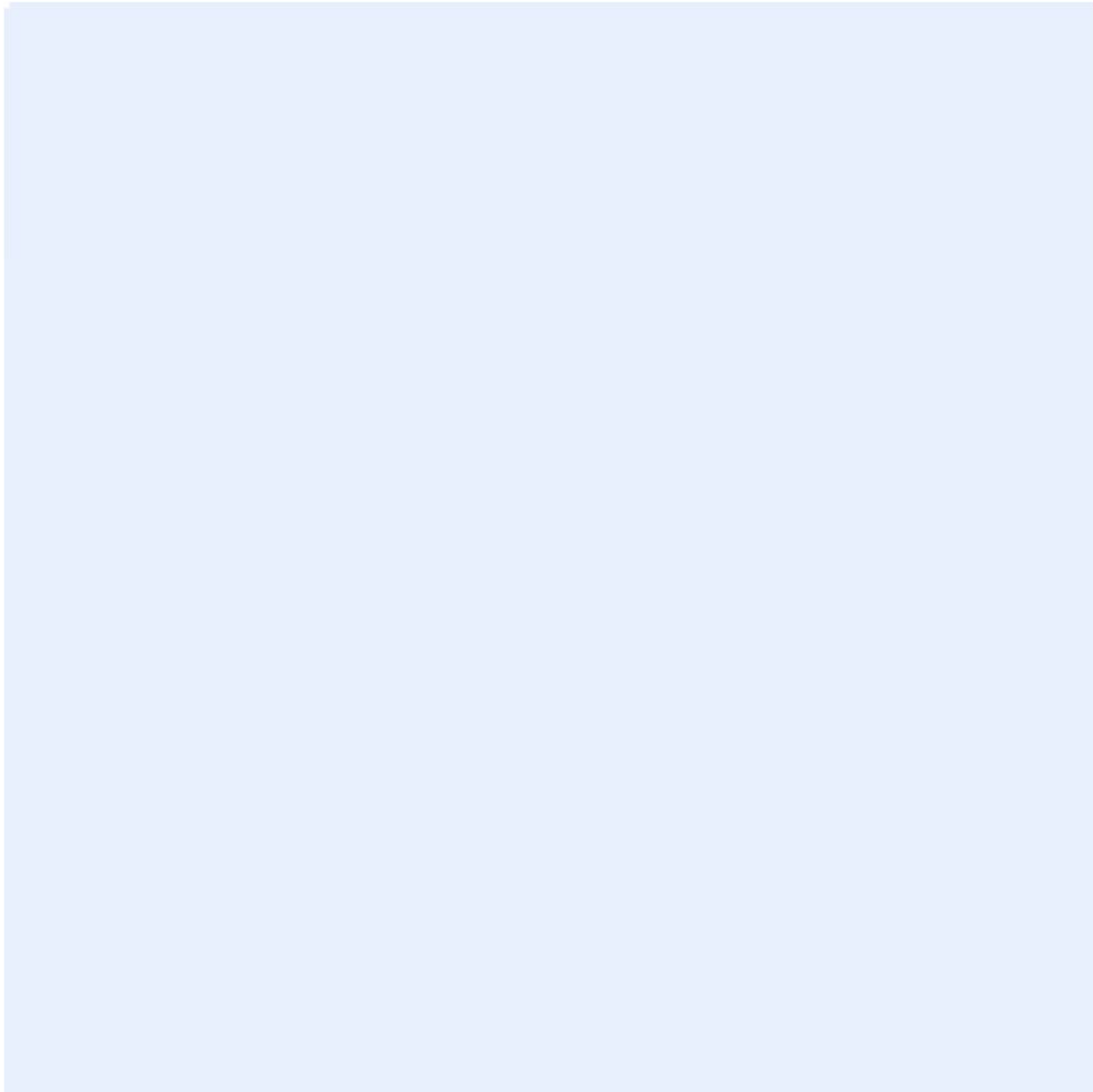


Figure 1 :

**DETAILED FIELD INSPECTION FORM A
DEWATERING / DIKE INSPECTION REPORT
MEADOWBANK GOLD PROJECT**



APPENDIX II : PHOTOGRAPHS

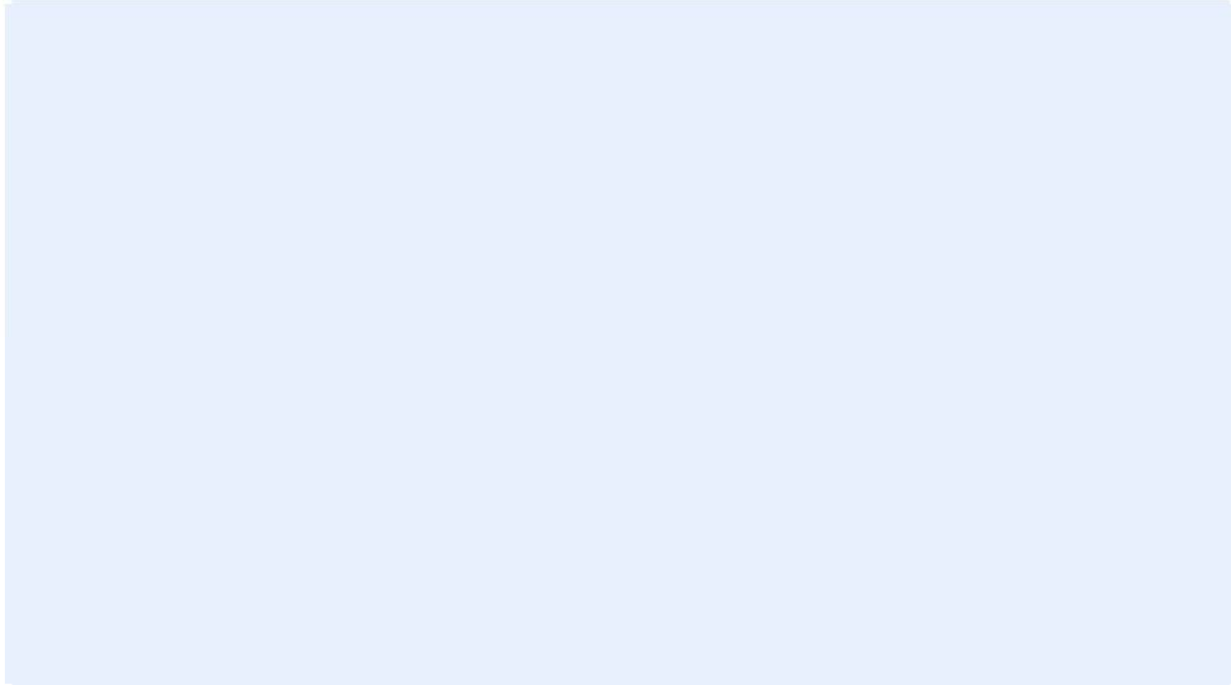


Figure 2 :

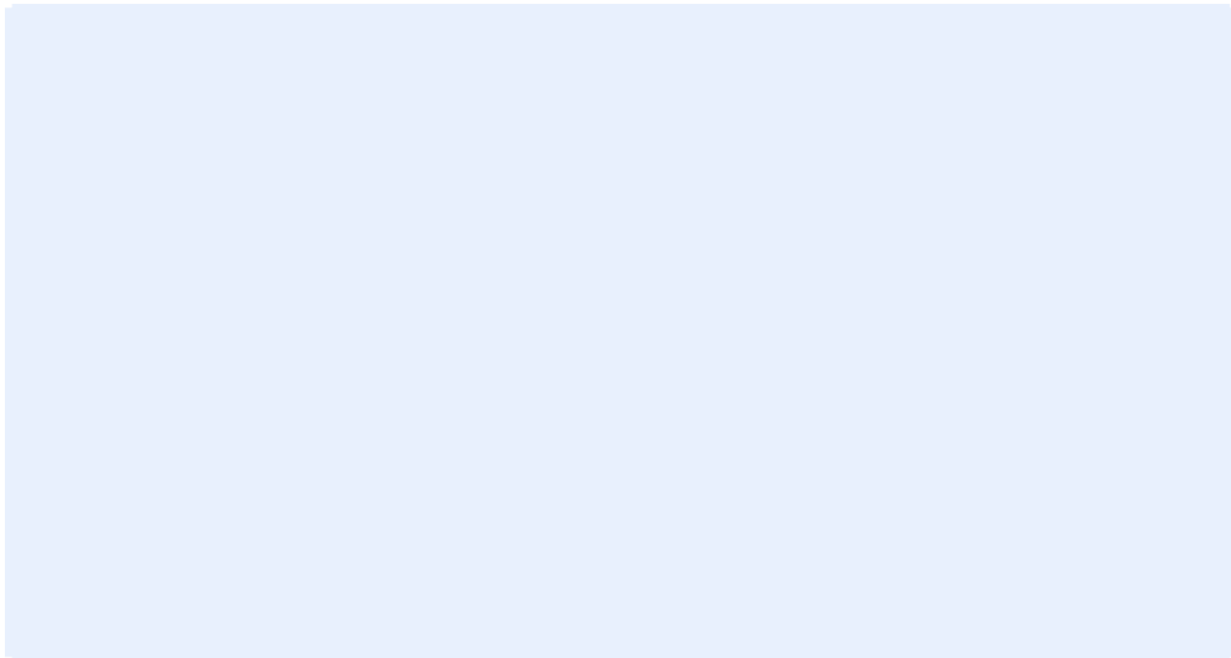


Figure 3 :

DAILY REPORT DIKE AND GEOTECHNICAL ENGINEERING AGNICO-EAGLE MINES MEADOWBANK PROJECT				
Date: 12/12/2014		Technician / Engineer: _____		
Weather : Sunny ☐ Overcast ☐ Rain ☐ Snow ☐ Wind ☒		Comments: _____		
Health and Safety: Concern / Incident Y ☐ N ☒				
Comments: _____				
Dewatering Dikes				
<u>BayGoose Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation: _____
Instrumentation	Piezometers (Auto.) ☒	Photos	Y ☐ N ☒	
	☐			
	Thermistors (Auto.) ☒			
	Thermistors (4) (Manual) ☐			
	Inclinometer ☐	Work Activity	Y ☐ N ☒	Description: _____
	SeePage (2,8,7,9,10,11) ☐			
	USB key (DL9) ☐			
<u>East Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation: _____
Instrumentation	Piezometers (Auto.) ☒	Photos	Y ☐ N ☒	
	Thermistors (Auto.) ☒			
	Thermistors (Manual) ☐	Work Activity	Y ☐ N ☒	Description: _____
	Inclinometer ☐			
	Survey Prisms ☐			
<u>South Camp Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation: _____
Instrumentation	Thermistor (Manual) ☐	Photos	Y ☐ N ☒	
		Work Activity	Y ☐ N ☒	Description: _____
<u>Vault Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation: _____
Instrumentation	Thermistors (Manual) ☐	Photos	Y ☐ N ☒	
	Vault Lake : 2 Flowmeter ☐	Work Activity	Y ☐ N ☒	Description: _____
Instrumentation	Piezo. Vpond 11 (Manual) ☐			
Tailings Facilities System				
<u>Stormwater Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation: _____
		Photos	Y ☐ N ☒	
		Work Activity	Y ☐ N ☒	Description: _____
<u>Saddle Dam 1</u>		Field Visit	Y ☐ N ☒	Comment / Observation: _____
		Photos	Y ☐ N ☒	
Instrumentation	Thermistors (Manual) ☐			
		Work Activity	Y ☐ N ☒	Description: _____
<u>Saddle Dam 2</u>		Field Visit	Y ☐ N ☒	Comment / Observation: _____
		Photos	Y ☐ N ☒	
Instrumentation	Thermistors (Manual) ☐			
		Work Activity	Y ☐ N ☒	Description: _____
<u>Coffer Dam - Central Dike</u>		Field Visit	Y ☐ N ☒	Comment / Observation: _____
		Photos	Y ☐ N ☒	
Instrumentation	Piezometers (Manual) ☐			
Instrumentation	Thermistor (Manual) ☐	Work Activity	Y ☐ N ☒	Description: _____
<u>OTHER</u>		Work Activity	Y ☐ N ☒	Description: _____
	☐			
Ground Control Inspection - Open Pit				
Review of Ground Control f Y ☐ N ☒ Pit Visit Y ☐ N ☒ Comment/Observations: _____				
Items to Review (num.): _____				
Items Follow Up in Ground Control Register (after visit) Y ☐ N ☒ _____				

Appendix B

Dike Failure Scenario Appendices from the ERP

Dike Failure Scenarios

1. Dewatering Dikes
 2. Central Dike (removed)
 3. Saddle Dams (removed)
 4. Storm water Dike (removed)
-

Appendix 1

Dewatering Dikes

Dewatering Dike System

The Dewatering Dike System includes the East Dike, Bay Goose Dike, South Camp Dike and Vault Dike as shown on the general mine site plan provided at the beginning of this document. The dike construction for East Dike and Bay Goose Dike involved the dumping of rockfill into water to create the shells of the dikes, excavation through rockfill and lakebed soils to bedrock, placement of granular filter and core materials, dynamic compaction, construction of the cut off wall using slurry supported trench techniques and grouting of the bedrock and contact between the cut off wall and bedrock using cementitious grout. South Camp Dike and Vault Dike both include a bituminous liner and a key trench cut-off to make the structure impermeable. East Dike and Bay Goose Dike have crest widths in excess of 50 m and are not used by haul trucks during normal mine operation. South Camp Dike and Vault Dike have crest widths in excess of 25 m and may be used as haul roads during normal mine operation.

East Dike and Bay Goose Dike are considered high consequence structures, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. South Camp Dike is considered to be a significant consequence structure, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. Vault Dike is considered to be a low consequence structure, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. The dikes are relatively low, wide structures that exceed the minimum design criteria factors-of-safety (FoS) for stability for pre-drawdown conditions, operation conditions with maximum head difference across the dikes, pseudo-static earthquake conditions, and post closure conditions. Consequently, the probability of dike failure is considered to be low provided that the dikes are constructed according to the design. Mitigation against failure of the dikes includes a quality control and quality assurance program during construction, and an ongoing program of dike surveillance and monitoring during operations, as specified in the design.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Dewatering Dikes see Table A.1 below.

East Dike

The East Dike was constructed in 2008, with foundation grouting continuing into early 2009. The East Dike has a crest length of 800 m, including abutments, and was constructed in water with a maximum water depth to bedrock at the cut off of 7.2 m. The crest of the East Dike is at elevation 137.1 m and the average lake level along the dike is 133.1 m. The main components of the East Dike include a rockfill shell, a granular core with downstream filter zone, a soil-bentonite cut-off wall through the densified granular core zone to the underlying foundations, and a grout curtain from the base of the cut-off wall into the underlying bedrock.

During operations, the East Dike separates the eastern portion of Second Portage Lake from the Portage Pit and the Tailings Storage Facility behind the Central Dike. Following closure, the East Dike will remain as a permanent structure that will separate Third Portage Lake (El. 134.1 m) from Second Portage Lake (El. 133.1 m) and maintain the existing water elevation difference of 1 metre.

The East Dike is approximately 800 m in length through an average water depth of approximately 2.3 metres, and a maximum water depth to bedrock of about 7.2 m. Crest width is approximately 55 metres. Minimum setback from the Portage Pit (distance between dike toe and pit crest) is greater than 170 metres.

Bay Goose Dike

The Bay Goose Dike together with the South Camp Dike isolates the Bay-Goose Pit from Third Portage Lake. The Bay Goose Dike acts as a permanent structure to allow mining of the Goose Pit and the southern portion of Portage Pit. The main components of the Bay Goose Dike include a rockfill shell, a granular core with downstream filter zone, a soil-bentonite and cement-soil-bentonite cut-off wall through the densified granular core zone to the underlying foundations, a jet grouted wall between the base of the cut-off wall and bedrock where the cut-off wall was not constructed on bedrock, and a grout curtain from the base of the cut-off wall or jet grouted wall into the underlying bedrock.

The Bay Goose Dike is approximately 2,200 m in length, and was constructed in water depths less than 9 metres at the cut off. Crest width varies between approximately 85 and 100 m. Minimum design setback from the Portage and Goose Pit is 70 metres.

South Camp Dike

The South Camp Dike covers a narrow channel within Third Portage Lake and in conjunction with the Bay Goose Dike isolates the Bay Goose Pit from Third Portage Lake.

The South Camp Dike is located south of the plant site area and is used to connect the mainland to South Camp Island. It covers a narrow channel, approximately 60 m in width, where water depths were between 0.5 and 1 m.

The South Camp Dike was primarily constructed between April and June of 2009, prior to ice breakup. During the winter of 2009-2010 additional thermal capping material and rock fill for the haul road was added to the dike. The South Camp Dike has a broad rock fill shell with a bituminous geomembrane liner installed on the upstream side of the shell. The liner was founded on native frozen (permafrost) till material, in a trench approximately 3 to 5 m below the lakebed surface. Compacted granular material mixed with bentonite was placed above the toe of the liner. The haul road is located on the downstream side of the dike. The South Camp Dike is approximately 85 m in length through water depths between 0.5 and 1m. Crest width is approximately 25 metres.

Vault Dike

The construction of the Vault Dike at Meadowbank was conducted from February 2013 to March 2013. Vault Dike is located across a shallow creek which connects Wally Lake and Vault Lake, at the Vault Pit area approximately 8 km north of the main Meadowbank site. Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit from Wally Lake during mining activities.

Vault Dike is designed and constructed as a zoned rock fill dam with filter zones, an impervious upstream liner consisting of a bituminous membrane, and an upstream key trench made of aggregate mixed with bentonite. The filter zones minimize seepage and internal erosion and facilitate seepage collection. Vault Dike includes a key trench at the base of the upstream side filled with a 0-25 mm fill amended with bentonite surrounding the liner. Coarse and fine filter material was placed on the upstream slope as geomembrane bedding. The bulk part of the dike consists of coarse rock fill material. The embankment crest is at El. 142.4 m and the upstream toe is at approximately El. 139.4 m. The downstream toe is at approximately El. 139.6 m and the bottom of the key trench ranges from El. 135.6m to El. 142.3m, with an average height of El. 137.0m. The upstream and downstream fill

slopes of the dam are 1.5H: 1V. The Vault Dike is approximately 275 m in length through a maximum water depth of 1 m. The crest width is approximately 25 metres.

Table A.1: Meadowbank Dewatering Dikes Summary of Consequences and Proposed Monitoring/Action for Rare Events Based on Water Retaining Embankment Failure Modes Identified in ICOLD Study (1995)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Lake level rise because of restricted outflow from Third Portage, Second Portage Lake or Wally Lake (excessive inflow is a far less likely scenario).	Water spilling over the crest. The crest is wide and comprises coarse rock fill. Significant damage to the dike is not credible, based on performance of other rock fill structures subjected to overtopping or flow through events. Mining operations might need to be suspended, but there will be considerable warning time given the design freeboard and the storage volume within the lakes.	Lake levels should be part of safety information provided to mine management. Outflow channels should be inspected weekly during thaw, open water season, and during ice break-up. If overtopping is likely, a temporary spillway could be constructed and armoured to control and localize flow at shallow dike sections.
	(2) Dam crest settles more than 2m over a distance of (say) 50m or so. This scenario requires extensive loss of support in the foundation since the rock fill of the dikes is essentially not settlement prone itself. For foundation settlement of this magnitude to occur, a piping event must develop and which in itself might be a failure mode. Or, there would have to be an unexpected layer of compressible soil in the foundation.	Same as (1).	The situation envisaged in this scenario should develop slowly with crest settlement evident at least several weeks before a run-away event develops. Easily observed cracks should be evident. Monitoring of crest settlement is appropriate, and is included in the design. Rockfill and till available from the mining operation can be placed to raise the dike crest.
Internal Erosion	(1) Dike Section: Cut off wall, cut off key trench or bituminous liner is defective, allowing high water flow across the wall. This defect occurs at a deep water location where the core backfill and filters are segregated and permeable; the combination allows erosion of the cut off wall and increasing seepage.	The cut off wall will develop a progressively increasing void ratio, thereby increasing the rate of water flow through the dike. This is not a catastrophic failure mode as the rockfill shoulders of the dike will be stable, and at its worst, would lead to temporary suspension of mining.	Monitor seepage from downstream face for rate of seepage, and for presence of sediment in seepage. Will become evident as localized intensive seepage at dike toe and can be repaired. May also see settlement in the cut off wall. Will be most likely in deep water sections. Gradients across the cut off wall in shallow water are not high enough to cause piping.
	(2) Dike Section: Cut off wall loses bentonite because of improper construction.	Same consequences as erosion because of defect, as above.	Bentonite makes up 2% of the cut off wall fill. Loss of this material will increase the permeability of the cut off wall and increase the rate of seepage.

Failure Mode	Scenario	Consequence	Monitoring/Action
	(3) Foundation: Till is possibly non-uniform with more transmissive zones and not self-filtering. It is possible that one of these zones may align with defective construction of the core backfill and defective construction of the cut off wall allowing high flows. Seepage along the transmissive zone beneath the downstream rockfill section could erode the foundation tills at the downstream toe or flow into the downstream rockfill because of the lack of filtering.	Limited seepage at the toe or into the rockfill would accelerate into a large inflow, and could lead to the undermining of the dike if no action was taken. This is a credible catastrophic failure mode if increased seepage is not detected in time.	No particular instrumentation is needed as this failure mode will show itself as localized and increasing seepage. It could be detected by walk-over inspection by an experienced engineer or technician. Remedial action could comprise a reverse filter and rockfill buttress depending on location of the flow and configuration of the foundation, freezing, or grouting if identified in time. Quality control of cut off is important, and most important for deep water sections. In the worst case, the pit may be deliberately flooded in a controlled manner, the cut off repaired, and the pit dewatered.
Seepage within Embankment	Seepage on its own is not a credible failure scenario. The downstream rockfill shell has extremely high flow through capacity. The rockfill zone is both large and pervious, so that seepage will daylight on the downstream face and lead to instability. Any seepage related failures must include internal erosion, see above.	No credible consequences. May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage.	Seepage monitoring program.
Seepage within Foundation	Defective construction of cut off leading to transfer of unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation, or leading to a piping event as above.	This failure mechanism has caused embankment failures elsewhere because of straightforward pore pressure induced instability. However, it is unclear that it could cause failure of the Dewatering Dikes because of their large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm before the crest roadway could be reinstated.	If this mechanism arises it should show itself during initial dewatering or very shortly thereafter.

