APPENDIX B20 - TAILINGS STORAGE FACILITY: OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL, VERSION 3 (SEPT. 2013)

MEADOWBANK GOLD PROJECT

TAILINGS STORAGE FACILITY

Operation, Maintenance and Surveillance Manual

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 3
September 2013

TAILINGS STORAGE FACILITY

OPERATION, MAINTENANCE AND

SURVEILLANCE MANUAL

MEADOWBANK GOLD PROJECT

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 Services Manager

AEM- Corporate Environment Director

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

Approved by: ______________________________
Julie Belanger
Engineering Superintendent

____
Kevin Buck
Environment Superintendent

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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 ^{o}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, is 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 Environment Superintendent is responsible for maintaining an up-to-date list of the registered holders of this OMS manual in Table 1-1.

The AEM Environment 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 6, 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 licence requirements and environmental permitting considerations;

- Infrastructure and Economic Losses (third parties): the embankment is classified as "high" due to the water licence 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

Name / Position / Address or Location	OMS Manual Copy No.
General Manager Meadowbank / Jean Beliveau, Alexandre Proulx (ass.) / OFFICE	1
Environment Superintendent / Kevin Buck / OFFICE	2
Mine Operations Superintendent /Martin Beausejour, Brock Johnston (ass.) / OFFICE	3
Engineering Superintendent / Julie Belanger / OFFICE	4
Site Services Superintendent / Eric Trudel/ OFFICE	5
Dike Design Engineer / Golder Associates Ltd./ 500 – 4260 Still Creek Drive, Burnaby, BC, V5C 6C6	6
Dike Design Engineer / SNC-Lavalin Inc./ 5500, Boulevard des Galeries, Bureau 200, Quebec, Quebec, G2K 2E2	7
Update as Required	

Table 1-2 Record of OMS Manual Revisions and 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

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 May 31, 2015

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 *important* 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 *critical* fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affection important infrastructure or services *(e.g., highway, industrial facility, storage facilities for dangerous substances)*
Extreme	Permanent	More than 100	Major loss of *critical* fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services *(e.g., hospital, major industrial complex, major storage facilities for dangerous substances)*

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)
Update as Required		

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
Update as Required			

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
Update as Required			

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
Update as Required			

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:

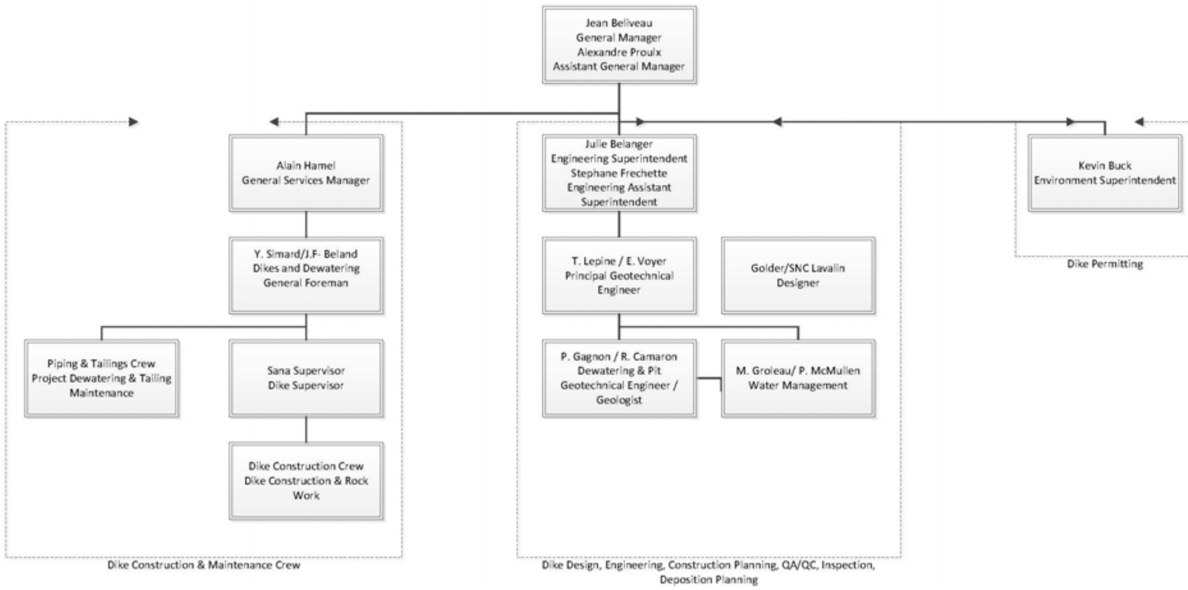
- Plan and oversee the construction of the embankments of the TSF;
- Provides the overall management of the TSF;
- Oversees the design, development, construction and deposition activities of the TSF;
- Monitors the thermistor instrumentation of the TSF;
- Monitors quantity and manages the water of the 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 /Principal Geotechnical Engineer	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/ Principal Geotechnical Engineer	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 Plan 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