Failure Mode	Scenario	Consequence	Monitoring/Action
Internal Conduit Rupture	There are no water off take works or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(1) Normal Operation: The rockfill shoulders of the dikes are wide and have high shear strength, making it a conservative design. Slope failure requires failure in the foundation and which would then extend into the overlying dike. Sliding failure is considered unlikely given the low horizontal forces generated by water and ice forces relative to the normal frictional force due to the weight of the dikes and the friction angles of foundation materials	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rockfill shoulders will not necessarily compromise the water retaining function of the dikes. Failures which reach the core may cause failure.	This mechanism should develop during construction or dewatering, due to increase in load and associated pore water pressure increase. Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dikes by a trained inspector is an appropriate monitoring strategy. Survey of crest, face, and toe is also appropriate. Stabilizing berms can be placed inside the dikes or through water along the upstream shoulder.
	(2) Earthquake Induced: Occurrence of an extreme earthquake, much in excess of the current understanding of seismicity of the area.	The extreme earthquake loading for this site is a low magnitude. Settlement of the dikes could occur in the event of a large earthquake. Dynamic compaction of the core during construction may have subjected the rockfill shells to accelerations equivalent to the expected earthquake loading. This would not be a failure situation. The crest is also erosion resistant for any earthquake induced wave action in the impounded water.	Dike inspection following earthquakes felt on site.

Failure Mode	Scenario	Consequence	Monitoring/Action
Failure of Cut off Wall or Bituminuous Liner Due to Movement of the Dikes	Differential horizontal movement of dikes due to water or ice loading, or pit wall failure. Creates a breach in the cut off wall, cut off key trench or bituminuous liner. Ice and water forces are not credible due to the ratio of frictional forces generated by the weight of the dike versus ice loads and water pressure. Pit wall failure involving the dike unlikely based on assessments of pit wall stability and setback distance between the pit and the dikes.	Large inflows through the breach. Pit would flood requiring suspension of mining activities. Potential for loss of life for workers inside dikes.	No enhanced monitoring. Prism monitoring program sufficient. If the pit floods, then repairs to cut off or bituminuous liner would be done prior to dewatering.
Unexpected Settlements	Unexpected foundation soils consolidate during dike construction. A significant quantity of clay that was not recognized during foundation excavation would be required to generate settlement required for a water release event. Settlement of the core will be limited by dynamic compaction.	2 m of core settlement would be required to allow water flow through the rockfill and over the settled core. This flow would not cause failure of the rockfill shells. It would also be readily repaired by placing more end-dumped till into the settled zone.	No enhanced monitoring required, as settlement would be apparent from prism monitoring data and visual inspection. Excessive settlements may be remediated by excavating rockfill above the core and placing more till. Soil conditions will be observed during construction, and design revised to accommodate actual conditions.

A.1.1 Failure Scenario during Operations

The 'worst-case' scenario for failure of the dewatering dikes during operations would involve a movement of the dikes that compromises the integrity of the cut off wall, cut off key trench or bituminous liner. However, the rockfill has a very high flow-through capacity and a high strength and will not move unless the foundation is involved. The water will flow through the upstream rockfill first, then through the core and cut off wall, cut off key trench or bituminous liner, and finally through the downstream rockfill berm. Flow through cracks opening in the foundation may erode the foundation soils and the core. The upstream rockfill will choke the flow to some degree, and flow will decrease once the downstream toe of the dike is inundated and the head difference across the dike begins to reduce.

Although this describes a 'worst-case' scenario, a catastrophic failure of the pit dewatering dike system is not considered a credible failure mode. Elements of the dike design, including the width of the dike section, and the inclusion of filters, in addition to the cut off wall, cut off key trench and bituminous liner make catastrophic failure of the dike highly unlikely. However, for the purposes of this document, the effects of such a failure are described below.

Potential Effect

In the case of East Dike, the worst-case scenario would be associated with the short portion of the dike through the deepest water along the alignment at the centre of the dike. In this area the water depth is as much as 7 m to bedrock at the cut off wall within the dike. This inflow could potentially result in loss of workers caught in flowing water. Breach of the East Dike would be unlikely to trap workers in the pit when access ramps are on the west side, opposite the inflows. Breach of the East Dike would result in cessation of mining, either temporarily or permanently.

Upon completion of the East Dike and dewatering of the northwest arm of Second Portage Lake, there was approximately 17 million m³ (Mm³) of water remaining in Second Portage Lake. If the segment of dike at the deepest portion were suddenly removed, flow from Second Portage Lake into the pit would continue until the elevation of the lake drops by several metres, at which time the current lake bottom would be exposed and would act as a barrier to flow towards the pit. This scenario is the worst in the final year of pit operation when pit volume is the largest. The volume of water associated with this drawdown would be on the order of about 10 Mm³. Some erosion of the till between the pit crest and dike toe would be expected, so the depth of water loss from the lake may be larger, but this would take some time to fully develop.

Inflow to the pit could expose large amounts of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the exposure of shoreline and shoal habitat on fish and fish habitat would be to temporarily eliminate spawning areas and result in reduced water quality from exposure of sediment to wave and wind induced erosion. The effect of this would last approximately one year as inflow from Third Portage Lake to Second Portage Lake averages 10 Mm³ annually (AMEC, 2003). Presuming that the dike breach is repaired, water levels in Second Portage Lake would rise over the

spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

In the case of Bay Goose Dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the southeast segment of the dike through the deepest water along the alignment. In this area, water depth is as much as 20 m deep at the cut off, and the pit could be as deep as 130 m. This inflow could potentially result in loss of workers caught in flowing water. Breach of the Bay Goose Dike would be unlikely to trap workers in the pit when access ramps are on the northwest side, opposite the inflows. Breach of the Bay Goose Dike would result in cessation of mining of the Goose Pit, either temporarily or permanently.

In the unlikely event that such a failure of the Bay Goose Dike were to occur, the rate and volume of water entering the downstream pit would depend on the magnitude of the breach and the length of time to repair the breach. Third Portage Lake has an estimated volume of 446 Mm³ (Golder, 2006). The final volume of Portage Pit (30.0 Mm³) is roughly 6.7% of the volume of the lake, while Goose Pit (14.8 Mm³) is approximately 3.3% of the volume. In the case of a catastrophic breach of the Bay Goose Dike, the estimated Third Portage Lake water level drawdown would be approximately 1.0 m and 0.5 m, respectively assuming that the failure occurs when the pits are completely excavated and a complete filling of the pits. These estimated worst-case scenario changes in water level are comparable to the mean average annual difference between high and low water (0.3 m) on Third Portage Lake.

There would be a small impact to fish and fish habitat in Third Portage Lake in the event of a 0.5 m to 1.0 m drop in water level. Areas used for spawning may be slightly nearer to the ice cover and a small amount of habitat might be vulnerable to freezing. Water quality within the pit would be temporarily impaired from an increase in suspended and dissolved solids, although water quality would return to near background during the first winter as sediment would settle under the ice cover.

In the case of South Camp dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the centre segment of the dike through the deepest water along the alignment. In this area, the water depth is only a maximum of 1 m. This inflow could put the workers at risk at the site on a temporary basis and a potential loss of life between 0 and 10 due to workers caught in flowing water. Breach of South Camp Dike could eventually result in cessation of mining, either temporarily or permanently.

If the segment of dike at the deepest portion were suddenly removed, flow from Third Portage Lake into the pit would continue until the elevation of the lake drew down slightly as South Camp Dike retains a maximum depth of 1 m of water. The impact of a potential failure would likely be limited.

Inflow to the pit could expose a limited amount of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the dike failure will probably have no significant fish or wildlife habitat, affected or deteriorated. Presuming that the dike breach is repaired, water levels in Third Portage Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

In the case of Vault dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the centre segment of the dike through the deepest water along the alignment. In this area, the water depth is only a maximum of 1 m. This inflow could put the workers at risk at the site on a temporary basis and a potential loss of life between 0 and 10 due to workers caught in flowing water. Breach of the Vault Dike could eventually result in cessation of mining, either temporarily or permanently.

If the segment of dike at the deepest portion were suddenly removed, flow from Wally Lake into the pit would continue until the elevation of the lake drew down slightly as Vault Dike retains a maximum depth of 1 m of water. The impact of a potential failure would be limited.

Inflow to the pit could expose a limited amount of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the dike failure will probably have no significant fish or wildlife habitat, affected or deteriorated. Presuming that the dike breach is repaired, water levels in Wally Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

Mitigation, Management, and Monitoring

A major cut off breach scenario due to pit wall movement, while possible, has a low probability of occurrence in East Dike or Bay Goose Dike. If foundation movement was sufficient to compromise the cut off wall, then the core backfill would act as a semi-permeable element and limit flow. Water would first need to flow through the rockfill shell, the core backfill, the damaged cut off wall, and then through more of the core, filters, and the downstream rockfill. Provided that the downstream filter elements against the rockfill shell are properly constructed, then migration of the core and cut off wall into the rockfill will not occur. Some additional seepage may occur due to failure of the cut off wall; however this would be noted during regular monitoring. Mitigation could be by jet grouting, freezing, or installation of sheet piling through the cut off wall.

The use of appropriately graded filters in the design of dikes and dams is standard engineering practice, and is the key to preventing internal erosion. The dike design includes the use of a two zone filter on the upstream face of the pit side rockfill. During the construction of the dikes a quality control and quality assurance program was undertaken.

Routine visual inspection of the dikes is to be conducted on a regular basis to document any changes in the dikes.

During the operation of the dikes, a series of monitoring instrumentation will be installed, including:

- Thermistors to monitor the thermal regime in the dike and foundations;
 - Slope inclinometers and prisms to monitor deformations within the dikes; and
 - Piezometers to measure pressure and to infer flow through the dikes.
-

Piezometers downstream of the cut off wall would be monitored for pressure changes as the pits are deepened. Increasing pressure would indicate that less head loss is occurring across the seepage cut off, which might indicate that a crack has formed, permeability is increasing, or the pit is experiencing inflows from some other potential flow pathway. The instrumentation will be monitored to identify any potentially problematic areas relating to dike instability. Mitigation measures for seepage and piping could include:

- Additional pressure grouting of bedrock materials;
- De-pressurization wells;
- Construction of a slurry cut off wall within the core just upstream of the suspected seepage area;
- Jet grouting of the core and foundation in the suspected seepage or crack area;
- Construction of a cutter soil mixing (CSM) wall in the suspected crack area;
- Freezing;
- Installation of toe drains; and
- Construction of interceptor ditches within the down-stream overburden materials.
- Allow pit to flood, install new cut off or bituminous liner under no-flow conditions, then dewater and resume mining.

Specific monitoring and mitigation strategies have been developed as part of an Operations Plan (OMS Manual) for the dewatering dikes.

A.1.2 Failure Scenario during Closure

At end of mine life, once the water quality of the pit lake has been determined to be suitable for release, a portion of the south end of the Bay-Goose Dike will be removed resulting in a hydraulic connection between the Goose/Portage Pit Lake and Third Portage Lake. The East Dike will be the only dike that will remain in service. The elevation of the pit lake will be equal to Third Portage Lake. The elevation difference between the pit lake and Second Portage Lake will be approximately 1 m. Consequently, there will be a low hydraulic gradient from the pit lake towards Second Portage Lake. During the closure and post-closure period, the natural central and east channel outlets that connect Third Portage to Second Portage Lake will continue to carry the entire flow between the two lakes.

Potential Effect

A breach of the East Dike would create an additional outlet and cause water to leave the Portage/Goose pit area and spill into Second Portage Lake at a greater rate, partly at the expense of flow from the central and east channel outlets. This would cause a rise in water level in Second Portage Lake and a reduction in level in Third Portage Lake. The additional water would flow through the channel connecting Second Portage Lake to Tehek Lake until the water elevations in Second and Third Portage lakes equilibrated.

In the event of such a scenario, water would flow from Third Portage Lake, northward through the pit lake area, and then east through a potential East Dike breach and into Second Portage Lake. There is a naturally large outlet capacity via the connecting channel from Second Portage to Tehek Lake. Water residence time in Second Portage Lake during and after mine development is less than one year. Thus, in the event of an East Dike breach, any additional water added to Second Portage Lake would leave the system relatively quickly. Given the flow-through nature of the lake there would be little net change in Second Portage Lake volume or lake elevation as water would easily be absorbed into the much larger Tehek Lake.

Drawdown of Third Portage Lake would be limited, given the large size of the lake (33 km²) and the constriction points within the system that would slow drawdown. Specifically, the magnitude of drawdown in the event of a breach would depend on the magnitude and depth of the breach, time of year (winter ice cover would prevent loss of water), response time, flow rate (i.e., the loss of water depends on the location of the breach and friction through the system), and the outlet capacity of Second Portage Lake. For example, total annual average discharge from Third Portage to Second Portage Lake is approximately 10 Mm³ with a mean annual difference in water level between spring and fall of 0.3 m. Given the large size of Third Portage Lake, a breach resulting in the loss of 10 Mm³ of water, which is equivalent to an entire open water season of runoff through all discharge channels would result in a drawdown of only about 0.3 m. Maximum drawdown would be one metre.

Reductions in water level would therefore be small and have only minor impacts to fish habitat in Third Portage Lake. Adverse impacts to water quality would not be expected given that water quality within Goose/Portage pits is expected to be very high.

Mitigation, Management and Monitoring

Internal erosion of the cut off wall could result in an increase of the rate of water flow through the East Dike. However, this is extremely unlikely due to the low hydraulic gradient across the East Dike (~ 1 m of head difference) and the filter effect of the core backfill. Such a scenario is more likely to occur during the operational phase of the East Dike when the hydraulic gradient across the dike section is much higher, though in the opposite direction. If such a scenario were to occur, it would not be considered a catastrophic failure mode due to the stability of the rockfill shoulders comprising the outside structural elements of the dike.

A breach in the East Dike during closure could be managed by the placement of material to reduce the flow of water and reduce potential erosion of the till core. The hydraulic gradient across the dike at closure is low. The dike could be repaired and hydrologic conditions restored without any danger to the overall stability of the dike, provided annual monitoring is carried out following closure.

EMERGENCY RESPONSE PLAN, VERSION 18, FEBRUARY 2016



MEADOWBANK GOLD PROJECT

Emergency Response Plan

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

Version 18
February 2016

EXECUTIVE SUMMARY

The Emergency Response Plan (ERP) is activated when an operations-related emergency, accident or malfunction occurs, or if such an incident is foreseeable. The ERP outlines potential emergency scenarios, initial actions for emergencies and the internal and external resources available including personnel, emergency response equipment and communication systems.

The ERP will be reviewed and updated as required, but on a minimum basis of at least once per year or following its implementation should a cyanide release occur.

IMPLEMENTATION SCHEDULE

This Plan will be immediately implemented.

DISTRIBUTION LIST

AEM – Linked to Intelex Documents on AEM Intranet system for following authorized users:

AEM – General Mine Manager / Designate

AEM – General Superintendent Operations

AEM – General Superintendent Maintenance

AEM -- General Superintendent General Services

AEM – Cost Management Superintendent

AEM – Health and Safety Superintendent / Designate

AEM – Human Resources Superintendent / Designate

AEM – Engineering Superintendent / Designate

AEM – Geology Superintendent / Designate

AEM – Environment Superintendent / Designate

AEM – Process Plant Superintendent / Designate

AEM – Site Services Superintendent / Designate

AEM – Mine Superintendent / Designate

AEM – Maintenance Superintendent / designate

AEM – Emergency Response Counselors

AEM – OHSC Co-chairs

AEM – Security

AEM – General Supervisor Inventory

Updated Hard copies distribution list:

AEM -- Meadowbank Emergency Response Centers

TABLE OF CONTENTS

EXECUTIVE SUMMARY	II
DISTRIBUTION LIST	III
DOCUMENT CONTROL	IV
SECTION 1 INTRODUCTION	8
1.1 Purpose and Scope of the Emergency Response Plan	8
1.2 AEM's Policy Statement	8
1.3 Policy With Respect to Contractors and Visitors.....	9
1.4 Environmental Policy.....	9
SECTION 2 ORGANIZATION AND JOB RESPONSIBILITIES	10
2.1 General Manager.....	10
2.2 Emergency Control Group.....	10
2.2.1 Official In-Charge.....	11
2.2.2 General Superintendents.....	11
2.2.3 Incident Commander.....	11
2.2.4 Emergency Log Recorder.....	13
2.2.5 Muster Station Coordinator.....	14
2.2.6 Emergency Response Team (ERT)	14
2.2.7 Mine Superintendent.....	14
2.2.8 Mill Superintendent.....	15
2.2.9 Environmental Superintendent.....	15
2.2.10 Health and Safety Superintendent.....	15
2.2.11 Site Services Superintendent.....	15
2.2.12 Maintenance Superintendent.....	16
2.2.13 Human Resources Superintendent.....	16
2.2.14 Health Care Professionals.....	16
2.2.15 Security Department.....	16
2.2.16 Procurement/Warehousing General Supervisor.....	17
2.2.17 Department's Duty cards / Roles and Responsibilities.....	18
Manager on Duty.....	18
Health and Safety.....	20
Dept. Head where incident occurred.....	22
Logistic (General Services Superintendant).....	23
Warehouse.....	24
Human Resources.....	25
ERT Captain.....	26
Environment.....	28
Maintenance.....	29
Mine.....	30
Engineering.....	31
Geology.....	32
Site Services.....	33
Electrical.....	35
Mill.....	36

	Camp / Housekeeping.....	37
	Incident Commander.....	38
	Scribe.....	39
2.3	Occupational Health and Safety Committee.....	40
2.4	All Employees	40
2.5	Supervisor.....	40
2.6	Other Personnel.....	40
2.7	Emergency Response Contact Information (Contacts listing).....	41
2.8	Emergency Coordination Centre.....	45
2.9	Training.....	46
2.10	Emergency Response Equipment.....	46
SECTION 3	COMMUNICATION SYSTEMS.....	47
SECTION 4	EMERGENCY MEASURE.....	48
	General Emergency Response Flowchart.....	49
4.1	Fire.....	50
4.2	Medical Evacuation Plan.....	52
4.3	Aircraft Crash Disaster.....	55
4.4	Pipeline Breakage.....	56
4.5	Toxic Gas Releases.....	56
4.6	Dike Failure.....	57
4.7	Emulsion Plant.....	57
4.8	Baker Lake Marshalling Facility.....	57
4.9	Emergencies dealing with reagents.....	58
4.10	Fatality occurring on site.....	59
4.11	Missing Person.....	
SECTION 5	REFERENCES.....	60
SECTION 6	LIST OF ACRONYMS.....	61

LIST OF TABLES

Table 2.1: Emergency Response Contact Information	41
Table 2.2: External Emergency Phone Numbers	43

LIST OF APPENDICES

Appendix A:	Dike Failure Scenarios
	A.1 Dewatering Dikes
	A.2 Central Dike
	A.3 Saddle Dams
	A.4 Storm water Dike
Appendix B:	Emergencies Involving Reagents
	B.1 Cyanide (Sodium Cyanide)
	B.1.1 General Cyanide Spill/Release Guidelines
	B.1.2 Cyanide Transportation Accidents

B.1.3 Cyanide involved in fires
B.1.4 Important release of HCN from storage
B.1.5.1 Process Plant: Important release of HCN
B.1.5.2 Process Plant: Release during Mixing / Unloading
B.1.5.3 Process Plant: Pipe, Valve breakage.
B.1.5.4 Process Plant: Major Breakage on tailing lines, cyanide treatment pumps or Tank rupture.
B.1.6: Failure or overtopping of tailings impoundments

- Appendix C:** Emergency Response Plan for DYNOL Nobel Emulsion Plant
- Appendix D:** Oil Pollution Emergency Response Plan
- Appendix E:** Nolinor ERP Plan (Note: accessible only on Intelex under Plans – Emergency Response)
- Appendix F:** Baker Lake Facilities O M Manual Appendix
- Appendix G:** Baker Lake Facilities O M Manual
- Appendix H:** Baker Lake Bulk Fuel Storage Facility Env. Perof Monitoring Plan Ver. 2
- Appendix I:** Meadowbank Transportation Management Plan AWP/AR
- Appendix J:** Vault Emergency Response Plan
- Appendix K:** MBK-HSS-3009 Emergency Response Guideline Handbook – ERG 2012
- Appendix L:** Site maps quick link
- Appendix M:** Spill Contingency Plan
- Appendix N:** Meadowbank Crisis Management Plan

SECTION 1 • INTRODUCTION

1.1 PURPOSE AND SCOPE OF THE EMERGENCY RESPONSE PLAN

The purpose of this Emergency Response Plan (ERP) is to provide a consolidated source of information for employees, contractors, and site visitors to respond quickly and efficiently to any foreseeable emergency that would likely occur at the Meadowbank project site. This ERP forms a component of the Environmental Management System (EMS) for the Project. As such, it is a working document that will be reviewed and updated on a regular basis as mine development, construction and operations proceed.

This ERP addresses gold mining, processing, transportation and related activities at the Meadowbank site as well as possible emergency scenarios that may occur off-site along the All Weather Private Access Road or at the Baker Lake Marshalling Facility. Guiding the development of this document has been the principle that an effective ERP must provide:

- A clear chain of command for safety and health activities;
- Well-defined corporate expectations regarding safety and health;
- Comprehensive hazard prevention and control methods; and
- Record-keeping requirements to track program progress.

AEM will ensure that all employees, contractors and site visitors fully understand and comply with all legislated safety standards, and the policies and procedures outlined in the ERP.

This ERP will be reviewed annually, or more frequently as required, to ensure compliance with applicable legislation, to evaluate its effectiveness and to continually improve the procedures. All employees, contractors and site visitors are encouraged to offer suggestions for ways to eliminate potential hazards and improve work procedures.

1.2 AEM'S POLICY STATEMENT

AEM is committed to protecting the health and safety of all its workers and the environment, and to adhering to all legislated safety standards. The necessary resources will be available to respond quickly and efficiently to all emergencies to prevent injury to, or degradation of, the health of individuals or the environment. In implementing this emergency response policy, AEM will set preparedness targets and report its progress on a regular basis.

To this end:

All relevant safety and emergency response laws and regulations will be incorporated into the ERP as minimum standards.

Senior management is responsible for making funds and other resources available, including hiring and training qualified personnel, to ensure the successful implementation of the ERP in the event of an emergency.

All supervisors are responsible for ensuring that their employees are aware of, and trained in, the proper emergency response procedures and that procedures and contact information are posted in all work areas. Supervisors are also responsible for ensuring that all employees follow safe work

methods and all related regulations to prevent emergencies from occurring, and that they are provided with the proper tools to do so, including Personal Protective Equipment (PPE).

An emergency response team and coordination centre is established at the Meadowbank site.

The ERP will be tested on a periodic basis to ensure its effectiveness.

1.3 POLICY WITH RESPECT TO CONTRACTORS AND VISITORS

Every person working at or visiting the Meadowbank site receives an orientation upon arrival and as such is apprised of, and required to follow the ERP policies and procedures set forth in this manual. For a list of responsibilities, see Section 2.

Major contractors, such as those for mining and hauling, are required to have their own HS services. This is verified by AEM management prior to engagement of the contractor.

1.4 ENVIRONMENTAL POLICY

AEM is committed to achieving a high standard of environmental care in conducting its mineral exploration activities. AEM's Environmental Policy includes:

- Compliance with all applicable legislation including laws, regulations, and standards. Where laws do not exist, appropriate standards will be applied to minimize environmental impacts resulting from exploration activities.
- Open communication with government, the community, and employees on environmental issues.
- Development and adherence to management systems that adequately identify, monitor, and control environmental risks associated with AEM's exploration activities.
- Assurance that the employees are aware of their responsibilities and comply with AEM's Environmental Policy and field guide.

It is the policy of AEM to protect the environment, public health and safety, and natural resources by conducting operations in an environmentally sound manner while pursuing continuous improvement of our environmental performance.

SECTION 2 • ORGANIZATIONAL RESPONSIBILITIES

This section details the roles and responsibilities of all parties involved in emergency response planning and implementation at the Meadowbank mine site.

2.1 GENERAL MANAGER

The General Manager is responsible for implementing and maintaining the ERP. In addition, the General Manager's responsibilities are to:

- Act as a spokesperson on behalf of AEM with the public, media, and government agencies, as required;
- Prepare and submit any formal reports (within the required time frame) to regulators and AEM management detailing the occurrence of an emergency; this includes submitting an incident reporting form;
- Ensure that the Health & Safety and Environment Superintendents have the means (financial and otherwise) to ensure that all required resources are made available, or provided from off-site if required;
- Work with the H&S, Human Resources and Environment Superintendent to evaluate what training is required by all staff, ensure that all staff are given appropriate training, and ensure that all staff are retrained as needed;
- Ensure that the Human Resources Superintendent has the means (financial and otherwise) to ensure that all employees' training requirements are current;
- Ensure that inspections of emergency response training practices and emergency response equipment are carried out;
- Ensure that emergency response exercises are conducted annually,
- Ensure that the results of the regular inspections are used to improve emergency response practices, and improve relevant plans accordingly;
- Complete an annual detailed review of the ERP with the management team and the Joint Health and Safety Committee with particular emphasis on the objectives and methods of the plan, and the job descriptions of all positions named within;
- Ensure that updates to new emergency communications information (new phone numbers, changes in reporting structure, etc.) are distributed as soon as the new information becomes available;

2.2 EMERGENCY CONTROL GROUP – ON SITE MANAGEMENT TEAM

Appendix: MBK-HSS-3001-F-A Emergency Response Plan - Organizational Flowchart

No single department can handle an emergency situation alone. Everyone must work together to manage the emergency and coordinate the effective use of all available resources.

Therefore at the time of any emergency, all the management team and/or their designate must report to the 3rd floor Emergency Response Control room #1 or to the Emergency Response Control Room #2, at the Training room or to the Emergency Response Control Room #3 at the Meadowbank gatehouse.

The Emergency Control Team structure lends support, fosters efficiency and provides additional knowledge during an emergency response situation.

The Official In-Charge, (General Mine Manager or Designate) maintains the overall coordination and direction of the Emergency and ensures the continued safety of all employees and the public.

However, the Superintendent or designate of the Area affected by the emergency, will assist with the development of the overall emergency response plan.

The remainder of the Emergency Control Team will be given specific tasks to perform that will assist with the management and coordination of the emergency response plan.

Roles & Responsibilities of the Emergency Control Group (See Duty Cards)

2.2.1 Official In-Charge

The Official In-Charge (General Manager or designate) will take charge for overseeing and approving the overall emergency strategy.

Immediate duties of the Official In-Charge include:

- Consult with the Incident Commander the status of emergency.
- Appoint an Emergency Log Recorder to maintain a written record of the time and events, including all discussions, instructions and decisions made by the Emergency Control Team;
- Appoint a Muster Station Coordinator, who will ensure that proper head counts are conducted at three (3) designated Muster Stations.
- Issues specific tasks to the members of the Management as they arrive at the Control Room, as per this guideline;
- Brief the Emergency Control Team;
- Ensure that the safety of personnel is maintained, throughout the operation.
- Ensure procedures are in place for prompt dispatch of requested personnel, materials and equipment to the emergency area.
- Arrange for all reports to be presented at specific intervals to the Emergency Control Team
- Finalize the recommendations of the Incident Commander for rescue and recovery operations.

- The Official In-Charge is the only person authorized to release information to Government Agencies, Corporate Office or the Local Communities. He may delegate this activity to other members of the Emergency Control Team.
 - Verify all information you release;
 - Keep a record of all inquiries (media and non-media);
 - Do not speculate on causes;
 - Do not speculate on resumption of normal operations or when the problem will be solved;
 - Advise that further updates will be forth coming.
- Notify the corporate management, if the following appear probable:
 - fatalities;
 - injuries that could probably become items of local, regional or national media interest;
 - there is a public health or environmental risk;
 - an incident involving chemicals where there is a large volume or the potential for over reaction (e.g., cyanide);
 - a spill of effluent or contaminated water or chemical substance to an area that lies outside the area of drainage control of the mine site (i.e., an external spill);
 - mine operations may be stopped for more than two (2) days;
 - Government authorities will become involved.
- Ensure all response teams, regulatory agencies and any other agency on emergency alert notice are advised when the emergency has ended.
- Ensure all documentation (i.e., notes, log sheets, written instructions, etc.) is gathered for the creation of the final report.
- Participate in debriefing.

2.2.2 General Superintendents:

- General Services, Operations and Maintenance will report to the Emergency Control Room and support the General manager/Designate in whatever capacity required.
- They will also ensure that the Superintendent/Designate in each of their respective Department's is aware of the emergency.
- They will assist with the investigation and write up of the final report

2.2.3 Incident Commander: – Usually a Trained Staff Member (ERT Coordinators or Supt. / GF.)

The responsibilities of the Incident Commander include;

- Ensure Security has been notified of emergency;

- Ensure the evacuation procedures have been activated, if required;
- Ensure that there are sufficient ERT members available to respond to the emergency;
- Ensure that the ERT has back-up support, a standby Team;
- Ensure that ERT Team has refreshments and nourishment (if the emergency requires several hours to resolve);
- Assess the size and severity of the emergency and the likely consequences. Establish response priorities;
- Maintain communication with the ERT Captain.
- Advise the Official In-Charge of the ERT Team's activities, regarding the rescue and recovery operations.
- Appoint sufficient personnel, equipment and outside services are available. Utilize the members of the Emergency Control Team to organize these resources.
- Advise Official In-Charge when the emergency situation is under control and give the "All Clear".
- Participate in emergency investigation.
- Coordinate an orderly return to normal operating conditions.
- Arrange for a debriefing session, and utilize the services of all involved in resolving the emergency.
- Assist to write the final report.

2.2.4 Emergency Coordination Center Log Recorder : - *"keep a systematic record of the emergency events" and get an accurate "Head Count during Emergencies"*

- These persons can be the Engineering Supt/Designate/ General Supt. (whoever is available to perform these duties).
- The log is intended to be a systematic record of the events from the start of the emergency through all phases to termination, and will be used in the preparation of the final report. It is important that the log be legible and that all information is recorded.
- Date and time the incident was reported, who reported the event;
- Every person entering or exiting the "Emergency Control Room" must report to Log Recorder.
- Record all subsequent developments as they occur;
- Record all phone calls all discussions and decisions made;
- Record any other information that needs to be captured for the final report;

- Keep all the sheets of paper used to record information numbered, for the final report;
- All the pages will be initialed by the recorder and official in-charge;
- The official document will stay with the Health & Safety Department upon completion of the emergency.

2.2.5 Meadowbank Site / Muster Stations Coordinator: *“Provide a Head Count during Emergencies”.*

- As soon as Management begins to assemble in the Emergency Control Room , the Person In Charge (the manager/designate) needs to assign a member of the Management Team *to be responsible for ensuring that the Muster Stations are contacted.*
- These persons can be the Geology Supt/Designate/ General Supt. (whoever is available to perform these duties).
- The Muster Stations Coordinator is required to contact the three Muster Stations by radio on channel **“Spare RPTR”** to ensure that there is a Supervisor or designate in charge of that specific muster station and give him/her 20 minutes to achieve the head count.
- The Muster Stations Coordinator will need to record the time the muster station was called, who is in-charge of the muster station, and any other instructions that have been given.
- The Muster Stations Coordinator needs to open the Flo on his/her laptop in order to cross reference the names, once they receive the lists from the Muster Stations. (Additional persons may need to be assigned to assist with the cross reference, in order to complete the head count in a timely manner).

2.2.6 Emergency Response Team (ERT Team) Duties:

- The ERT Team Members must report to the Fire Hall, when paged for a “code One” emergency;
- ERT Team Members will be given instructions on the emergency by the Incident Commander;
- ERT Team Members will follow instructions from the Incident Commander and will not put the Team at risk;
- The ERT Team Captain will maintain radio contact with the Incident Commander throughout the emergency:

2.2.7 Mine Superintendent/Designate Duties;

- Ensure that all employees working, are accounted for;
- Ensure that the ERT Members of his crew have responded to the “code One” emergency;

- If the “Emergency” is in the Pit, them assist the Official-in-Charge with the action plan to deal with the emergency:
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.8 Mill Superintendent/Designate Duties;

- Ensure all employees working, at this time, are accounted for;
- Ensure that the ERT Members on his crew, have responded to the “ Code One” emergency;
- If the “ Emergency” is in the Mill facilities, assist the Official-in-Charge with the action plan to deal with the emergency:
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.9 Environmental Superintendent/Designate Duties:

The following are the responsibilities of the Environmental Superintendent/Designate;

- Provide technical advice on probable environmental effects resulting from a spill and how to minimize them;
- Provide advice to the Official-in-Charge for appropriate spill response procedures;
- Ensure that Environmental Staff are available to direct the spill response action plan;
- Assist with restoring of the Operations back to normal operating standards:

2.2.10 Health and Safety Superintendent/Designate Duties:

The Health and Safety Superintendent/Designate will be responsible for:

- Ensure that an Incident Commander is in place to oversee the ERT Teams;
- Ensure that all Management respond to the emergency and meet in the emergency control room;
- He will oversee all activities that require Security or Nursing. He will arrange for Medevac transport, if required;
- Will assist with getting a “head count” for the Official in-charge;
- Assist with obtaining outside help if required:

2.2.11 Site Services Superintendent/Designate Duties:

The following are the responsibilities of the Site Services Superintendent/Designate;

- Ensure that all his employees are accounted for

- Ensure that all ERT Member on his Crew, respond to the “ code One” emergency;
- If the “ Emergency” is involves the Site facilities, assist the Official-in-Charge with the action plan to deal with the emergency;
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.12 Maintenance Superintendent/Designate:

The following are the responsibilities of the Maintenance Superintendent/Designate:

- Ensure that all of his employees are accounted for;
- Ensure that all ERT Members of his crew respond to the “Code One” emergency;
- If the “Emergency” is in the Maintenance Shops, then assist the Official-in-Charge with the action plan to deal with the emergency;
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.13 Human Resources Superintendent/Designate Duties:

The following are the responsibilities of the Human Resources (HR) Superintendent/Designate;

- Ensure that all HR employees are accounted for;
- Provide assistance to the Official-in-Charge if there are employees issues, such as injuries, transportation requirements, etc.:

2.2.14 Health Care Professional (Nurse/Medic):

The on-site health professionals are responsible for the following:

- Providing on-site first aid and other medical support;
- Establish a triage location if there are multiple casualties;
- Arrange for medevac transportation, if required;
- Ensuring that the first aid room is maintained at all times, by using First Responders as support:

2.2.15 Security Department:

The on-Site Security Supervisor is responsible for the following:

- Ensuring that the Security officer has activated the appropriate level of emergency notification;
- Ensure that access points to the emergency are properly guarded.

- Notify the Baker Lake Gatehouse if the emergency involves the All-weather private Road (AWPR).
- Assist with other duties as requested by the Emergency Control Group.

2.2.16 Procurement and Logistic / Warehouse Department:

The on-Site Procurement or Warehouse General Supervisor / Designate will be responsible for:

- Ensure that all his employees are accounted for
- Ensure that all ERT Member on his Crew, respond to the “ code One” emergency;
- Assist as required by supplying equipment and/or manpower;
- Assist with restoring of the Operations back to normal operating standards:

2.2.17 Duty Cards for each Department/Roles and Responsibilities

Each individual' roles and responsibilities are defined on the following pages:

Name: _____

Date: _____

Time assumed Role: _____

Manager On Duty - Duty Card	Completed	Time
1. Notified of an emergency – Make decision to have the whole Management Paged – control group		
2. Brief Management Team on the emergency		
3. Appoint a Scribe – Engineering department		
4. Decide if communications are to be cut – Notify IT		
5. Ensure that the emergency remains confidential – limit what is said to employees		
6. Conduct a head count – (Muster Stations) Assign duty to Geology Department		
7. Ensure unaffected Departments are put on Standby – E.g.: mine dept. – may need equipment		
8. Ensure all Service Departments are put on Standby – as required by ERT – Camp / Mine / Site Services / Maintenance / Manpower / Equipment / Tools / Equipment		
9. Ensure Power House is on standby		
10. Ensure that Protocol is on standby – flights to and from site for our workers / Mutual Aid teams		
11. Ensure Warehouse is on standby:		

Note: list of materials taken will be kept and accounted for after the emergency is over		
12. Do we need radios, ERP, Site Drawings out for incident command team		
13. Security / Close Roads		
Once Emergency is over:		
1. Initiate the "Emergency Stand Down" when required		
2. Follow up with HR Designate on any victim or surviving members concerns		
3. Hold a de-briefing with Personnel prior to them exiting the site		
4. Gather any information for Corporate HQ and Regulatory Agencies (Mines Inspector)		
5. Prepare and facilitate a Debriefing Session		
6. General Manager will liaise with media with ALL information going out from site.		
* Write notes on reverse side and return this Card to Scribe after the Incident Debriefing for compilation purposes		
<i>No information will be relayed to Corporate or Media without the expressed confirmation of the Manager on Duty.</i>		

Name: _____

Date: _____

Time assumed role: _____

Health & Safety Department or Designate Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Offer support to all Incident Command Group Management Team Members		
3. Account for all persons in Health and Safety Dept.		
4. Liaison between Emergency Response Teams and Incident Command Group Management Team Members		
5. Review remaining Emergency Response Capabilities: manning, equipment, resources		
Questions to ask: a) Do we need to stop operations? (Ex: SCBA use – if SCBA's are required for emergency, and we have other confined space work occurring, do we cancel? b) Do we need to reduce or have rescuers stand down during an emergency to ensure that we have adequate numbers available for continuation of normal operations? c) (Ex: mine rescue team called out to an emergency, 12 people show up, only 6 is required for emergency, and then 6 can stand down and go back to work and be available if another emergency occurs at same time. d) If people and equipment are available to meet		

Regulation requirements, then normal operations can continue. If not – consider putting alternate plans in place.		
6. Respond to any field requests		
7. Maintain notes of all decisions made with times as required.		
8. Organize and manage any site security requirements		
9. Liaison with any other emergency resource provider		
10. Provide information updates to the Incident Command Group		
11. Maintain Health and Safety Standards at the Mine Site during any incident		
12. Assist with any trauma management situations and Post Incident Debriefing sessions as required		
13. Participate in the incident debriefing session		
14. Liaison with the Department Head where incident occurred and help with incident investigation process		
15. Advise on corrective action initiatives		
16. Communicate with Mines Inspector – Serious Injury / Dangerous Occurrence – only after approval of Manager on duty		
*Write notes on reverse side and return this Card to scribe after the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Department Head where incident occurred Duty Card	Completed	
Print Name:		
1. Report to Command Centre		
2. Gather all available information and share with Incident Command Group Team Members		
3. Account for all persons under area of responsibility – (Need to determine who is missing and where they may be)		
4. Confirm effective Communications with Responders and Relative Supervisors		
5. Confirm Incident losses and status of the incident		
6. Designate an Assistant if required		
7. Assess current resources and determine if additional resources are required		
8. Manage Personnel duty hours, needs, food and other		
9. Visit the incident scene if required – and Safe to do so		
10. Assemble any information required for a report		
11. Attend the Incident Debriefing		
*Write notes on reverse side and return this Card to Scribe after the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Logistic or Designate Duty Card (General Services Superintendant)	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Ensure that flights are arranged for outgoing and incoming purposes when required		
4. Ensure IT is available upon request – (cut communications) fix radios etc.		
5. Arrange transportation of all personnel as required		
6. Arrange for provision of food, water, temporary shelter, radios, PPE, etc. when required		
7. Assemble any information required for a report		
8. Participate in the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe after the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Warehouse or Designate Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Assemble lists for inventory of possible equipment or supply needs		
4. Source any supplies and equipment that is requested by the Manager on Duty		
5. Source any requests for external services or supplies		
6. Designate an Assistant if Required		
7. Schedule Support Staff Personnel if required		
8. Ensure that someone is available at all times during the entire emergency to supply equipment materials as necessary		
9. Assemble any information required for a report		
10. Participate in the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe after the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Human Resources/Designate Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons under area of responsibility		
3. Set up a format for any media communications		
4. Confirm information accuracy if required		
5. Designate an Assistant if required		
6. Ensure proper notification systems are followed (RCMP are responsible for initial notification of family in fatal events)		
7. Coordinate any follow up visits to family of victims		
8. Confirm that Employee Assistance Program, Critical Incident Stress or Victim Services is available to injured or survivors or Post Traumatic Stress sufferings of any personnel		
9. Assemble any information required for a report		
10. Help Manager on Duty prepare communication to advise workforce		
11. Participate in the Incident Debriefing		
12. All communication to media will be done through the Manager on Duty		
*Write notes on reverse side and return this Card to scribe after the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Emergency Response Team Captain Duty Card	Completed	Time
Print Name:		
1. Respond to the scene or requested area with all available and applicable equipment		
2. Confirm communication with the Incident Commander at Base Station		
3. Contact Department Head of affected area for any request or directions through Incident Commander		
4. Direct emergency activities with your Team		
5. Maintain Safe Working Standards with you team		
6. Offer periodic Status Reports to Incident Commander at Base Station		
7. Secure the incident scene – as per Regs. 16.03/16.04		
8. Liaison with any other external emergency personnel		
9. Ensure area clearances with Helicopter Pilots – if required		
10. Respond accordingly within you and your team's capabilities		
11. Request any additional resources through your Incident Commander at Base Station		
12. Assemble any information required for a report		

13. Attend the Incident Debriefing		
14. Take Cell Phone with them when going off site – phone number is 867-793-1330		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Note: Captain must have a report that will be submitted at completion of emergency which includes all of the above.