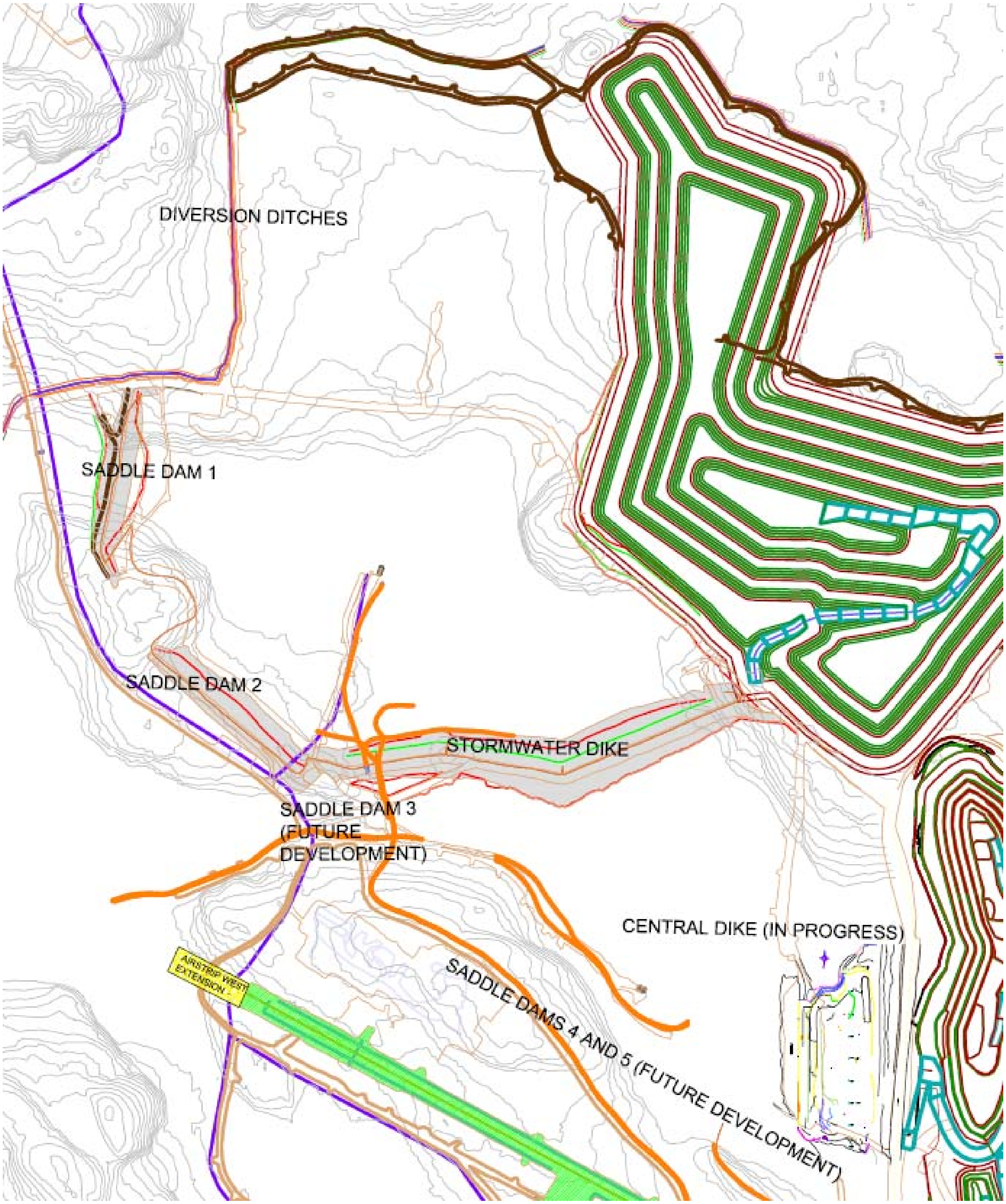
The TSF is the permanent surface storage facility for tailings produced during the operation of the mine. The TSF is located north of the Plant Site, as presented on Figure 2, and will be developed in two cells in the following order:

1. North Cell; and
2. South Cell.

The main components of the TSF are:

- Perimeter containment structures (Saddle Dams 1 to 6, inclusive, 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 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 ditches and sumps, is to collect surface water runoff and seepage from the TSF for pumping to the water treatment plant. 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.