Name: _____

Date: _____

Time assumed role: _____

Environmental Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists if requested		
5. Liaison with all field operations on the incident when involving spills/chemicals		
6. Liaise with Government Regulators as necessary for reporting spills/chemicals etc. upon approval of Manager on Duty.		
7. Designate an Assistant if required to help out in the field		
8. Direct external Emergency Spill Response Personnel to proper location(s) if required		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Maintenance Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists		
5. Liaison with all field operations on the incident when involving equipment, machinery		
6. Have personnel available to deal with broken down machinery etc.		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available if required by Emergency Response Team		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Mine Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists		
5. Liaison with all field operations on the incident when involving incidents in the pit		
6. Ensure that contractors in area of responsibility are notified and accounted for		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available as necessary to help Emergency Response Teams		
9. Assemble any information required for a report		
10. Attend the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Engineering Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Maintain a log of events, calls, requests, external personnel and contact lists (SCRIBE) for the incident		
5. Liaison with all field operations on the incident when involving incidents where engineering is required		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Geology Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Conduct a proper head count of all persons assembled in the Muster Stations (Procedure can be found in Emergency Response Plan)		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Site Services Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure that manpower, equipment is available for the proper function and maintenance of fire sprinkler systems		
5. Ensure that manpower, equipment is available to maintain an open road (AWPR) to Baker Lake		
6. Ensure that manpower is available as airport marshal and for moving material arriving in aircraft, fuel, etc.		
7. Ensure that manpower, equipment is available for transportation of men/gear to help Emergency Response Teams		
8. Maintain a log of events, calls, requests, external personnel and contact lists		
9. Designate an Assistant if required to help out in the field		
10. Make equipment and manpower available as necessary to help Emergency Response Teams		
11. Assemble any information required for a report		
12. Attend the Incident Debriefing		

*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Electrical Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure that personnel and equipment is available to maintain the required power supply		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Mill Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Conduct a proper head count of all persons assembled in the Arctic Corridor Muster Station		
5. Maintain a log of events, calls, requests, external personnel and contact lists		
6. Designate an Assistant if required to help out in the field		
7. Make equipment and manpower available as necessary to help Emergency Response Teams		
8. Assemble any information required for a report		
9. Attend the Incident Debriefing		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Camp/Housekeeping Department Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre through HR		
2. Account for all persons in area of responsibility		
3. Be available as a resource to Incident Command Group		
4. Ensure an adequate supply of food when requested		
5. Ensure that an adequate supply of blankets, washers/dryers are available when requested		
6. Maintain a log of events, calls, requests, external personnel and contact lists		
7. Designate an Assistant if required to help out in the field		
8. Make equipment and manpower available as necessary to help Emergency Response Teams		
9. Assemble any information required for a report		
10. Ensure that HR has all available information		
*Write notes on reverse side and return this Card to scribe during the Incident Debriefing		

Name: _____

Date: _____

Time Assumed Role: _____

To be filled out by Incident Commander:

Incident Commander Duty Card	Completed	Time
Print Name:		
1. Initiate an emergency response as required		
2. Ensure communications with Emergency Response Team Captain and be there to request assistance or resources		
3. Ensure incident scene is secured as required		
4. Liaise between Emergency Response Team and Incident Command Group		
5. Ensure that all gear, equipment, supplies required by Emergency Response Team is made available to them		
6. Have the gear, equipment, supplies brought to Emergency Response Teams when required		
7. Assemble any information required for a report		
8. Request any additional resources at any time required		
9. Attend the Incident Debriefing if requested		
*Write notes on reverse side and return this Card to ICS during the Incident Debriefing		

Name: _____

Date: _____

Time assumed role: _____

Scribe Duty Card	Completed	Time
Print Name:		
1. Report to Command Centre		
2. Scribe all accounts of activity in chronological order		
3. Scribe information as requested by the Incident Command Group – Manager on Duty		
4. Provide a detailed report at end of incident		
5. Assemble any information required for a report		
*Write notes on reverse side and return this Card to ICS during the Incident Debriefing		

2.3 OCCUPATIONAL HEALTH AND SAFETY COMMITTEE:

The Occupational Health and Safety Committee is responsible for:

- Review the emergency response plan on an annual basis.
- Assist with any investigation resulting from the emergency.

2.4 ALL EMPLOYEES:

All employees are responsible for:

- Reporting to the nearest Muster Station when an fire alarm is sounded;;
- Employees reporting to the Muster Station need to assemble at the placard that has their department name.
- Employee's must be quiet and await the "head count".
- Reporting any emergency by either using a two-way radio on your regular "working channel" (Note: Working zone channel 9 (AEM Surface should initiate a Code 1 on channel 3 (Mill Repeater) or by using the telephone to call 6911, to describe the type, the location, and nature the emergency, including possible injuries, trapped personnel, and the presence of any chemical or explosive hazards.

2.5 SUPERVISOR:

The Supervisor is responsible for:

- Ensuring the "Code One" call in, is accurate and that all the pertinent information is available for the official-in-Charge. (providing details regarding the type, the location, and the nature of the emergency, including possible hazardous materials involved and health and safety concerns);
- Ensure all workers on his shift are accounted for:

2.6 OTHER PERSONNEL:

Depending on the nature of the emergency (medical, electrical, mechanical, fire, etc.) other site personnel, including the Site Electrician, Site Mechanic, and others, may be called upon to play key roles.

2.7 EMERGENCY RESPONSE CONTACT INFORMATION – INTERNAL & EXTERNAL

AEM internal emergency response personnel, their duties, and phone numbers has been compiled in Table 2.1, Important external contacts such as regulatory agencies, health organizations and transportation companies providing evacuation support are listed in Table 2.2.

Table.1: Internal Emergency Response Contact Information Chart

NOTE: Pagers are activated by dialing 6930 and listen for instructions

GENERAL MANAGER or Acting Manager	Pager: 404
Bertin Paradis	Ext: 6725
	Cell: 819-355-9348
Assistant-General MANAGER	Pager: 215
Luc Chouinard	Ext: 6767
	Cell: 819-856-8160
INCIDENT COMMANDER	Pager: 402 Ext: 6809
Andre Rouleau	Cell: 819-355-2191
Philippe Beaudoin	Cell: 450-847-4214
Maintenance General Superintendent	
Richard Grenier	Cell: 819-354-9531
General Services Superintendent	
Alain Hamel	Cell: 819-856-5411
Operations General Superintendent	Pager: 237
Martin Beausejour	Cell: 819-355-2913
Cost Management	Pager: 236
Health & Safety	Pager: 213
Information Technology	Pager: 282
Security	Pager: 468
Engineering	Pager: 230
Geology	Pager: 218

Mining Dept.	Pager: 234
Environment	Pager: 232
Process Plant	Pager: 214
Energy and Infrastructure	Pager: 219
Human Resources	Pager: 217
Maintenance	Pager: 231
Logistic and Warehouses	Pager: 216

Every department has the obligation to designate a representative that is wearing the departmental pager and is also knowing and understanding basic principles of the Emergency Response Plan.

Table 2.2: External Emergency Phone Numbers

Organization / Authority	Telephone Number	Fax Number
NT-NU 24-HOUR SPILL REPORT LINE	867.920.8130	867.873.6924
Nunavut Water Board	867.360.6338	867.360.6369
Environnement Canada, Environnemental Protection Branch	867.669.4700	867.873.8185
Environment Canada: 24-hour emergency pager monitored by Emergency and Enforcement	867-920-8130	Same as NT-NU 24-hours spill
Manager Pollution Control & Air Quality Environmental Protection, Government of Nunavut	867.975.7748	867.975.5981
General Inquiry Department of Environment, Government of Nunavut	867.975.7700	
Indian and Northern Affairs Canada (INAC) – Water Resources Manager, Nunavut Regional Office	867.975.4550	867.975.4585
Indian and Northern Affairs Canada (INAC) – Manager, Land Administration, Nunavut Regional Office	867.975.4280	867.975.4286
Kivalliq Inuit Association – Reporting Line	867.645.2810 or 867.645.2800	
Department of Fisheries and Oceans (DFO) – Nunavut Regional Office	867.979.8000	867.979.8039
Workers Safety and Compensation Commission Mine Inspector: Martin Van Rooy	800.661.0792 867.979.8527	
Keewatin Health Services – Baker Lake	867.793.2816 867.793.2817	
Keewatin Air Ambulance (Medevac) 24h/7 – Rankin Inlet dispatch	867.645.4455	
Baffin Regional Hospital (Iqaluit)	867.979.7300	
Baker Lake RCMP Baker Lake RCMP – emergency number Cambridge Bay RCMP	867.793.0123 867.793.1111 867.983.1111	
Baker Lake Hamlet Office	867.793.2874	
Baker Lake Fire Emergency	867.793.2900	

Baker Lake Radio Station	867.793.2962	
Baker Lake Airport	867.793.2564	
poison & drug information service (PADIS)	866-727-1110	
Search and rescue – Arctic Armed Forces	800.267.7270	
Rescue Coordination Centre Trenton	613.965.3870	
NAVCAN (Flight Information Center North Bay)	866.541.4109	
CANUTEC (Spill Support Information)	613.996.6666	
Charter Aircraft (for Evacuation)		
Keewatin Air Ambulance (Medevac) 24h/7 – Rankin Inlet dispatch	867.645.4455	
Calm Air	204.677.0513 204.677.0519	
Nolinor	450.476.0018 888.505.7025	
First Air	867.669.6694 867.444.2002	
Helicopter Transport Services (HELI transport)	613.839.5868	
Nunavut Emergency Management – Rankin Inlet	1-867-645-6803	
Nunavut Emergency Management – Iqaluit	1-867-979-6262	

2.8 EMERGENCY COORDINATION CENTRE

Emergency operations will be directed out of the Emergency Control Centre (ECC). The ECC is located in the 3rd Floor of the Service Building Conference Room, or in the Training room on the main floor, or in the Security Guard Building by Air Strip from where the following will take place:

- Key decisions will be made and operations will be managed;
- Technical information to direct emergency activities will be provided;
- A communications centre will be established for emergency operations and to communicate with other organizations;
- Resource procurement will be provided and resource use will be directed;
- Any damage will be assessed and long-range objectives and plans will be developed; and
- Information on the emergency will be stored and disseminated to all necessary internal and external parties.

The following information is available at the centre:

- Shutdown procedures for operations;
- Locations of hazardous material storage areas;
- Locations of emergency and safety equipment;
- Locations of first aid stations and muster areas;
- Maps of communities and environmental maps;
- Information on location of other communications equipment, including portable sets;
- Information on emergency power;
- Contacts for other utilities;
- Operating manuals;
- Materials Safety Data Sheets (MSDS);
- List of personnel with alternate skills for use in emergencies;
- Type and location of alarm systems;
- Accident report forms;
- Accident status board and log book;
- Notification lists, staff lists, contact lists, with regular and emergency telephone/pages numbers, etc.

The ICC will be located at a safe and secure place near the site of the emergency. All responses and mitigation efforts developed at the ECC will be implemented through the ICC.

In the event of an emergency, security personnel may be required to establish and maintain a security perimeter to prevent or minimize injury to personnel, to preserve evidence for investigation, or to prevent unauthorized access to the scene.

2.9 TRAINING

The HR Superintendent is responsible for documenting, tracking, and updating all training activities. Record of training requirements and training attendance will be kept, tracked and updated for all employees by the HR Superintendent to ensure that retraining occurs as required.

For mine operations, AEM will ensure a sufficient number of trained ERT team members are on site at all times. All members of the ERT will be trained and familiar with emergency and spill response procedures. Emergency training will be conducted annually to ensure that a sufficient number of team members are available and that their training is up-to-date. The following will be included in the training:

- A review of the SCP and responsibilities of the team members;
- The nature, status, and location of fuel and chemical storage facilities;
- The location of on-site and off-site spill response equipment, and how to use it;
- Emergency contact lists;
- Desktop exercises of “worst case” scenarios; and
- The likely causes and possible effects of spills.

2.10 EMERGENCY RESPONSE EQUIPMENT

The Emergency Measures Counsellor will ensure that site drawings and equipment lists are posted conspicuously in key locations throughout the site so that important information is always readily available. This will include the following:

- Location and isolation points of energy sources;
- Location of emergency equipment (e.g., fire water pumps, fire extinguishers, monitors, self-contained breathing apparatus);
- Emergency procedures outlines, such as specialist firefighting, chemical neutralization;
- Location of equipment for combating pollution (e.g., booms, skimmers, pumps, absorbents, dispersants);
- Availability of internal and external emergency medical support (e.g., hospitals, clinics, ambulances, medical supplies, personnel with medical or first aid training);
- Location of toxicity testing facilities (e.g., gas and water);
- Location of wind direction / speed indicators;
- Directions on how to contact the local or regional weather forecasting service;
- Location of personal protective equipment and directions on its proper use; and
- Location of first aid stations and muster areas.

The Incident Commander, EMC, and Health and Safety Superintendent will know where, throughout the project site, all of this information is posted and where emergency equipment is stored. These individuals will also be trained in the proper use of emergency equipment.

External emergency response equipment includes the mobile emergency response equipment described in the SCP.

SECTION 3 • COMMUNICATION SYSTEMS

The primary basis for communication will be the phone system; back-up communication will be available via satellite phone. For on-site communication, hand-held radios will be mandatory for all employees working or travelling in remote areas from the main camp. Cell phones can be used as an additional means of communication. Back-up power sources and replacement batteries for communications equipment will be available to provide continuous, uninterrupted operation either at fixed facilities or at emergency sites.

Key site personnel will be accessible at all times by either portable radios, radios in vehicles, or office radios. The Health Care Professional will carry a hand-held radio and will be available at all times. Security personnel will monitor the emergency channel twenty-four hours per day. Senior management personnel will rotate as "On-Call Managers" for after-hour emergencies. An accommodations list that highlights key personnel will be posted and updated as required.

Lists of employees trained in first aid, mine rescue, and Emergency Response will also be posted. Employees and contractors who will be on site for extended periods will be trained initially and then retrained annually. This training will include the locations and use of emergency equipment, terminology used, and who needs to be contacted immediately in the event of an emergency.

SECTION 4 • EMERGENCY MEASURES

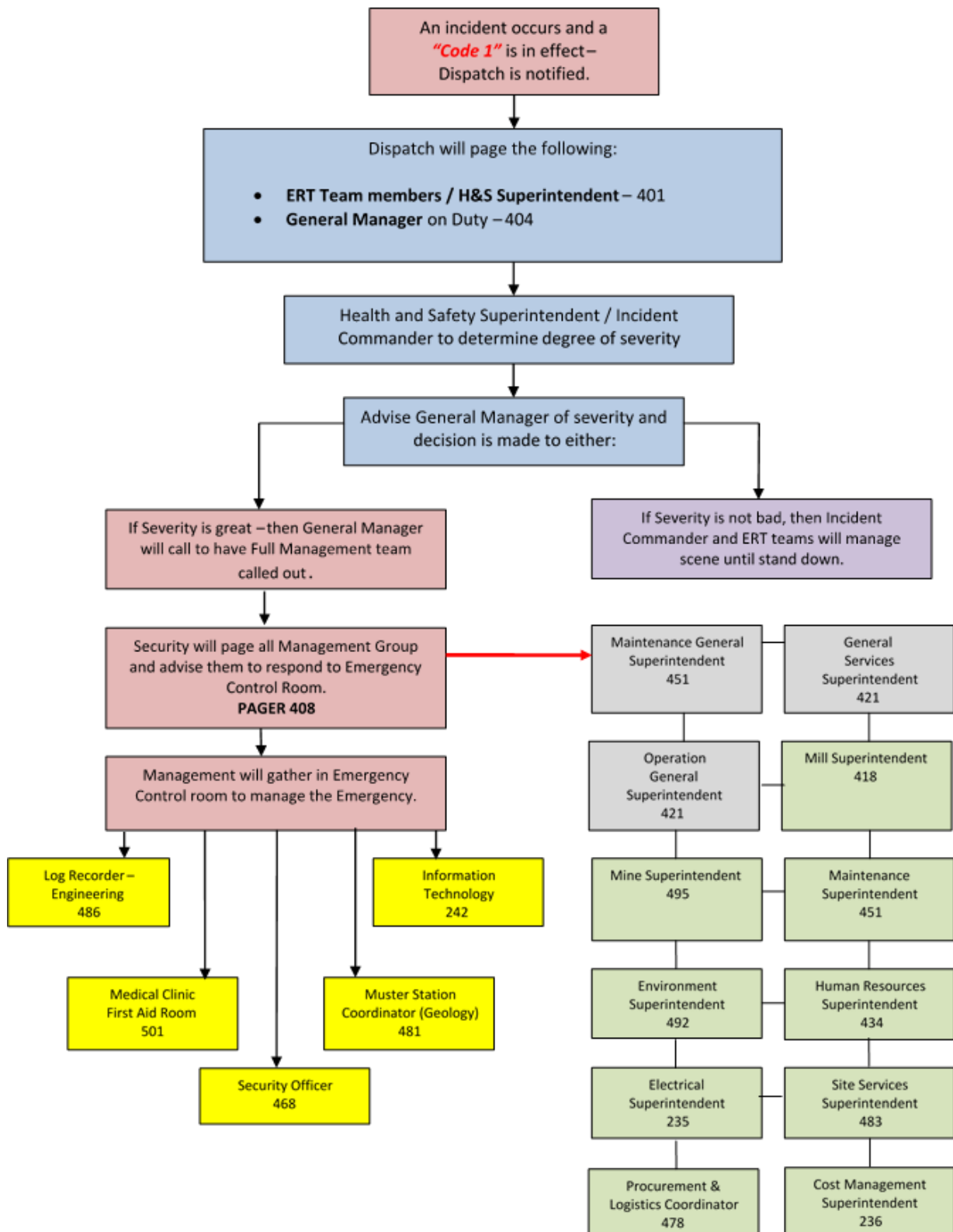
Appendix MBK-HSS-3001-F-B Emergency Measures Response Flowchart

In the event of an emergency, the employee will have to follow our emergency procedure:

- Emergency is initiated - by calling **6911** on desk type phones, or calling on Two-way radio on **"Working Channel" – Code 1 – Code 1 – Code 1**.
- All communication stops except for those involved with the Emergency – I.e.: First Aid Room attendants, Medics, ERT as required.
- All work stops in First Aid Room / Clinic – and in affected area – depending on seriousness of Emergency – the whole site.
- First Aid Room Attendant / Medic will answer the phone and/or radio.

Note: if the First Aid Room Attendant / Medic do not answer, then Security Guard will answer and/or a Supervisor on radio will answer so that Emergency Response can be initiated.

- **Responder** – will ask where the medic is required?
- **Caller** – will give a brief description of the Emergency – name, location and what is wrong and/or required.
- **Responder** – will confirm location and details of incident and activate the **ERT** team. Security will be notified by responder and a page will be sent out to all **ERT** team members on site.
- The person at the casualty(s) will administer First Aid if trained to do so.
- Incident Commander Center will be immobilized as to ensure that communications, transportation, and effective deployment of **ERT** resources are conducted. It is mandatory that the Official In-Charge be notified immediately.
- Transportation will be arranged to meet at the **ERT** hall by the two large doors for medical gear and **ERT** team members.
- The **ERT** team (minimum of 6 team members) will assemble as quickly as possible. (Expectation – when the page goes off – all **ERT** team members will make their way expediently to the **ERT** hall.
- As soon as steps have been implemented to properly attend to the injuries, the Incident Commander will notify the appropriate authorities of the accident by telephone, providing as much information as possible. A complete accident description and investigation form is required to be submitted as soon as possible. The accident description and investigation form will be completed and submitted by the General Mine Manager. Unless some action is required to remove an immediate hazard, the site of any serious accident will be cordoned off and remain unchanged until clearance is received from the appropriate authorities.



4.1 FIRE

The Camp Complex and Process Plant is equipped with a fire detection and audible fire warning system. All site operating personnel receive basic training in the use of fire extinguishers. This training is tracked by the HR Superintendent.

For any situation involving fires, the first action will be to extinguish the fire if it is safe to do so and then report the incident. If the person cannot safely put out the fire, it must be reported as quickly as possible. In the event of a fire alarm, all employees not directly involved with fighting the fire will report to the designated muster location (section 5.2). Employees will remain in this area until assigned other duties by the ERT or until given clearance that the emergency is over.

In the event that a fire causes damage to mining equipment, site buildings, or chemical containers, particulates and/or gases could be released into the air, and hazardous materials and/or other chemicals (e.g., fuels, oils, battery acid, lime, etc.) could be spilled. In the short-term, this could result in air quality degradation, and potentially affect the local vegetation in the case of a spill or burn scar. Should such scenarios occur, the following actions will be taken, as required and WHEN IT IS SAFE TO DO SO:

- Air quality monitoring for airborne emissions;
- Collection and incineration of all putrescible (food items);
- Removal of debris and contaminated soil for disposal on-site or off-site at a licensed disposal facility;

Further details on the cleanup of chemical spills are provided in the Spill Contingency Plan.

The incident commander will;

- Locate the source of fire.
- Dispatch the evacuation at the safest muster point.
- Assign a captain and his team.
- Ensure the security of all the ERT's members or any other service persons (medics, security guard, electricians, etc...).
- If the intervention of the mine inspector is necessary for a special investigation, he will ask to the security department to ensure the integrity of the scene.
- Call the end of the emergency measures and invites everyone evacuated to reintegrates their original locations.

General Manager or designate can decide to use any available machinery to separate all or part of a building to protect people or minimize losses.

Incident Reports are to be filed detailing the causes of the fires and responses undertaken. This information will be used by the EMC in subsequent fire prevention activities.

4.1.1 Muster Point

In the event that an evacuation is necessary, it is important that all affected personnel leave the emergency area and congregate at a pre-determined area or *Muster point* so that a head count can be taken to determine if there are any missing persons. Employees must remain at the muster point until the supervisor of the emergency area gives permission to return to work.

Upon hearing a fire alarm, smoke alarm, or evacuation alarm you shall

- **Do Not Panic** – Always ensure that you are prepared for the weather conditions – Dress appropriately – (Winter clothing during winter months).
- *DO NOT* delay and *DO NOT* stay and finish work before taking the proper steps to evacuate.
- Always **close** windows/doors as you leave your office etc.
- *Always* head to the *closest* **EXIT** door and follow **EXIT** signs to the closest outside door.
- Once outside head to the *closest* “*Muster Station*”.
- Once in “*Muster Station*” – Stay put until relieved or instructed otherwise by the **Muster Station Leader**.
- The **Muster Station Leader** will designate a specific guard for every door of the muster in order to avoid people already registered to leave the Muster Station.
- The **Muster Station Leader** will *conduct a tally* (head count) of everyone in his/her department. Ensure that you get your name on the tally form.
- Note: on nightshift, the highest level of Management may be a front line Supervisor.
- *DO NOT* enter a building when the alarm is sounding. Head straight to a “Muster Station”.
- *Never* go through a building to get to a “Muster Station”. Once you are outside, the first door you open should be the one to the “Muster Station”.
- *Never* disregard an evacuation alarm. We understand that the system goes off without incident on occasion, but to disregard an *alarm is to endanger your life and the lives of others*.
- *Stay in* “Muster Station” until you are instructed to “Stand Down” by the **Incident Commander** or the **Muster Station Leader**.
- *Do Not* leave “Muster Station” to go outside for a smoke. It is important for your Supervisor to know where you are at all times – especially during an “Emergency”.
- The only person authorized to initiate a “Stand Down” is the **Incident Commander or the General Manager or designate**.
- Failure to follow proper Evacuation Procedures will result in Discipline.
- The following areas are considered “**Muster Stations**” (see Figure)



4.2 MEDICAL EVACUATION (MEDEVAC) PLAN

In the event of serious injury, it may be necessary to remove the individual from the source of the danger and to administer emergency first aid. The Health Professional will be notified immediately in order to take charge of the situation and ensure the safe removal of the injured person to the first aid room if possible.

- The **ERT** team will respond with (Nurse / Medic) and assist as necessary with equipment, treatment etc.
- The (Nurse / Medic) and as many **ERT** team members as required will respond to the incident site. When the (Nurse / Medic) arrives at the scene, they will notify the First Aid Treatment Room.
- First Aid will be administered to casualty(s); the casualty(s) will be secured and transported to the First Aid Room. Vehicles transporting casualty(s) will have priority over any other vehicle on site.
- Once the "Mechanisms of Injury" and the patient's condition have been assessed, a decision will be made by the (Nurse / Medic) whether a Medevac is required and decide on ground or air transportation. There are guidelines to follow to make this determination.

Depending on the **MEDEVAC** Company that has been chosen, the (Nurse / Medic) may have to escort the patient to the receiving Health Care Facility.

The Official In-Charge will notify the (Nurse / Medic) when the **MEDEVAC** has arrived and landed. The (Nurse / Medic) with the help of the **ERT** team will transfer the patient into the ambulance, to the aircraft.

If the **MEDEVAC** comes to site with a **Medical crew**:

- ❖ The **MEDEVAC** team will call ahead to notify their ETA.
- ❖ The Manager on Duty or designate will ensure that a vehicle is sent to the airstrip at the ETA.
- ❖ The **Medical crew** with their equipment will be brought to the First Aid Room.
- ❖ Once the **MEDEVAC** equipment is in place, the **ERT** team will assist the **MEDEVAC Medical crew**, and (Nurse / Medic) with the transfer of the patient to the ambulance, and into the aircraft.

After the aircraft has left AEM – MBK site, the (Nurse / Medic) will notify the receiving Medical facility with the ETA to their closest airport. The **MEDEVAC** pilot will advise receiving airport air traffic controller that an ambulance is required for transportation to receiving Medical facility.

All Operations type work will be suspended until (Nurse / Medic) are back in First Aid Room. The incident scene, materials, machinery, medical equipment etc. will remain undisturbed until the investigating team has conducted the investigation. This type of incident is considered a “Reportable Incident” therefore the Mines Inspector shall be notified (without delay). The Official In-Charge will be responsible for ensure that this occurs. Under no circumstances shall any person move, or otherwise interfere with any wreckage or equipment at the scene of a “reportable incident” until an inspector has conducted an investigation of the incident and has given permission to do so.

The Official In-Charge will make all necessary calls to the outside for notification purposes: I.e.: Corporate Office notification, Mines Inspector, RCMP, etc.

If the incident is of a fatality, it is CLEAR that the Coroner or in his/her absence, the RCMP are in total control of the incident scene. The scene is to remain undisturbed until orders have been issued by either of these two authorities.

The scene will then be released to the local authorities such as the Mines Inspector for their portion of the investigation.

Upon arrival of the aircraft to the airport of the Receiving Medical Facility (other than Baker Lake), the receiving team will be notified and a designated person will call the Incident Command (control center) and update them on their arrival and the next steps to be taken. I.e.: transportation to Receiving Medical Facility.

The Receiving Medical Facility will communicate with AEM – MBK Division (Nurse / Medic) on frequent basis to update site on patient’s condition and treatment.

[Control + Click here to link to procedure MKK-HSS-C-004 Medical Evacuation Communication Pathway](#)

4.3

AIRPLANE CRASH DISASTER

Emergency Response begins as soon as an air crash is identified or reported.

- When the Meadowbank Air Traffic Controller or Meadowbank Security is notified that an approaching aircraft is having difficulty, they will immediately notify the General Manager or Designate.
- In the event of reported air crash off-site the Meadowbank Air Traffic Controller or Meadowbank Security will notify the General Manager or Designate.
- Emergency Response procedure will be initiated if required for response by ERT
- The ERT Team on scene will make a preliminary assessment and notify the Nursing Clinic.
- The Nurse or Medic, with the ERT Team, shall establish triage, treatment, transportation, communication, and staging.
- The ERT Incident Commander will direct all emergency response actions, and assess the need for additional resources keeping the Command Post updated as to all actions
- The RCMP will establish access and traffic control and assist the Coroner in body recovery and identification, if necessary.
- The Incident Commander will instruct emergency response personnel to not move debris associated with the wreckage, ie. cargo, plane remnants, passenger belongings, unless there is imminent danger of items being destroyed, or unless they inhibit access to passenger rescue.
- The Coroner/RCMP is responsible for the identification, movement and/or removal of the fatality. Unauthorized personnel are not to move the dead without express approval of the Coroner/RCMP, except when there is a question of whether the person is deceased or if the body is in danger of being destroyed. In all cases involving the movement of a body, personnel moving the body shall make careful note of the location and condition of the body for the Coroner/RCMP.
- Upon notification of an air disaster, NAV Canada will be responsible for air traffic in proximity to the scene, with immediate regulatory control of airspace around the area.
- They will keep the airspace clear of intrusive air traffic, to the limits of the regulations.
- **Recovery:**
- Recovery immediately follows emergency response. It involves direction from the General Manager or Designate.
- Maintaining access control to the scene.
- Providing emergency social services (critical stress debriefing), for employees and rescue workers.

- Investigating the accident.
 - Clean-up of the crash site.

 - **4.4 PIPELINE BREAKAGE**
 - Pipelines will be used to transport tailings solids, reclaim water, freshwater, and domestic sewage on site. Pipeline breakage could lead to localized, short-term smothering of vegetation, the release of poor-quality water, and potentially exposure of mine personnel to infectious or toxic substances. In the event of a pipeline breakage, the following actions will be taken as required and when it is safe to do so:
 - Shut off the feed to the pipeline;
 - Physically contain the spill through the construction of dikes, berms, sumps and collection ditches;
 - Pump collected water to the tailings reclaim pond or sewage treatment plant;
 - Collect and remove solids for disposal in the tailings facility, incineration, or off-site disposal at a licensed disposal facility; and
 - Monitor for residual contaminants on land and in surface water.
 - A general response procedure for the handling of spilled domestic sewage (infectious substances) is provided in the Spill Contingency Plan (Appendix M).
 - A specific response procedure for cyanide involved systems is provided in Appendix B of the Meadowbank Site Emergency Response Plan.

 - **4.5 TOXIC GAS RELEASES**
 - In the event of a toxic gas release, the following actions will be taken:
 - Immediately evacuate the area/building and notify the incident commander;
 - If possible and safety permits, turn off the source of the gas and ventilate (i.e., open windows/doors to outdoors) the area;
 - Isolate the area and restrict access to ERT personnel only; and
 - Implement air quality monitoring
 - For the mill, refer to the specific procedure *General Alarm Evacuation Procedure*.
- Control + [Click here to link to procedure MBK-MIL-HS-0001](#)**
- A general response procedure for the release of compressed gases is provided in the SCP.
- ❖ **IN THE EVENT THAT CYANIDE HYDROGEN (HCN) IS INVOLVED, REFER TO APPENDIX B OF THIS DOCUMENT.**

○ **4.6 DIKE FAILURE**

- In the event of a dike failure, the following actions will be taken:
- Immediately evacuate the area and pit where failure could affect and notify the incident commander;
- Isolate the area and restrict access to ERT personnel only
- Use any material, heavy equipment and tools to make temporary or permanent repairs. All work to be conducted under ECC's supervision.

A detailed Emergency Preparedness Plan (EPP) was developed to address the consequences of failure of any of the dikes on site. The procedure was developed by the Geotechnical Engineering team with the assistance of the dike designer (Golder Associates provided the first version of the dike OMS and EPP, which was then elaborated upon by AEM) and the review of the EMC and the Safety Superintendent. The EPP for the dewatering dikes and Tailings Storage Facility are available in the Operation, Maintenance and Surveillance Manual (OMS manual) for the Tailings Storage Facilities and the Dewatering Dikes. Background information and potential failure scenarios of the dewatering dikes and Tailings Storage Facility are provided in Appendix A.

In the event that the failure involves Tailings installations, refer to Appendix B.1.6

4.7 EMULSION PLANT

A detailed Emergency Response Plan (ERP) was prepared by Dyno Nobel and addresses incidents and potential incidents involving the manufacturing, handling and storage of explosives and related products in Dyno Nobel Canada Inc.'s magazines, emulsion plants and worksites at Meadowbank. The ERP for Dyno Nobel emulsion plant is provided in Appendix B.

4.8 BAKER LAKE MARSHALLING FACILITY

The Baker Lake Marshaling facilities is located 2 Km., east of the Hamlet of Baker Lake and is used for the interim storage of supplies, including hazardous materials, prior to being transported to the mine site. The fuel farm at the Facility is used for bulk storage of:

60,000,000 liters of fuel

1,900,000 liters of Jet "A" fuel.

Spill emergencies occurring at the Marshaling Facility will be handled according to the Spill Contingency Plan (Appendix M).

In case of any other major disaster, the primary Emergency procedures will fall under the Hamlet of Baker Lake authorities' responsibility.

By-Law no 212 (Emergency Response Plan) has already been adopted by local authorities. This By-Law for Baker Lake Hamlet's ERP plan is provided in Appendix C.

Maps and drawings of the Baker Lake fuel farm installations are also provided under Appendix C.1. and C.2.

Also, it is understood that major disaster occurring to Agnico Eagle Mines installations in Baker will be managed by RCMP's Baker Lake detachment, under Hamlet's governance as required under their contingency plans as revised on 2013-01-17.

4.9 EMERGENCIES DEALING WITH REAGENTS

At Meadowbank mine site, we carry the following reagents:

- Cyanide (Sodium Cyanide)
- Copper Sulphite
- Lime (Calcium Oxide) (Quick Lime)
- Sodium Metabisulphite
- Caustic Soda (Sodium Hydroxide)
- Sulphur (Prill form)
- Nitric Acid
- Calcium Chloride (Dust Suppression)
- Flocculants
- Lead Nitrate
- Milsperse (Antiscalant)

Emergency Procedures for dealing with some of these reagents are found in **Appendix B of this Emergency Response Plan.**

4.10 FATALITY OCCURING ON SITE

➤ **INCIDENT SITE:**

- Incident site must be kept barricaded off and guarded and undisturbed until appropriate personnel (RCMP), (Coroner), (Mines Inspector) have conducted their investigations and have released the scene.
- Consult with the Incident Commander regarding the agent dispersed, dissemination method, level of PPE required, location, geographic complications (if any), and the number of person(s) involved.
- Ensure that all person(s) involved have the proper level of PPE protection, training and knowledge to deal with the situation.

➤ **RECOVERY AND ON-SITE MORGUE:**

- Wear PPE until all bodies(s) are deemed free of contamination.
- Establish a preliminary (holding) morgue.
- Gather all necessary information and document all findings.
- See the Decontamination section for decontamination procedures.
- Decontaminate affected bodies before they are removed from the incident site.

➤ **MISSING PERSON:**

SECTION 5 • REFERENCES

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- Golder Associated Ltd. October 2008. Draft Report on East Dike Design, Meadowbank Gold Project,
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- NWT Water Board. January 1987. Guidelines for Contingency Planning. Government of the Northwest Territories.

SECTION 6 • LIST OF ACRONYMS

AEM	Agnico-Eagle Mines Limited – Meadowbank Division
AWPAR	All Weather Private Access Road
CDA	Canadian Dam Association
DFO	Fisheries and Oceans Canada
ECC	Emergency Coordination Centre
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EPP	Emergency Preparedness Plan
ERG	Emergency Response Guidebook
ERP	Emergency Response Plan
ERT	Emergency Response Team
FoS	Factors-of-Safety
GN	Government of Nunavut
HAZCOM	Hazard Communication
HMMP	Hazardous Materials Management Plan
HR	Human Resources
HSC	Occupational Health & Safety Committee
IATA	International Air Transport Association
IC	Incident Commander
ICC	Incident Command Centre
INAC	Indian and Northern Affairs Canada
KIA	Kivalliq Inuit Association

MMER	Metal Mining Effluent Regulations
MSDS	Materials Safety Data Sheets
MSHA	Mine Safety and Health Administration
NWB	Nunavut Water Board
OHSA	Occupational Health and Safety Administration
OHSP	Occupational Health & Safety Plan
PPE	Personal Protective Equipment
SCP	Spill Contingency Plan
TDG	Transportation of Dangerous Goods
TSF	Tailings Storage Facility
WCB	Worker's Compensation Board
WHMIS	Workplace Hazardous Materials Information System

APPENDIX A

Dike Failure Scenarios

A.1 Dewatering Dikes

A.2 Central Dike

A.3 Saddle Dams

A.4 Storm water Dike

Appendix A.1

Dewatering Dikes

Dewatering Dike System

The Dewatering Dike System includes the East Dike, Bay Goose Dike, South Camp Dike and Vault Dike as shown on the general mine site plan provided at the beginning of this document. The dike construction for East Dike and Bay Goose Dike involved the dumping of rockfill into water to create the shells of the dikes, excavation through rockfill and lakebed soils to bedrock, placement of granular filter and core materials, dynamic compaction, construction of the cut off wall using slurry supported trench techniques and grouting of the bedrock and contact between the cut off wall and bedrock using cementitious grout. South Camp Dike and Vault Dike both include a bituminous liner and a key trench cut-off to make the structure impermeable. East Dike and Bay Goose Dike have crest widths in excess of 50 m and are not used by haul trucks during normal mine operation. South Camp Dike and Vault Dike have crest widths in excess of 25 m and may be used as haul roads during normal mine operation.

East Dike and Bay Goose Dike are considered high consequence structures, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. South Camp Dike is considered to be a significant consequence structure, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. Vault Dike is considered to be a low consequence structure, based on Canadian Dam Association (CDA, 2007) Dam Safety Guidelines. The dikes are relatively low, wide structures that exceed the minimum design criteria factors-of-safety (FoS) for stability for pre-drawdown conditions, operation conditions with maximum head difference across the dikes, pseudo-static earthquake conditions, and post closure conditions. Consequently, the probability of dike failure is considered to be low provided that the dikes are constructed according to the design. Mitigation against failure of the dikes includes a quality control and quality assurance program during construction, and an ongoing program of dike surveillance and monitoring during operations, as specified in the design.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Dewatering Dikes see Table A.1 below.

East Dike

The East Dike was constructed in 2008, with foundation grouting continuing into early 2009. The East Dike has a crest length of 800 m, including abutments, and was constructed in water with a maximum water depth to bedrock at the cut off of 7.2 m. The crest of the East Dike is at elevation 137.1 m and the average lake level along the dike is 133.1 m. The main components of the East Dike include a rockfill shell, a granular core with downstream filter zone, a soil-bentonite cut-off wall through the densified granular core zone to the underlying foundations, and a grout curtain from the base of the cut-off wall into the underlying bedrock.

During operations, the East Dike separates the eastern portion of Second Portage Lake from the Portage Pit and the Tailings Storage Facility behind the Central Dike. Following closure, the East Dike will remain as a permanent structure that will separate Third Portage Lake (El. 134.1 m) from Second Portage Lake (El. 133.1 m) and maintain the existing water elevation difference of 1 metre.

The East Dike is approximately 800 m in length through an average water depth of approximately 2.3 metres, and a maximum water depth to bedrock of about 7.2 m. Crest width is approximately 55 metres. Minimum setback from the Portage Pit (distance between dike toe and pit crest) is greater than 170 metres.

Bay Goose Dike

The Bay Goose Dike together with the South Camp Dike isolates the Bay-Goose Pit from Third Portage Lake. The Bay Goose Dike acts as a permanent structure to allow mining of the Goose Pit

and the southern portion of Portage Pit. The main components of the Bay Goose Dike include a rockfill shell, a granular core with downstream filter zone, a soil-bentonite and cement-soil-bentonite cut-off wall through the densified granular core zone to the underlying foundations, a jet grouted wall between the base of the cut-off wall and bedrock where the cut-off wall was not constructed on bedrock, and a grout curtain from the base of the cut-off wall or jet grouted wall into the underlying bedrock.

The Bay Goose Dike is approximately 2,200 m in length, and was constructed in water depths less than 9 metres at the cut off. Crest width varies between approximately 85 and 100 m. Minimum design setback from the Portage and Goose Pit is 70 metres.

South Camp Dike

The South Camp Dike covers a narrow channel within Third Portage Lake and in conjunction with the Bay Goose Dike isolates the Bay Goose Pit from Third Portage Lake.

The South Camp Dike is located south of the plant site area and is used to connect the mainland to South Camp Island. It covers a narrow channel, approximately 60 m in width, where water depths were between 0.5 and 1 m.

The South Camp Dike was primarily constructed between April and June of 2009, prior to ice breakup. During the winter of 2009-2010 additional thermal capping material and rock fill for the haul road was added to the dike. The South Camp Dike has a broad rock fill shell with a bituminous geomembrane liner installed on the upstream side of the shell. The liner was founded on native frozen (permafrost) till material, in a trench approximately 3 to 5 m below the lakebed surface. Compacted granular material mixed with bentonite was placed above the toe of the liner. The haul road is located on the downstream side of the dike. The South Camp Dike is approximately 85 m in length through water depths between 0.5 and 1m. Crest width is approximately 25 metres.

Vault Dike

The construction of the Vault Dike at Meadowbank was conducted from February 2013 to March 2013. Vault Dike is located across a shallow creek which connects Wally Lake and Vault Lake, at the Vault Pit area approximately 8 km north of the main Meadowbank site. Vault Dike is essential to allow the dewatering of Vault Lake and to isolate Vault Pit from Wally Lake during mining activities.

Vault Dike is designed and constructed as a zoned rock fill dam with filter zones, an impervious upstream liner consisting of a bituminous membrane, and an upstream key trench made of aggregate mixed with bentonite. The filter zones minimize seepage and internal erosion and facilitate seepage collection. Vault Dike includes a key trench at the base of the upstream side filled with a 0-25 mm fill amended with bentonite surrounding the liner. Coarse and fine filter material was placed on the upstream slope as geomembrane bedding. The bulk part of the dike consists of coarse rock fill material. The embankment crest is at El. 142.4 m and the upstream toe is at approximately El. 139.4 m. The downstream toe is at approximately El. 139.6 m and the bottom of the key trench ranges from El. 135.6m to El. 142.3m, with an average height of El. 137.0m. The upstream and downstream fill slopes of the dam are 1.5H: 1V. The Vault Dike is approximately 275 m in length through a maximum water depth of 1 m. The crest width is approximately 25 metres.

Table A.1: Meadowbank Dewatering Dikes Summary of Consequences and Proposed Monitoring/Action for Rare Events Based on Water Retaining Embankment Failure Modes Identified in ICOLD Study (1995)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Lake level rise because of restricted outflow from Third Portage, Second Portage Lake or Wally Lake (excessive inflow is a far less likely scenario).	Water spilling over the crest. The crest is wide and comprises coarse rock fill. Significant damage to the dike is not credible, based on performance of other rock fill structures subjected to overtopping or flow through events. Mining operations might need to be suspended, but there will be considerable warning time given the design freeboard and the storage volume within the lakes.	Lake levels should be part of safety information provided to mine management. Outflow channels should be inspected weekly during thaw, open water season, and during ice break-up. If overtopping is likely, a temporary spillway could be constructed and armoured to control and localize flow at shallow dike sections.
	(2) Dam crest settles more than 2m over a distance of (say) 50m or so. This scenario requires extensive loss of support in the foundation since the rock fill of the dikes is essentially not settlement prone itself. For foundation settlement of this magnitude to occur, a piping event must develop and which in itself might be a failure mode. Or, there would have to be an unexpected layer of compressible soil in the foundation.	Same as (1).	The situation envisaged in this scenario should develop slowly with crest settlement evident at least several weeks before a run-away event develops. Easily observed cracks should be evident. Monitoring of crest settlement is appropriate, and is included in the design. Rockfill and till available from the mining operation can be placed to raise the dike crest.
Internal Erosion	(1) Dike Section: Cut off wall, cut off key trench or bituminous liner is defective, allowing high water flow across the wall. This defect occurs at a deep water location where the core backfill and filters are segregated and permeable; the combination allows erosion of the cut off wall and increasing seepage.	The cut off wall will develop a progressively increasing void ratio, thereby increasing the rate of water flow through the dike. This is not a catastrophic failure mode as the rockfill shoulders of the dike will be stable, and at its worst, would lead to temporary suspension of mining.	Monitor seepage from downstream face for rate of seepage, and for presence of sediment in seepage. Will become evident as localized intensive seepage at dike toe and can be repaired. May also see settlement in the cut off wall. Will be most likely in deep water sections. Gradients across the cut off wall in shallow water are not high enough to cause piping.
	(2) Dike Section: Cut off wall loses bentonite because of improper construction.	Same consequences as erosion because of defect, as above.	Bentonite makes up 2% of the cut off wall fill. Loss of this material will increase the permeability of the cut off wall and increase the rate of seepage.
	(3) Foundation: Till is possibly	Limited seepage at the toe or	No particular instrumentation is

Failure Mode	Scenario	Consequence	Monitoring/Action
	non-uniform with more transmissive zones and not self-filtering. It is possible that one of these zones may align with defective construction of the core backfill and defective construction of the cut off wall allowing high flows. Seepage along the transmissive zone beneath the downstream rockfill section could erode the foundation tills at the downstream toe or flow into the downstream rockfill because of the lack of filtering.	into the rockfill would accelerate into a large inflow, and could lead to the undermining of the dike if no action was taken. This is a credible catastrophic failure mode if increased seepage is not detected in time.	needed as this failure mode will show itself as localized and increasing seepage. It could be detected by walk-over inspection by an experienced engineer or technician. Remedial action could comprise a reverse filter and rockfill buttress depending on location of the flow and configuration of the foundation, freezing, or grouting if identified in time. Quality control of cut off is important, and most important for deep water sections. In the worst case, the pit may be deliberately flooded in a controlled manner, the cut off repaired, and the pit dewatered.
Seepage within Embankment	Seepage on its own is not a credible failure scenario. The downstream rockfill shell has extremely high flow through capacity. The rockfill zone is both large and pervious, so that seepage will daylight on the downstream face and lead to instability. Any seepage related failures must include internal erosion, see above.	No credible consequences. May require upgrade of the seepage collection system. May need to suspend mining activities while reducing seepage.	Seepage monitoring program.
Seepage within Foundation	Defective construction of cut off leading to transfer of unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation, or leading to a piping event as above.	This failure mechanism has caused embankment failures elsewhere because of straightforward pore pressure induced instability. However, it is unclear that it could cause failure of the Dewatering Dikes because of their large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm before the crest roadway could be reinstated.	If this mechanism arises it should show itself during initial dewatering or very shortly thereafter.

Failure Mode	Scenario	Consequence	Monitoring/Action
Internal Conduit Rupture	There are no water off take works or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(1) Normal Operation: The rockfill shoulders of the dikes are wide and have high shear strength, making it a conservative design. Slope failure requires failure in the foundation and which would then extend into the overlying dike. Sliding failure is considered unlikely given the low horizontal forces generated by water and ice forces relative to the normal frictional force due to the weight of the dikes and the friction angles of foundation materials	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rockfill shoulders will not necessarily compromise the water retaining function of the dikes. Failures which reach the core may cause failure.	This mechanism should develop during construction or dewatering, due to increase in load and associated pore water pressure increase. Initial stages of failure should be observable as tension cracks in the dike crest. Walk-over inspection of the dikes by a trained inspector is an appropriate monitoring strategy. Survey of crest, face, and toe is also appropriate. Stabilizing berms can be placed inside the dikes or through water along the upstream shoulder.
	(2) Earthquake Induced: Occurrence of an extreme earthquake, much in excess of the current understanding of seismicity of the area.	The extreme earthquake loading for this site is a low magnitude. Settlement of the dikes could occur in the event of a large earthquake. Dynamic compaction of the core during construction may have subjected the rockfill shells to accelerations equivalent to the expected earthquake loading. This would not be a failure situation. The crest is also erosion resistant for any earthquake induced wave action in the impounded water.	Dike inspection following earthquakes felt on site.

Failure Mode	Scenario	Consequence	Monitoring/Action
Failure of Cut off Wall or Bituminuous Liner Due to Movement of the Dikes	Differential horizontal movement of dikes due to water or ice loading, or pit wall failure. Creates a breach in the cut off wall, cut off key trench or bituminuous liner. Ice and water forces are not credible due to the ratio of frictional forces generated by the weight of the dike versus ice loads and water pressure. Pit wall failure involving the dike unlikely based on assessments of pit wall stability and setback distance between the pit and the dikes.	Large inflows through the breach. Pit would flood requiring suspension of mining activities. Potential for loss of life for workers inside dikes.	No enhanced monitoring. Prism monitoring program sufficient. If the pit floods, then repairs to cut off or bituminuous liner would be done prior to dewatering.
Unexpected Settlements	Unexpected foundation soils consolidate during dike construction. A significant quantity of clay that was not recognized during foundation excavation would be required to generate settlement required for a water release event. Settlement of the core will be limited by dynamic compaction.	2 m of core settlement would be required to allow water flow through the rockfill and over the settled core. This flow would not cause failure of the rockfill shells. It would also be readily repaired by placing more end-dumped till into the settled zone.	No enhanced monitoring required, as settlement would be apparent from prism monitoring data and visual inspection. Excessive settlements may be remediated by excavating rockfill above the core and placing more till. Soil conditions will be observed during construction, and design revised to accommodate actual conditions.

A.1.1 Failure Scenario during Operations

The 'worst-case' scenario for failure of the dewatering dikes during operations would involve a movement of the dikes that compromises the integrity of the cut off wall, cut off key trench or bituminous liner. However, the rockfill has a very high flow-through capacity and a high strength and will not move unless the foundation is involved. The water will flow through the upstream rockfill first, then through the core and cut off wall, cut off key trench or bituminous liner, and finally through the downstream rockfill berm. Flow through cracks opening in the foundation may erode the foundation soils and the core. The upstream rockfill will choke the flow to some degree, and flow will decrease once the downstream toe of the dike is inundated and the head difference across the dike begins to reduce.

Although this describes a 'worst-case' scenario, a catastrophic failure of the pit dewatering dike system is not considered a credible failure mode. Elements of the dike design, including the width of the dike section, and the inclusion of filters, in addition to the cut off wall, cut off key trench and bituminous liner make catastrophic failure of the dike highly unlikely. However, for the purposes of this document, the effects of such a failure are described below.

Potential Effect

In the case of East Dike, the worst-case scenario would be associated with the short portion of the dike through the deepest water along the alignment at the centre of the dike. In this area the water depth is as much as 7 m to bedrock at the cut off wall within the dike. This inflow could potentially result in loss of workers caught in flowing water. Breach of the East Dike would be unlikely to trap workers in the pit when access ramps are on the west side, opposite the inflows. Breach of the East Dike would result in cessation of mining, either temporarily or permanently.

Upon completion of the East Dike and dewatering of the northwest arm of Second Portage Lake, there was approximately 17 million m³ (Mm³) of water remaining in Second Portage Lake. If the segment of dike at the deepest portion were suddenly removed, flow from Second Portage Lake into the pit would continue until the elevation of the lake drops by several metres, at which time the current lake bottom would be exposed and would act as a barrier to flow towards the pit. This scenario is the worst in the final year of pit operation when pit volume is the largest. The volume of water associated with this drawdown would be on the order of about 10 Mm³. Some erosion of the till between the pit crest and dike toe would be expected, so the depth of water loss from the lake may be larger, but this would take some time to fully develop.

Inflow to the pit could expose large amounts of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the exposure of shoreline and shoal habitat on fish and fish habitat would be to temporarily eliminate spawning areas and result in reduced water quality from exposure of sediment to wave and wind induced erosion. The effect of this would last approximately one year as inflow from Third Portage Lake to Second Portage Lake averages 10 Mm³ annually (AMEC, 2003). Presuming that the dike breach is repaired, water levels in Second Portage Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

In the case of Bay Goose Dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the southeast segment of the dike through the

deepest water along the alignment. In this area, water depth is as much as 20 m deep at the cut off, and the pit could be as deep as 130 m. This inflow could potentially result in loss of workers caught in flowing water. Breach of the Bay Goose Dike would be unlikely to trap workers in the pit when access ramps are on the northwest side, opposite the inflows. Breach of the Bay Goose Dike would result in cessation of mining of the Goose Pit, either temporarily or permanently.

In the unlikely event that such a failure of the Bay Goose Dike were to occur, the rate and volume of water entering the downstream pit would depend on the magnitude of the breach and the length of time to repair the breach. Third Portage Lake has an estimated volume of 446 Mm³ (Golder, 2006). The final volume of Portage Pit (30.0 Mm³) is roughly 6.7% of the volume of the lake, while Goose Pit (14.8 Mm³) is approximately 3.3% of the volume. In the case of a catastrophic breach of the Bay Goose Dike, the estimated Third Portage Lake water level drawdown would be approximately 1.0 m and 0.5 m, respectively assuming that the failure occurs when the pits are completely excavated and a complete filling of the pits. These estimated worst-case scenario changes in water level are comparable to the mean average annual difference between high and low water (0.3 m) on Third Portage Lake.

There would be a small impact to fish and fish habitat in Third Portage Lake in the event of a 0.5 m to 1.0 m drop in water level. Areas used for spawning may be slightly nearer to the ice cover and a small amount of habitat might be vulnerable to freezing. Water quality within the pit would be temporarily impaired from an increase in suspended and dissolved solids, although water quality would return to near background during the first winter as sediment would settle under the ice cover.

In the case of South Camp dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the centre segment of the dike through the deepest water along the alignment. In this area, the water depth is only a maximum of 1 m. This inflow could put the workers at risk at the site on a temporary basis and a potential loss of life between 0 and 10 due to workers caught in flowing water. Breach of South Camp Dike could eventually result in cessation of mining, either temporarily or permanently.

If the segment of dike at the deepest portion were suddenly removed, flow from Third Portage Lake into the pit would continue until the elevation of the lake drew down slightly as South Camp Dike retains a maximum depth of 1 m of water. The impact of a potential failure would likely be limited.

Inflow to the pit could expose a limited amount of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the dike failure will probably have no significant fish or wildlife habitat, affected or deteriorated. Presuming that the dike breach is repaired, water levels in Third Portage Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

In the case of Vault dike, the worst-case scenario dike breach that could allow the greatest amount of water inflow would be associated with the centre segment of the dike through the deepest water along the alignment. In this area, the water depth is only a maximum of 1 m. This inflow could put the workers at risk at the site on a temporary basis and a potential loss of life between 0 and 10 due to workers caught in flowing water. Breach of the Vault Dike could eventually result in cessation of mining, either temporarily or permanently.

If the segment of dike at the deepest portion were suddenly removed, flow from Wally Lake into the pit would continue until the elevation of the lake drew down slightly as Vault Dike retains a maximum depth of 1 m of water. The impact of a potential failure would be limited.

Inflow to the pit could expose a limited amount of shoreline and shoal habitat around the lake. Water flowing into the pit could entrain suspended solids and dissolved constituents from the dike material and pit walls. If necessary, the water could be retained within the pit and diked area and would be amenable to treatment (e.g., particle settling, in-situ amendment) before discharge, should it be required.

The ecological effects of the dike failure will probably have no significant fish or wildlife habitat, affected or deteriorated. Presuming that the dike breach is repaired, water levels in Wally Lake would rise over the spring and summer to return to pre-breach elevations and would re-fill the lake in the event of a 'worst-case' scenario.

Mitigation, Management, and Monitoring

A major cut off breach scenario due to pit wall movement, while possible, has a low probability of occurrence in East Dike or Bay Goose Dike. If foundation movement was sufficient to compromise the cut off wall, then the core backfill would act as a semi-permeable element and limit flow. Water would first need to flow through the rockfill shell, the core backfill, the damaged cut off wall, and then through more of the core, filters, and the downstream rockfill. Provided that the downstream filter elements against the rockfill shell are properly constructed, then migration of the core and cut off wall into the rockfill will not occur. Some additional seepage may occur due to failure of the cut off wall; however this would be noted during regular monitoring. Mitigation could be by jet grouting, freezing, or installation of sheet piling through the cut off wall.

The use of appropriately graded filters in the design of dikes and dams is standard engineering practice, and is the key to preventing internal erosion. The dike design includes the use of a two zone filter on the upstream face of the pit side rockfill. During the construction of the dikes a quality control and quality assurance program was undertaken.

Routine visual inspection of the dikes is to be conducted on a regular basis to document any changes in the dikes.

During the operation of the dikes, a series of monitoring instrumentation will be installed, including:

- Thermistors to monitor the thermal regime in the dike and foundations;
- Slope inclinometers and prisms to monitor deformations within the dikes; and
- Piezometers to measure pressure and to infer flow through the dikes.

Piezometers downstream of the cut off wall would be monitored for pressure changes as the pits are deepened. Increasing pressure would indicate that less head loss is occurring across the seepage cut off, which might indicate that a crack has formed, permeability is increasing, or the pit is experiencing inflows from some other potential flow pathway. The instrumentation will be monitored to identify any potentially problematic areas relating to dike instability. Mitigation measures for seepage and piping could include:

- Additional pressure grouting of bedrock materials;
 - De-pressurization wells;
 - Construction of a slurry cut off wall within the core just upstream of the suspected seepage area;
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- Jet grouting of the core and foundation in the suspected seepage or crack area;
- Construction of a cutter soil mixing (CSM) wall in the suspected crack area;
- Freezing;
- Installation of toe drains; and
- Construction of interceptor ditches within the down-stream overburden materials.
- Allow pit to flood, install new cut off or bituminous liner under no-flow conditions, then dewater and resume mining.

Specific monitoring and mitigation strategies have been developed as part of an Operations Plan (OMS Manual) for the dewatering dikes.

A.1.2 Failure Scenario during Closure

At end of mine life, once the water quality of the pit lake has been determined to be suitable for release, a portion of the south end of the Bay-Goose Dike will be removed resulting in a hydraulic connection between the Goose/Portage Pit Lake and Third Portage Lake. The East Dike will be the only dike that will remain in service. The elevation of the pit lake will be equal to Third Portage Lake. The elevation difference between the pit lake and Second Portage Lake will be approximately 1 m. Consequently, there will be a low hydraulic gradient from the pit lake towards Second Portage Lake. During the closure and post-closure period, the natural central and east channel outlets that connect Third Portage to Second Portage Lake will continue to carry the entire flow between the two lakes.

Potential Effect

A breach of the East Dike would create an additional outlet and cause water to leave the Portage/Goose pit area and spill into Second Portage Lake at a greater rate, partly at the expense of flow from the central and east channel outlets. This would cause a rise in water level in Second Portage Lake and a reduction in level in Third Portage Lake. The additional water would flow through the channel connecting Second Portage Lake to Tehek Lake until the water elevations in Second and Third Portage lakes equilibrated.

In the event of such a scenario, water would flow from Third Portage Lake, northward through the pit lake area, and then east through a potential East Dike breach and into Second Portage Lake. There is a naturally large outlet capacity via the connecting channel from Second Portage to Tehek Lake. Water residence time in Second Portage Lake during and after mine development is less than one year. Thus, in the event of an East Dike breach, any additional water added to Second Portage Lake would leave the system relatively quickly. Given the flow-through nature of the lake there would be little net change in Second Portage Lake volume or lake elevation as water would easily be absorbed into the much larger Tehek Lake.

Drawdown of Third Portage Lake would be limited, given the large size of the lake (33 km²) and the constriction points within the system that would slow drawdown. Specifically, the magnitude of drawdown in the event of a breach would depend on the magnitude and depth of the breach, time of year (winter ice cover would prevent loss of water), response time, flow rate (i.e., the loss of water depends on the location of the breach and friction through the system), and the outlet capacity of Second Portage Lake. For example, total annual average discharge from Third Portage to Second Portage Lake is approximately 10 Mm³ with a mean annual difference in water level between spring and fall of 0.3 m. Given the large size of Third Portage Lake, a breach resulting in the loss of 10 Mm³ of water, which is equivalent to an entire open water season of runoff through all discharge channels would result in a drawdown of only about 0.3 m. Maximum drawdown would be one metre.

Reductions in water level would therefore be small and have only minor impacts to fish habitat in Third Portage Lake. Adverse impacts to water quality would not be expected given that water quality within Goose/Portage pits is expected to be very high.

Mitigation, Management and Monitoring

Internal erosion of the cut off wall could result in an increase of the rate of water flow through the East Dike. However, this is extremely unlikely due to the low hydraulic gradient across the East Dike (~ 1 m of head difference) and the filter effect of the core backfill. Such a scenario is more likely to occur during the operational phase of the East Dike when the hydraulic gradient across the dike section is much higher, though in the opposite direction. If such a scenario were to occur, it would not be considered a catastrophic failure mode due to the stability of the rockfill shoulders comprising the outside structural elements of the dike.

A breach in the East Dike during closure could be managed by the placement of material to reduce the flow of water and reduce potential erosion of the till core. The hydraulic gradient across the dike at closure is low. The dike could be repaired and hydrologic conditions restored without any danger to the overall stability of the dike, provided annual monitoring is carried out following closure.

Appendix A.2

Central Dike

Central Dike

The Central Dike system is comprised of a Central Dike, a series of perimeter dikes, and the natural basin of the northwest arm of Second Portage Lake, as shown on the general mine site plan provided at the beginning of this document. The Central Dike cross-section consists of:

- A rockfill embankment, constructed from run-of-mine waste rock, placed in lifts and compacted, with the upstream face designed at 3H:1V and 2H:1V and the downstream face designed at a 1.5H:1V slope;
- An upstream two zone granular filter and inverted granular filter along the foundation;
- A bituminous liner with appropriate cover on the upstream face and part of the foundation;

A central or upstream key trench; The Central Dike is a high consequence structure, based on Dam Safety Guidelines (CDA, 2007). Slope stability analyses show that the dike will meet or exceed design FoS for stability under static and pseudostatic earthquake load conditions. Consequently, the probability of failure of the Central Dike is considered to be very low.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Central Dike see Table A.2 below.

Table A.2: Meadowbank Tailings Storage Facility Summary of Consequences and Proposed Monitoring / Action for Rare Event Based On Water Retaining Embankment Failure Modes Identified in ICOLD Study (1995)

Failure Mode	Scenario	Consequence	Monitoring/Action
Overtopping	(1) Pond Level rises because of restricted outflow (excessive inflow is a far less likely scenario). Water will spill at the low point on the dike system, which will depend on the construction schedule.	Water spills over the crest but, as this crest is both wide and comprises coarse compacted rock fill, minimal damage to the dike is credible. There will be considerable warning time prior to overtopping given the design freeboard and the storage volume.	Adjust decant and/or deposition rate. Add spillway in Central Dike, Saddle Dam, or natural ground.
	(2) Dam crest settles more than available freeboard over a distance of (say) 50m or so. This scenario requires unexpected foundation condition, such as glacial lake clay deposit. Settlement would occur upon placement of rock fill during dike raise construction. Freeboard is greatest immediately after a raise and this scenario is therefore unlikely to occur.	Water and tailings spill over crest and if settlement was rapid might erode the crest. Travel of tailings will be dependent on volume of water available, and level of thaw. Tailings would only go to the pit, and not reach the lake.	The situation envisaged is unlikely. This scenario would develop slowly during construction of the dike. Crest settlement would be evident at least several weeks before an overtopping event occurred. Easily observed cracks should be evident during summer period, but could be hidden during the winter. Systematic crest settlement monitoring is appropriate, and included in the design. Production and addition of tailings to the Tailings Storage Facility could be stopped to maintain freeboard. A spillway could also be constructed. The tailings deposition plan maintains a long beach between the dike and the pond, which provides additional freeboard to overtopping of the dike by pond water.

Internal Erosion	(1) Dike Section: Upstream bituminous liner contains defects arising from undetected damage during installation. May lead to loss of water, but filter retains tailing.	Loss of water into the rock fill. This is not a catastrophic failure mode, because the rock fill of the dike will be stable, and at its worst, would lead to temporary suspension of mining. Plus the bituminous liner does not propagate a tear like a plastic liner, so undetected damage is typically small and does not grow. Also, the foundation slopes down towards the tailings, so seepage impounds in the rock fill and will tend to reduce further seepage	Not necessary to monitor directly. Will become evident as possible seepage at dike toe. QA/QC program during construction is the main defence against this scenario.
	(2) Dike Section: Upstream bituminous liner contains defects arising from undetected damage during installation. This defect occurs at the same location as a filter defect.	Loss of tailings and water into the rock fill. This is not a catastrophic failure mode, because the rock fill of the dike will be stable, and at its worst, would lead to temporary suspension of mining. Accumulation of ponded water within the rock fill would decrease the head difference driving flow, thereby limiting the potential for a catastrophic failure.	Not necessary to monitor directly. Will become evident as possible intensive seepage at dike toe, and potentially as tailings fines within seepage downstream of the toe. QA/QC program during construction is the main defence against this scenario.
Seepage within Embankment	Seepage on its own is not a credible failure scenario. The rock fill is pervious so seepage will daylight on the downstream face. Flow through the rock fill will not lead to instability. Any seepage related failures must include internal erosion, see above.	No credible consequences.	No scenario specific monitoring required.
Seepage within Foundation	If the till foundation had a zone of more pervious soil (e.g. gravel seams) and the more pervious zone was preferentially exposed to water pressure, then normal seepage would transmit an unexpectedly high fraction of the reservoir head into the downstream part of the dike foundation. This scenario requires construction defects in filters, liner, and cut off trench fill.	This failure mechanism has caused other embankment failures elsewhere because of straightforward pore pressure induced instability. However, it is unclear that it could cause failure of the Central Dike because of its large width compared to the retained water head. The most likely consequence is downstream toe slumping requiring a localized stabilizing berm.	If this mechanism arises it should show itself gradually as the tailings and water level increase in the basin by buildup of pore water pressures in the foundation. This would be detected during routine monitoring of piezometers installed in the foundation. Pressure relief wells could be installed in the foundation during operations. The tailings deposition plan maintains a long beach between the pond and the dike. This will reduce seepage gradients beneath the dike. In addition, the tailings act as an upstream blanket on the bottom of the TSF to limit seepage into the foundation.

Internal Conduit Rupture	There are no water off take works or other structures extending through the dikes.	Not applicable.	Not applicable.
Slope Instability	(1) Normal Operation: The rockfill has high frictional strength and the design widths make it conservative. Slope failure requires failure in the foundation, which would then extend into the overlying dike.	A foundation failure would cause a rotational slip or sliding failure until equilibrium was reached. This mechanism would limit access along the dike until repaired. Failure through the rock fill will not necessarily compromise the tailings or water retaining function of the dike.	Initial stages of failure should be observable as tension cracks in dike crest and movement at dike toe. Walk-over inspection of dikes by a trained inspector is an appropriate monitoring strategy. Survey of crest, face and toe is also appropriate. If movements associated with increases in foundation pore pressures are discovered, then construction could be stopped or staged to allow pore pressure dissipation. Placement of rockfill as a downstream toe berm could help prevent failure.
	(2) Earthquake Induced: Occurrence of an extreme earthquake, a very rare event.	The extreme earthquake loading for site is a low magnitude event. A large earthquake would not be expected to cause a catastrophic failure, rather the dike would settle. The Central Dike rock fill is placed in the dry and compacted, and will therefore have limited settlement. This would not be a failure situation. The crest is also erosion resistant for earthquake induced wave action in the impounded water.	No monitoring is necessary. Dike should be inspected following any earthquakes felt on site.
Liner Failure Due To Foundation Movement	Differential horizontal movement of the dike due to pit wall failure. Creates a breach in the liner and filter. Pit wall failure is unlikely based on assessments of pit wall stability and the setback between the pit and the toe of the dike. Also, the liner and rock fill can withstand significant deformation, making this an unlikely scenario.	Tailings and water escape into the dike rock fill, but pond there because the foundation slopes towards the dike, rather than the pit. It is noted that the tailings pond is operated approximately 500 metres away. Rapid escape of water will therefore be limited.	No enhanced monitoring. Prism monitoring program and visual inspection sufficient. Movement would be evident in setback area between dike and pit. Tailings at face of dike may be excavated to allow repair of liner, or placement of filter material. Other options include freezing tailings at face of dike.
Unexpected Settlements	The foundation till is expected to consolidate during construction and operations. There is no credible mechanism for a large degree of unexpected settlement following construction required to eliminate freeboard and release tailings/water.	A large settlement could lead to water flowing through the rock fill, but this would not cause failure of the rock fill. It could also be readily repaired by placing more end-dumped rock fill, and extending the liner, in a manner similar to the periodic raise.	No enhanced monitoring required, as excessive settlement would be apparent from prism monitoring data, and visual inspection.

A.2.1 Failure Scenario during Operations

In the case of failure of the Central Dike during operations, the 'worst-case' scenario would involve a flow of unfrozen water and tailings in association with a catastrophic failure of the dike in the later stages of mining when personnel and machinery are working in the open pit directly down-stream of the Tailings Storage Facility (TSF).

Potential Effect

The failure of the Central Dike could result in the sudden release of dike material and tailings from the TSF into that portion of the Portage Pit immediately adjacent to the dike. This could potentially result in loss of life. This would result in cessation of mining activities, either temporarily or permanently.

There would be no effect on the receiving environment water quality, fish or fish habitat because tailings would be contained within the pit and the dewatering dikes and the area would not yet be flooded.

Mitigation, Management and Monitoring

The calculated FoS for this failure mode, under static and pseudo-static conditions, are above design criteria in the Dam Safety Guidelines (CDA, 2007). Consequently, the probability of such a failure developing is low. Based on the tailings deposition plan, it is expected that the tailings pond will typically be 500 m or more from the face of the Central Dike. Furthermore, thermal modeling indicates the tailings and Central Dike will be frozen or partially frozen, and that the facility will tend to the frozen state in the long term. Therefore, a catastrophic failure of the Central Dike without some form of prior dam distress providing a warning of deteriorating conditions is not considered a credible catastrophic failure mode.

Mitigation against such a failure mode occurring will be to construct the Central Dike to design so that it is physically stable under all loading conditions. A comprehensive quality control and quality assurance program will be undertaken during dike construction to confirm foundation conditions, material type and quality, and to adjust designs as necessary to accommodate actual or unexpected conditions found at site.

- A management plan was developed for the operation of the tailings facility, and includes appropriate operational controls and monitoring activities. During operations, instrumentation will be installed to monitor not only the physical performance of the Central Dike itself, but also the performance of the TSF. The instrumentation installed and to be installed includes thermistors to monitor the thermal regime in the dike and foundations, and deposited tailings.
- Piezometers to measure pressure and to infer flow through the dike and foundation materials
- Prisms to monitor deformations within the dike.

If necessary, the stability of the foundation materials and of the dike during operations can be enhanced through the construction of a stabilizing toe berm or through freezing.

A.2.2 Failure Scenario during Closure

In the case of failure of the Central Dike during or following closure, the 'worst-case' scenario would involve a catastrophic failure of the dike and the release of tailings into the lake.

Potential Effect

Failure of the Central Dike during or following closure is not expected to result in loss of life, as mining operations will have finished.

Under this scenario, a catastrophic failure of the Central Dike could result in the sudden and unexpected release of dike material and tailings into the Portage Pit lake area. This could potentially produce a wave of sediment laden water that could over-top the East Dike.

Such a scenario would destroy fish habitat along the dike face and smother benthic habitat outwards from the failure area. Suspended solids and dissolved metals would increase in the water column and would cause displacement of fish and possible toxicity of some bottom sediments, depending on how much tailings material was lost. The new face would be subject to chronic erosion of fine tailings material until such time as a new, stable dike face could be established. Failure of the dike would not cause a change in water level. Impacts would be localized because the Central Dike is situated in the upper part of a blind arm of the lake with an extremely limited drainage area and low turnover. Consequently, transport of suspended sediment away from the area would be restricted and the area of impact would be relatively small.

Mitigation, Management, and Monitoring

The calculated FoS for the Central Dike design are greater than design criteria for post closure for static and pseudo-static (earthquake) conditions. Consequently, the likelihood of a failure occurring is low. Furthermore, thermal modeling indicates the tailings and Central Dike will progressively freeze, and that the facility will tend to the frozen state in the long term. Freezing will increase dike and tailings stability and decrease tailings mobility, and therefore this is not considered a credible catastrophic failure mode.

Mitigation against such a failure mode occurring will be to construct the Central Dike to the design so that it is physically stable under static and pseudo-static loading conditions, and to monitor during the mine life to assess the overall performance of the dike and the TSF. Data gathered during the operational period of the TSF can be used to re-evaluate the performance of the Central Dike structure in the context of longer term stability post closure.

Appendix A.3

Saddle Dams

Saddle Dams

Five Saddle dams will be constructed around the limits of the tailings basin. Two Saddle Dams were built between 2009 and 2011, the three other Saddle Dams will be built later during the mine operation. The saddle dam locations are shown on the general mine site plan provided at the beginning of this document. The saddle dams will be constructed by dumping a rockfill berm with a crest width of 30 m to allow haul truck traffic. The Saddle Dams will be re-sloped, with a minimum 6 m crest width. The downstream face will be angle of repose, or 1.32H:1V (Horizontal:Vertical), and the upstream face will be 3H:1V. The Saddle Dams will have an upstream two-zone granular filter and a liner. There is a potential for release of attenuation water, reclaim water, or tailings to Third Portage Lake in the event of an overtopping or catastrophic failure.

For information on the consequences and monitoring/action for the various embankment failure modes possible at the Saddle Dams see Table A.2 for the Central Dike.

A.3.1 Failure Scenario during Operation

Depending upon the phase of operations, breach or complete failure of a Saddle Dam could result in the uncontrolled release of Attenuation Pond water, Reclaim Pond water or tailings to Third Portage Lake. There is also the possibility of the Saddle Dams being overtopped through the formation of a wave resulting from a slope failure within the Portage Waste Rock Storage Facility and the sudden release of waste rock into the TSF.

A tailings beach will be formed on the toe of each Saddle Dam. As a result, the Reclaim Pond will be pushed away from the Saddle Dams. As the tailings and Saddle Dams are expected to freeze, and freezing will reduce the chance of tailings reaching Third Portage Lake, failure of the Saddle Dams with release of tailings to Third Portage Lake is not considered to be credible.

An overtopping or breach failure of the section of the Saddle Dams located just south of the intersection with the Stormwater Dike could potentially result in flow of Reclaim Pond water and/or tailings toward Third Portage Lake.

Potential Effect

Should an overtopping event or breach occur in a Saddle Dam, water flowing toward Third Portage Lake would consist of Reclaim Pond water which is predicted to exceed Metal Mining Effluent Regulations (MMER) guidelines for a number of constituents.

As a worst case of failure resulting in a dam breach, the total predicted Reclaim Pond volume of 0.75 Mm³ could be released towards Third Portage Lake. The Saddle Dams would not be expected to fail due to overtopping. This failure mode is not expected to release a considerable volume of water to Third Portage Lake. Given the size of Third Portage Lake, the impacts to water quality and on fish from a release of Reclaim Pond water would likely be localized.

A worst case scenario would also involve the flow of non-frozen tailings into Third Portage Lake. The distance between the toe of the Saddle Dams and Third Portage Lake is on the order of 150 m to 300 m. Such a scenario would destroy fish habitat and smother benthic habitat outwards from the failure area. Suspended solids and dissolved metals would increase in the water column and would cause

displacement of fish and possible toxicity of some bottom sediments, depending on how much tailings material was lost.

Mitigation, Management, and Monitoring

The dams are designed according to Dam Safety Guidelines (CDA, 2007), and were and will be constructed under controlled conditions. A comprehensive quality control and quality assurance program was and will be undertaken during construction to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual conditions found at site. The dams are predicted to eventually freeze, which will enhance stability. Therefore, failure of Saddle Dams by overtopping, full breaching or foundation and slope failure is not considered to be credible.

With respect to slope stability failure, the Saddle Dams are constructed of rockfill, which has high shear strength. Slope stability failures must therefore occur through foundation soils. The calculated FoS for slope stability failure modes through foundation soils are above the design criteria in the Dam Safety Guidelines (CDA, 2007) for static and pseudo-static conditions. Consequently, the probability of such a failure developing is low.

The tailings are expected to freeze, and freezing will reduce the chance of tailings reaching Third Portage Lake. The distance from Saddle Dam 1 to Third Portage Lake is about 300 m at its closest point. Leaks of supernatant water and or tailings from the South Saddle Dam would be most likely to occur during operations. Leaks would be visible, and could be mitigated during operations.

A.3.2 Failure Scenario during Closure

At closure Reclaim Pond water will be pumped to an Attenuation Pond, the basin behind the Saddle Dams will be drained and filled with run-of-mine, acid-buffering ultramafic waste rock (NPAG). The rock is expected to freeze over time. Failure of the Saddle Dams following closure is not considered to be credible. Further, the lack of water will reduce mobility of tailings if failure occurs.

Potential Effect

No effects to water quality, fish or fish habitat is expected.

Mitigation, Management, and Monitoring

As described previously, the dams were and will be designed to meet Dam Safety Guidelines (CDA, 2007). The dams were and will be constructed under controlled conditions. During the construction of the dams a comprehensive quality control and quality assurance program was and will be undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual or unexpected conditions found at site. Monitoring during operations will ensure the Saddle Dams perform as intended. The dams will eventually freeze, which will enhance stability. Therefore, post-closure failure of the Saddle Dams by full breaching or foundation and slope failure is not considered to be credible.

Appendix A.4

Stormwater Dike

Stormwater Dike

The Stormwater Dike is located at the northwest end of Second Portage Lake, within the TSF as shown on the general mine site plan provided at the beginning of this document. The location of the Stormwater Dike was selected to optimize the storage capacity of the main tailings basin, and of the Portage Attenuation Pond. The dike separates the tailings basin from the Attenuation Pond until approximately 2014 at which point the tailing deposition will start in the South tailing Cell. At the end of mine life, any remaining water will be treated within the TSF and released once discharge criteria are met.

The Stormwater Dike was constructed using rock fill, with a upstream slope of 3H: 1V and a downstream slope at angle of repose for rock fill. The minimum crest width is 6 m. Final crest is at elevation 150.0 m. The dike has a filter zone placed on the south face, underlying an impermeable element of bituminous geo-membrane. The maximum height of the dike is about 13 m. At the maximum cross section, the width of the base of the dike is approximately 95 m.

For information on the consequences and monitoring/action for the various embankment failure modes possible at Storm water Dike see Table A.2.

A.4.1 Failure Scenario during Operation

If slope failure of the Stormwater Dike were to occur when tailings are at their maximum elevation in the main tailings basin, and if the tailings are not frozen, this could potentially result in the sudden flow of tailings into the Attenuation Pond area. This in turn could potentially result in the development of a wave which overtops the Saddle Dam at the northwest end, releasing tailings and reclaim water to Third Portage Lake.

Potential Effect

A breach or failure of the Stormwater Dike may cause a wave-induced overtopping of the Saddle Dam at the northwest end. The Saddle Dam would not be expected to fail due to a single overtopping wave event.

This failure mode is not expected to release water to Third Portage Lake. The distance between the toe of the Saddle Dam and Third Portage Lake is on the order of 150 m, so tailings would likely settle out. The potential impacts on Third Portage Lake water quality, fish and fish habitat would likely be minor, localized and short-lived.

Mitigation, Management, and Monitoring

The Stormwater Dike was designed to meet Dam Safety Guidelines (CDA, 1999). The upstream side slopes were designed to allow machine traffic, and are therefore highly conservative with respect to slope stability. The dike was constructed in the dry under controlled conditions. During the construction of the dike a comprehensive quality control and quality assurance program was undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual conditions found at site. The dike will eventually freeze, which will enhance stability. Therefore, failure of the dike due to overtopping is not considered to be credible.

A.4.2 Failure Scenario during Closure

The Stormwater Dike will be covered by tailing on both upstream and downstream side, to equal out the different elevations. At closure Reclaim Pond water will be pumped to an Attenuation Pond, the

basin behind the Saddle Dams and Stormwater Dike will be drained and filled with run-of-mine, acid-buffering ultramafic waste rock (NPAG). The rock is expected to freeze over time. Failure of the Stormwater Dike following closure is not considered to be credible. Further, the lack of water will reduce mobility of tailings if failure occurs.

Potential Effect

No effects to water quality, fish or fish habitat is expected.

Mitigation, Management, and Monitoring

The Stormwater Dike was designed to meet Dam Safety Guidelines (CDA, 1999). The dike was constructed under controlled conditions. During the construction of the dike a comprehensive quality control and quality assurance program was undertaken to confirm foundation conditions, material type and quality, and to adjust designs as necessary to reflect actual or unexpected conditions found at site. Monitoring during operations ensure the Stormwater Dike performs as intended. The dike will eventually freeze, which will enhance stability. Therefore, post-closure failure of the Stormwater Dike by full breaching or foundation and slope failure is not considered to be credible.

APPENDIX B

Emergencies involving Reagents.

- **Immediate Actions**

For all spills and releases of any hazardous material, the following steps should always be taken:

- Stop the flow of material and/or contain it, if possible, using proper safety equipment and precautions. **Do not endanger yourself!**
- Administer first aid if required. If anyone comes in direct contact with cyanide solution decontaminate them immediately, monitor them closely and give oxygen if there is any indication of symptoms of poisoning.
- Contact your supervisor. Call for help.
- Secure the area.
- Prevent unnecessary exposure.
- Perform remedial action for cleanup.

Emergencies involving reagents might be addressed by first responders, by using **EMERGENCY RESPONSE GUIDEBOOK**



ERG2012.pdf

**In an emergency, CANUTEC may be called collect at
613-996-6666 (24 hours)
*666 cellular (Press star 666, Canada only)**

B.1: Cyanide (Sodium Cyanide)

UN #: 1689 (Guide 157 of the Emergency Response Guidebook)

Environmental remediation of a spill of cyanide will be managed under the:
MBK Spill Contingency Plan P.17 Section 4 and P.134 Appendix I

[Control + Click here to link to Environment Spill Contingency Plan](#)

- **B 1.1 General Cyanide Spill/Release Guidelines**

Immediate Actions

For all spills and releases of cyanide, the following steps should always be taken:

- Prevent unnecessary exposure.
- Stop the flow of material and/or contain it, if possible, using proper safety equipment and precautions. Do not endanger yourself.
- Administer first aid if required. If anyone comes in direct contact with cyanide solution decontaminate them immediately, monitor them closely and give oxygen if there is any indication of symptoms of poisoning.
- Contact your supervisor, call for help.
- Secure the area.
- Monitor for HCN Gas with MX-6 Gas Monitor.

Supervisor's Immediate Action

- Eliminate or reduce immediate health and safety hazards and administer first aid if required, Call for help by dialing 6911 or calling a Code 1 on the radio.
- Arrange for removal and transportation of injured out of the dangerous zone, if safe to do so.
- Begin containment if needed. Protect yourself and others.
 - Remove all unnecessary personnel and restrict entry to the area.
 - If the problem is in the mill, make sure the Mill Evacuation procedure is complete.
 - Ensure safe procedures are followed and proper safety equipment is used.
 - Eliminate the source.
- Assess the incident.
 - Determine the source, quantity, and type of material that was spilled/released.
 - Quantify health and environmental hazards, toxic vapors, ground/surface water contamination if and when required by I.C. or Environment Supervisor.
- Perform remedial action for cleanup.
- Clean up the incident area when asked by I.C.

All spills and remedial actions taken must be reported immediately to the area Supervisor.

- Protect yourself. Don't become a casualty. Wear the necessary personal protective equipment needed for containment. Use the "buddy" system. The following equipment along with containers of household bleach are located in the warehouse.
 - Rubber Gloves
 - Chemical Protective Suit (TYCHEM QC)
 - Rubber Boots
 - Chemical Goggles
 - Respirator (Handling Dry Cyanide Only)
-

Caution: Respirator is for protection from solid cyanide and solids containing cyanide i.e. dust, mud, etc. A respirator will not protect you from deadly HCN gas.

Perform life saving rescues and first aid. If needed, administration of cyanide antidote will be done by medical clinic personnel by applying the following procedure:

[Control + Click here to link to procedure MBK-HSS-C-0006](#)

SODIUM and/or Calcium CYANIDE (SOLID and/or FLAKED) (ID#1689, ERG #157)

If the release occurs in a wet area (i.e. rain storm) personnel shall obtain and wear self-contained breathing apparatus and full protective clothing/gear. The area should be monitored for HCN gas. The release should be controlled with earthen berms. Adding chemicals to reduce risk of HCN vapor emission will be done only under Incident Commander or Environmental Supervisor's authority.. Pump or excavate cyanide back into the nearest containment facility as directed by the Incident Commander or Environmental Supervisor. If a release occurs in a dry area personnel shall wear the appropriate respirator with cyanide dust cartridge and work coveralls. Using a shovel, carefully place material into a dry container for transport to an approved process component. Deposit the material in an area designated by the Incident Commander or Environmental Supervisor. Flush the spill area with water (use water spray to reduce vapors). **Do not use water if it will cause the spill to flow off of the containment.** The spilled cyanide can be reused and does not create a waste to be disposed of.

SODIUM CYANIDE - DILUTE PROCESS SOLUTIONS (ID# 1689 ERG #157)

This process is for diluted weak cyanide solutions. The process solutions may be high pH and may cause injury to exposed skin. Control flow by shutting down pumps and valves. Personnel shall wear full personal protective equipment, including clothing (TYCHEM Qc). Control area of spill with earthen berms. In case of questionable or unknown pH, monitor the area with an HCN monitor. Adding chemicals to reduce risk of HCN vapor emission will be done only under Incident Commander or Environmental Supervisor's authority. Pump any solution back into the nearest containment facility. Excavate all wet soil and haul it to an approved containment facility. Solution samples should be taken and analyzed under Incident Commander or Environmental Supervisor's authority.

**NOTE: Should the process plant need to be evacuated;
the procedure MBK-MIL-HS-0001 will apply**

[Control + Click here to link to procedure MBK-MIL-HS-0001](#)

B 1.2 Cyanide Transportation Accidents

Although there is a procedure for Transportation of dangerous goods on the Meadowbank AWP,

Control + [Click here to link to MBK-ENV-0010](#)

the following actions are to be taken in the event of an accident on the AWP or at the barge unloading facilities involving cyanide transport vehicle.

- Call Dispatch and report the location and nature of the accident and indicate the type of assistance required (medical help, environmental clean-up, fire and/or mechanical help);
- AEM personnel working in this area will evacuate and secure the 2 access roads leading to the unloading/storage area.
- Meadowbank's Incident Commander on duty will take command of any action required by the situation at this moment.
- Local resources (Baker Lake Fire dept. or R.C.M.P.) will not be involved in this process.

IF THERE IS A VICTIM and IF SAFE TO DO SO: Remove the victim from spoiled area

- As the very first minutes are critical for the victim, administration of oxygen must be the first action to be done on scene (IF THERE IS EVIDENCE THAT THE VICTIM IS CONTAMINATED WITH CYANIDE, THE DECONTAMINATION PROCEDURE MUST BE APPLIED PRIOR OF ANY ACTION).
- Cross contamination may be fatal to rescuers if they are not correctly protected against inhalation, skin absorption or ingestion of Cyanide or by-products. Proper PPE must include TYCHEM Qc suit, proper face mask, gloves, rubber boots etc...

WARNING: EVALUATE THE LIKELY HARM WITHOUT INTERVENTION

Before decontaminating the victim with water, all clothing should be removed.

Flush body immediately with water until medical help arrives or before transporting victim.

Dust half masks do not protect against HCN gas

IF THERE IS NO VICTIM:

- Secure the accident site so that the vehicles or spilled chemical not continue to present a hazard to others. This may involve blocking off the road back from the site in both directions in the event of a more serious accident.
- **If safe to do so** secure the site to prevent continued spill or leakage of contaminants into the surrounding environment.
- Upon receiving the accident call, Dispatch will initiate the mine's Emergency Response Team passing along the information to the Emergency Incident Commander (I.C.). The I.C. will then call out the required Emergency Response Personnel to assist at the accident site. He will also make sure to inform the Acting Manager of the situation.
- Accident site decontamination will then be initiated as per the Meadowbank Site Spill Contingency Plan.

Control + [Click here to link to Environment Spill Contingency Plan](#)

- Once the accident site is secured, all people requiring assistance have been removed to medical care and cyanide spill controlled, the Emergency Incident Commander will turn the scene over to the mine's safety personnel so that an appropriate accident investigation can be initiated.

B 1.3 Cyanide involved in Fires.

- Sodium cyanide (NaCN) is non-combustible.
 - The agent itself does not burn.
 - Sodium cyanide releases highly flammable and toxic hydrogen cyanide gas (HCN) on contact with acids or water.
 - Fire will produce irritating, corrosive, and/or toxic gases.
 - Stay upwind.
 - Note: Most foam will react with the agent and release corrosive/toxic gases.
 - For small fires, **do not use carbon dioxide**; use dry chemical, dry sand, or alcohol-resistant foam. **NOTE:** At Meadowbank, we are using non-Alcohol-resistant foam
 - For large fires, use water spray, fog, or alcohol-resistant foam. Move containers from the fire area if it is possible to do so without risk to personnel. Use water spray or fog; do not use straight streams. Dike fire control water for later disposal; do not scatter the material.
 - For fire involving tanks or car/trailer loads, fight the fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tanks.
-

Always stay away from tanks engulfed in fire. **NOTE:** At Meadowbank, most of the cyanide product is under its solid state.

- Run-off from fire control or dilution water may be corrosive and/or toxic, and it may cause pollution.
- If the situation allows, control and properly dispose of run-off (effluent).

Control + [Click here to link to Environment Spill Contingency Plan](#)

B 1.4 Important release of HCN from storage

- Large quantities of sodium cyanide are used at the Meadowbank Gold Project to optimize gold recovery from the ore. Due to transportation restrictions, normally a full year's supply of sodium cyanide will be transported and stored on site. This product will be stored on secured and separate laydown known as "Overpad" storage area. The product will also be handled, transferred and used in compliance with appropriate legislation and applicable Best Management Practices.
- Procurement and Logistics Department's workers are ruled by Procedure "MBK-WRH-0005" for Cyanide Storage.

Control + [Click here to link to procedure MBK-WRH-0005](#)

- In the event of a major release of HCN from the storage area it will be critical that any worker in the immediate area of the release evacuate upwind and call for help by following the **Code 1 procedure**.
 - Upon receiving the HCN release call, Dispatch will initiate the mine's Emergency Response Team passing along the information to the Emergency I.C. The Emergency I.C. will then call out the required Emergency Response Personnel to assist at the release site. He will also make sure to inform the Acting Manager of the situation.
 - Emergency Response Team will make sure evacuation is completed in Red and Yellow zones as determined in the **Emergency Response Guidebook 2012** and then will monitor the area by using MX-6 gas monitors. Following monitoring, and analyzing wind direction, air dampness and any other significant input, the decision will be then taken to evacuate a larger perimeter if needed to do so.
 - Depending of wind direction, the following buildings/area may be used as "MUSTER STATIONS" in case of a catastrophic situation requiring a major evacuation of the premises:
 - *FGL/SANA buildings*
 - *VAULT pit Refuge*
 - *DYNO-NOBEL Emulsion plant*
-

- After re-assessing the situation, Emergency I.C. and Acting Manager will decide if a complete Meadowbank site evacuation or if any other Emergency or remediation measure are required.

B 1.5.1 PROCESS PLANT Important release of HCN

- The cyanide transferred from the Storage laydown to the process plant is stored outdoor on a specific laydown, in front of door "C" of the Process Plant
- A maximum of 24 tons (24 bags) are stored in the mill at the same time.
- In case of a release of HCN, the monitoring system of the process plant will be activated automatically and the Emergency Evacuation of the mill will take place, accordingly to Procedure MBK-MIL-HS-0001.

Control + [Click here to link to procedure MBK-MIL-HS-0001](#)

- Upon receiving the HCN release call, Dispatch will initiate the mine's Emergency Response Team passing along the information to the Emergency I.C. The Emergency I.C. will then call out the required Emergency Response Personnel to assist at the release site. He will also make sure to inform the Acting Manager of the situation.
- Emergency Response Team will make sure evacuation is completed in Red and Yellow zones as determined in the **Emergency Response Guidebook 2012** and then will monitor the area by using MX-6 gas monitors. Following monitoring, and analyzing wind direction, air dampness and any other significant input, the decision will be then taken to evacuate a larger perimeter if needed to do so.
- Depending of wind direction, the following buildings/area may be used as "MUSTER STATIONS" in case of a catastrophic situation requiring a major evacuation of the premises:
 - *FGL/SANA buildings*
 - *VAULT pit Refuge*
 - *DYNO-NOBEL Emulsion plant*
- After re-assessing the situation, Emergency I.C. and Acting Manager will decide if a complete Meadowbank site evacuation or if any other Emergency or remediation measure is required.

B 1.5.2 PROCESS PLANT: Release during mixing / unloading

- Every Process Plant worker is required to be trained on "Chemical Awareness" and "Mill Induction" trainings. These mandatory trainings are scheduled on regular basis by training department for every new worker at Process Plant. Moreover, Oxygen administration training
-

is given to every Reagent Operators, Supervisors or Relief Operators working at Process Plant.

- There is an Oxygen administration First Aid Kit nearby the Mixing area. This kit includes: Oxygen administration portable system, and an Automated External Defibrillation kit. As the “buddy” system is always used, an affected (splashed) worker will be first removed from spoiled area, given oxygen, undressed and taken under the Emergency shower.
- In case of a release of HCN, the monitoring system of the process plant will be activated automatically and the Emergency Evacuation of the mill will take place, accordingly to Procedure MBK-MIL-HS-0001.
Control + [Click here to link to procedure MBK-MIL-HS-0001.](#)
- According to this procedure, after head count at Muster, if workers are missing, the Code 1 Procedure will be applied.

B 1.5.3 PROCESS PLANT: Pipe, Valve breakage.

- In case of a small visible leak on the cyanide network (pipe, valve, etc...), a red ribbon and required warning tags will immediately be installed in order to protect the affected area. Supervisor will take all necessary measures to stop the leak and repair the broken part. The primary measure will be to communicate with the Process Plant Operator and have the broken section isolated and/or de-activated by control room operator.

Control + [Click here to link to related procedure.](#)

- In case of a major and/or catastrophic leak that could endanger workers, then there will be an immediate evacuation of mill as per the **MBK-MIL-HS-0001** procedure.

Control + [Click to link to procedure MBK-MIL-HS-001](#)

• B 1.5.4 PROCESS PLANT: Major breakage on tailing lines, cyanide treatment pumps or tank rupture.

- If a sudden major breakage is happening on any vital cyanide destruction and/or tailing lines, complete stopping of the Process Plant will immediately be required.
- Complete stopping will be done by following procedure **MBK-MIL-OP-002**.

Control+ [Click here to link to procedure MBK-MIL-OP-002](#)

- Also, the Process Plant Reagent operator will immediately close the manual valve at the feed of the CIP to prevent the leach tank from emptying inside the mill and then, overflowing. Also
-

the valve at the exit of leach tank #9 towards the CIP will be closed as additional safety measure. This will prevent any major spill inside the mill that could result in slurry going out of the mill.

- When situation will permit it and as required by production general supervisor, the mill will be restarted according to the procedure **MBK-MIL-OP-0044** Process plant power outage.
Control + [click here to link to procedure MBK-MIL-OP-0044.](#)

B 1.6 Failure or overtopping of tailings impoundments.

- Appendix A of this ERP plan refers to Dike failures but more precise measures are described in the " TAILING STORAGE FACILITIES / Operations, Maintenance and Surveillance Manual. " and in the "Dewatering Dikes OMS Manual "
- **Control + [Click here to link to the "Dewatering Dikes OMS Manual"](#)**
- **Control+[Click here to link to the "TSF OSM Manual"](#)**
- This manual should be consulted as containing primary emergency measures for tailing impoundments failure and more likely Section 8 and 9 as below:
- ***Extract from OMS Manual:***

SECTION 8 • EMERGENCY PREPAREDNESS PLAN	8-1
8.1 Emergency Procedures	8-1
8.1.1 Operation	8-1
8.2 Emergency Details	8-2
8.2.1 Access to the Project Site	8-2
8.2.2 Emergency Assessment	8-2
8.2.3 Emergency Communication and Actions	8-2
8.2.4 Site Emergency Procedure	8-3
8.2.5 Communication Equipment Location	8-3
8.3 Medical and First Aid Services	8-4
8.4 On Site Equipment and material	8-4
8.4.1 Pumping Equipment	8-4
8.4.2 Mobile Equipment	8-4
8.4.3 Earthwork Material and Equipment.....	8-1
• SECTION 9 • EMERGENCY RESPONSE REFERENCE DOCUMENTS	9-1

GENERAL INFORMATION ABOUT CYANIDE

Common Names:

- Sodium salt of hydrocyanic acid

Agent Characteristics

- **APPEARANCE:** White crystalline or granular powder.
- **DESCRIPTION:** Sodium cyanide releases hydrogen cyanide gas, a highly toxic chemical asphyxiant that interferes with the body's ability to use oxygen. Exposure to sodium cyanide can be rapidly fatal. It has whole-body (systemic) effects, particularly affecting those organ systems most sensitive to low oxygen levels: the central nervous system (brain), the cardiovascular system (heart and blood vessels), and the pulmonary system (lungs). Sodium cyanide is used commercially for fumigation, electroplating, extracting gold and silver from ores, and chemical manufacturing. Hydrogen cyanide gas released by sodium cyanide has a distinctive bitter almond odor (others describe a musty "old sneakers smell"), but a large proportion of people cannot detect it; the odor does not provide adequate warning of hazardous concentrations. Sodium cyanide is odorless when dry. Sodium cyanide is shipped as pellets or briquettes. It absorbs water from air (is hygroscopic or deliquescent).
- **METHODS OF DISSEMINATION:**
 - Indoor Air: Sodium cyanide can be released into indoor air as fine droplets, liquid spray (aerosol), or fine particles.
 - Water: Sodium cyanide can be used to contaminate water.
 - Food: Sodium cyanide can be used to contaminate food.
 - Outdoor Air: Sodium cyanide can be released into outdoor air as fine droplets, liquid spray (aerosol), or fine particles.
 - Agricultural: If sodium cyanide is released as fine droplets, liquid spray (aerosol), or fine particles, it has the potential to contaminate agricultural products.
- **ROUTES OF EXPOSURE:** Sodium cyanide can affect the body through ingestion, inhalation, skin contact, or eye contact.

Personal Protective Equipment

- **GENERAL INFORMATION:** First Responders should use a NIOSH-certified Chemical, Biological, Radiological, Nuclear (CBRN) Self Contained Breathing Apparatus (SCBA) with a Level A protective suit when entering an area with an unknown contaminant or when entering an area where the concentration of the contaminant is unknown. Level A protection should be used until monitoring results confirm the contaminant and the concentration of the contaminant.

NOTE: Safe use of protective clothing and equipment requires specific skills developed through training and experience.

Emergency Response

➤ **CHEMICAL DANGERS:**

- Sodium cyanide is water-reactive.
- Sodium cyanide decomposes on contact with acids, acid salts, water, moisture, and carbon dioxide, producing highly toxic, flammable hydrogen cyanide gas.
- Sodium cyanide solution in water is a strong base; it reacts violently with acid and is corrosive.
- Sodium cyanide is incompatible with strong oxidants.
- Carbon dioxide from the air is sufficiently acidic to liberate toxic hydrogen cyanide gas on contact with sodium cyanide.

➤ **EXPLOSION HAZARDS:**

- Sodium cyanide reacts violently with strong oxidants such as nitrates, chlorates, nitric acid, and peroxides, causing an explosion hazard.
- Upper and lower explosive (flammable) limits in air are not available for sodium cyanide.
- Containers may explode when heated or if they are contaminated with water.

➤ **FIRE FIGHTING INFORMATION:**

- Sodium cyanide is non-combustible.
 - The agent itself does not burn.
 - Sodium cyanide releases highly flammable and toxic hydrogen cyanide gas on contact with acids or water.
 - Fire will produce irritating, corrosive, and/or toxic gases.
 - Note: Most foam will react with the agent and release corrosive/toxic gases.
 - For small fires, do not use carbon dioxide; **use dry chemical**, dry sand, or alcohol-resistant foam.
 - For large fires, use water spray, fog, or alcohol-resistant foam. Move containers from the fire area if it is possible to do so without risk to personnel. Use water spray or fog; do not use straight streams. Dike fire control water for later disposal; do not scatter the material.
 - For fire involving tanks or car/trailer loads, fight the fire from maximum distance or use unmanned hose holders or monitor nozzles. Do not get water inside containers. Cool containers with flooding quantities of water until well after the fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tanks. Always stay away from tanks engulfed in fire.
-

- Run-off from fire control or dilution water may be corrosive and/or toxic, and it may cause pollution.
- If the situation allows, control and properly dispose of run-off (effluent).

➤ **INITIAL ISOLATION AND PROTECTIVE ACTION DISTANCES:**

- If a tank, rail car, or tank truck is involved in a fire, isolate it for 0.5 mi (800 m) in all directions; also consider initial evacuation for 0.5 mi (800 m) in all directions.
- Small spills (when spilled in water)
 - First isolate in all directions: 200 ft (60 m).
 - Then protect persons downwind during the day: 0.1 mi (0.2 km).
 - Then protect persons downwind during the night: 0.4 mi (0.7 km).
- Large spills (when spilled in water)
 - First isolate in all directions: 1300 ft (390 m).
 - Then protect persons downwind during the day: 0.8 mi (1.3 km).
 - Then protect persons downwind during the night: 3.0 mi (4.9 km).

➤ **PHYSICAL DANGERS:**

- Vapors may collect and stay in confined areas (e.g., sewers, basements, and tanks).
- Hazardous concentrations may develop quickly in enclosed, poorly-ventilated, or low-lying areas. Keep out of these areas. Stay upwind.
- Hydrogen cyanide gas produced from sodium cyanide mixes well with air; explosive mixtures are easily formed.

Signs/Symptoms

- **TIME COURSE:** Effects occur rapidly following exposure to sodium cyanide. Inhalation exposure to hydrogen cyanide gas released from sodium cyanide produces symptoms within seconds to minutes; death may occur within minutes.
 - **EFFECTS OF SHORT-TERM (LESS THAN 8-HOURS) EXPOSURE:** Early symptoms of cyanide poisoning include lightheadedness, giddiness, rapid breathing, nausea, vomiting (emesis), feeling of neck constriction and suffocation, confusion, restlessness, and anxiety. Accumulation of fluid in the lungs (pulmonary edema) may complicate severe intoxications. Rapid breathing is soon followed by respiratory depression/respiratory arrest (cessation of breathing). Severe cyanide poisonings progress to stupor, coma, muscle spasms (in which head, neck, and spine are arched backwards), convulsions (seizures), fixed and dilated pupils, and death. The CNS is the most sensitive target organ of cyanide poisoning. Cardiovascular effects require higher cyanide doses than those necessary for CNS effects. In serious poisonings, the skin is cold, clammy, and diaphoretic. Blue discoloration of the skin may be a late finding. Severe signs of oxygen deprivation in the absence of blue discoloration of the skin suggest cyanide poisoning.
-

➤ **EYE EXPOSURE:**

- Redness, pain, and severe deep burns.
- Contact with the eyes can contribute to whole-body (systemic) toxicity. See Inhalation Exposure.

➤ **INGESTION EXPOSURE:**

- Nausea, vomiting (emesis), abdominal pain, and irritation or corrosion of the lining of the esophagus and stomach.
- Whole-body (systemic) toxicity can occur. See Inhalation Exposure.

➤ **INHALATION EXPOSURE:**

- Mild to moderate: Central Nervous System (CNS) effects: headache, confusion, anxiety, dizziness, weakness (malaise), and loss of consciousness. Cardiovascular effects: palpitations. Respiratory effects: respiratory tract irritation, difficulty breathing or shortness of breath (dyspnea), and transient increase in rate and depth of breathing (hyperpnoea). Gastro Intestinal effects: nausea and vomiting (emesis).
- Severe: CNS effects: coma, seizures, and dilated pupils (mydriasis). Cardiovascular effects: shock, abnormal or disordered heart rhythms (dysrhythmias), critically low blood pressure, and cardiac arrest. Respiratory effects: abnormally rapid, followed by abnormally slow respirations; accumulation of fluid in the lungs (pulmonary edema); and respiratory arrest. Eye effects: dilated pupils, inflammation of the surface of the eye, and temporary blindness.

➤ **SKIN EXPOSURE:**

- Irritation, tissue damage (ulceration), burning sensation, and pain
- Absorption through the skin can contribute to whole-body (systemic) toxicity. See Inhalation Exposure.

Decontamination

- **INTRODUCTION:** The purpose of decontamination is to make an individual and/or their equipment safe by physically removing toxic substances quickly and effectively. Care should be taken during decontamination, because absorbed agent can be released from clothing and skin as a gas. Your Incident Commander will provide you with decontaminants specific for the agent released or the agent believed to have been released.

- **DECONTAMINATION CORRIDOR:** The following are recommendations to protect the first responders from the release area:

- Position the decontamination corridor upwind and uphill of the hot zone. The warm zone should include two decontamination corridors. One decontamination corridor is used to enter the warm zone and the other for exiting the warm zone into the cold zone. The decontamination zone for exiting should be upwind and uphill from the zone used to enter.
 - Decontamination area workers should wear appropriate PPE. See the PPE section of this card for detailed information.
-

- A solution of detergent and water (which should have a pH value of at least 8 but should not exceed a pH value of 10.5) should be available for use in decontamination procedures. Soft brushes should be available to remove contamination from the PPE. Labeled, durable 6-mil polyethylene bags should be available for disposal of contaminated PPE.
- **INDIVIDUAL DECONTAMINATION:** The following methods can be used to decontaminate an individual:
 - Decontamination of First Responder:
 - Begin washing PPE of the first responder using soap and water solution and a soft brush. Always move in a downward motion (from head to toe). Make sure to get into all areas, especially folds in the clothing. Wash and rinse (using cold or warm water) until the contaminant is thoroughly removed.
 - Remove PPE by rolling downward (from head to toe) and avoid pulling PPE off over the head. Remove the SCBA after other PPE has been removed.
 - Place all PPE in labeled durable 6-mil polyethylene bags.
 - Decontamination of Patient/Victim:
 - Remove the patient/victim from the contaminated area and into the decontamination corridor.
 - Remove all clothing (at least down to their undergarments) and place the clothing in a labeled durable 6-mil polyethylene bag.
 - Thoroughly wash and rinse (using cold or warm water) the contaminated skin of the patient/victim using a soap and water solution. Be careful not to break the patient/victim's skin during the decontamination process, and cover all open wounds.
 - Cover the patient/victim to prevent shock and loss of body heat.
 - Move the patient/victim to an area where emergency medical treatment can be provided.

First Aid

- **GENERAL INFORMATION:** Careful observation, supplemental oxygen, and supportive care may be sufficient therapy for the patient/victim who does not exhibit physical findings of cyanide toxicity. For the patient/victim exhibiting physical findings of cyanide toxicity, initial treatment consists of administration of antidotes under a physician's direction, respiratory and circulatory support (oxygen and IV fluids), correction of chemical imbalances in the blood, and seizure control. **Speed is critical.** Avoid mouth-to-mouth resuscitation regardless of route of exposure. Avoid contact with vomitus, which may off-gas hydrogen cyanide.
 - **Seek for medical attention by bringing the victim to the clinic after decontamination**
 - **If Antidote is needed, it must be administered by our medical clinic's personnel, under the following procedure:**
[Control + Click here to link to procedure MBK-HSS-C-006](#)
 - **EYE CONTACT:**
 - Immediately remove the patient/victim from the source of exposure.
 - Immediately wash eyes with large amounts of tepid water for at least 15 minutes.
-

- Monitor the victim for signs of whole-body (systemic) effects.
- If signs of whole-body (systemic) poisoning appear, see the Inhalation section for treatment recommendations.
- Seek medical attention immediately.

➤ **INGESTION:**

- Immediately remove the victim from the source of exposure.
- Establish secure large-bore IV access.
- Ensure that the patient/victim has an unobstructed airway.
- Do not induce vomiting (emesis).
- Immediately administer 100% oxygen.
- Prepare a cyanide antidote kit, for use under a physician's direction, for symptomatic patient/victims. See the Antidote section for antidote administration procedures.
- Treat seizures with benzodiazepines.
- Seek medical attention immediately.

➤ **INHALATION:**

- Immediately remove the patient/victim from the source of exposure.
- Evaluate respiratory function and pulse.
- Ensure that the patient/victim has an unobstructed airway.
- Immediately administer 100% oxygen.
- Assist ventilation as required.
- If breathing has ceased (apnea), provide artificial respiration.
- The nursing staff will:
 - Establish secure large-bore intravenous (IV) access.
 - Prepare a cyanide antidote kit, for use under a physician's direction, for symptomatic patient/victims. See the Antidote section for antidote administration procedures.
- Monitor for respiratory distress.
- Seek medical attention immediately.

➤ **SKIN:**

- Immediately remove the patient/victim from the source of exposure.
 - See the Decontamination section for patient/victim decontamination procedures.
 - Monitor the patient/victim for signs of whole-body (systemic) effects.
 - If signs of whole-body (systemic) poisoning appear, see the Inhalation section for treatment recommendations.
 - Seek medical attention immediately.
-

APPENDIX C

MBK-HSS-3002 Emergency Response Plan for DYNO Nobel Emulsion Plant

Control + Click here to link to this Specific Emergency Response Plan

APPENDIX D

MBK-HSS-3003 Oil Pollution Emergency Response Plan

Control + Click here to link to this specific Emergency Response Plan

APPENDIX E

MBK-HSS-3004 Nolinor ERP Plan (Note: accessible only on Intelex under Plans – Emergency Response (access limited))

Control + Click here to link to this specific Emergency Response Plan

APPENDIX F

MBK-HSS-3005 F-A Baker Lake Facilities O M Manual- Drawings Appendix

[Control + click here to link to the document](#)

APPENDIX G

MBK-HSS-3005 Baker Lake Facilities O M Manual

Control + Click here to link to this specific O M Manual- Drawings

APPENDIX H

MBK-HSS-3006 Baker Lake Bulk Fuel Storage Facility Environmental Performance Monitoring Plan Ver. 2

Control + Click here to link to this specific Plan

APPENDIX I

MBK-HSS-3007 Meadowbank Transportation Management Plan *AWPAR*

Control + Click here to link to this specific plan

APPENDIX J

MBK-HSS-3008 Vault Emergency Response Plan

Control + Click here to link to this specific plan

APPENDIX K

MBK-HSS-3009 Emergency Response Guideline Handbook – ERG 2012



ERG2012.pdf

APPENDIX L

[Site Maps Quick Link](#)

Control + Click here to link to Site Maps

APPENDIX M

SPILL Contingency Plan

Control +Click here to link to this specific plan

APPENDIX N

MEADOWBANK CRISIS MANAGEMENT PLAN

CONTROL + CLICK HERE TO LINK TO THIS PLAN