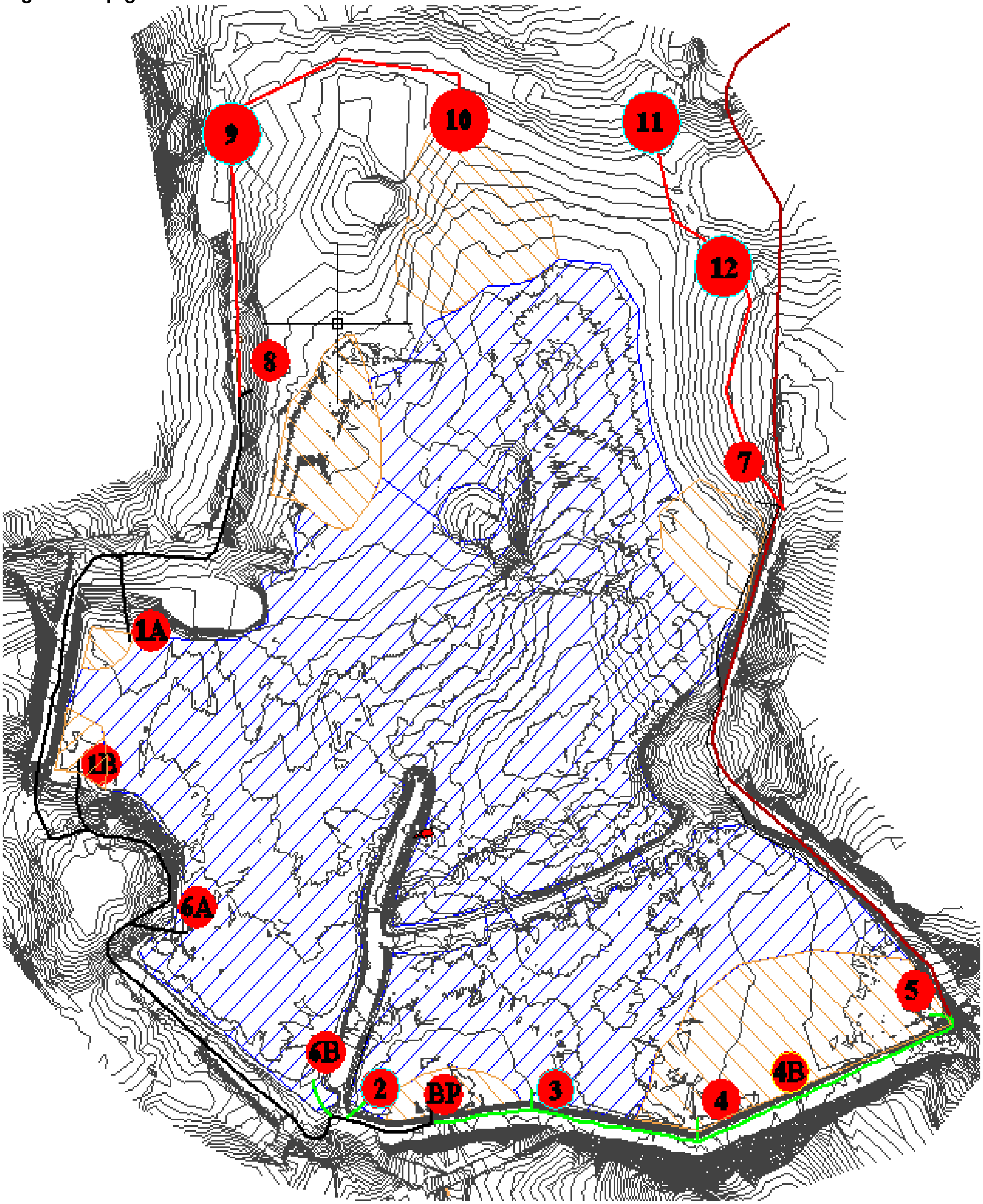
The ditches surrounding the TSF are designed to capture seepage and surface runoff water and provide gravity flow of the water into the sumps.

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 ditched or pumped into the environment if the limits are respected. Water collected form 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 Storage Capacity	24.5 m^3	calculated
	Life of mine total ore	31.8Mt	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 embankment upstream side slope*:	3H:1V	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 : Perimeter sumps:	1:10 year freshet runoff event 1 :100 year freshet runoff event	Refer to drawings
	Ditch Gradient	Minimum 0.3%	Refer to drawings
Process Plant Rate	Nominal daily processing rate	11,000-12,000 tpd	AEM
Operation	Tailings discharge solids content	52%	AEM
Operation	Average deposited slurry dry density	1.21 t/m^3	Assumed value pending field trials.
Operation	Deposition slope angle for slurry	0.5% to 4.0%	Assumed value pending survey.
Ice	Ice entrapment (by volume)	40% (allowance)	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 (during planned process plant shut-downs), 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. 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 General Foremen):

- 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 principal geotechnical engineer 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 Engineer 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. 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 location in the TSF.

The instrumentation and survey level are to be read and recorded at the frequencies shown in Table 6-1.

Table 6-1 Surveillance Items and Frequencies

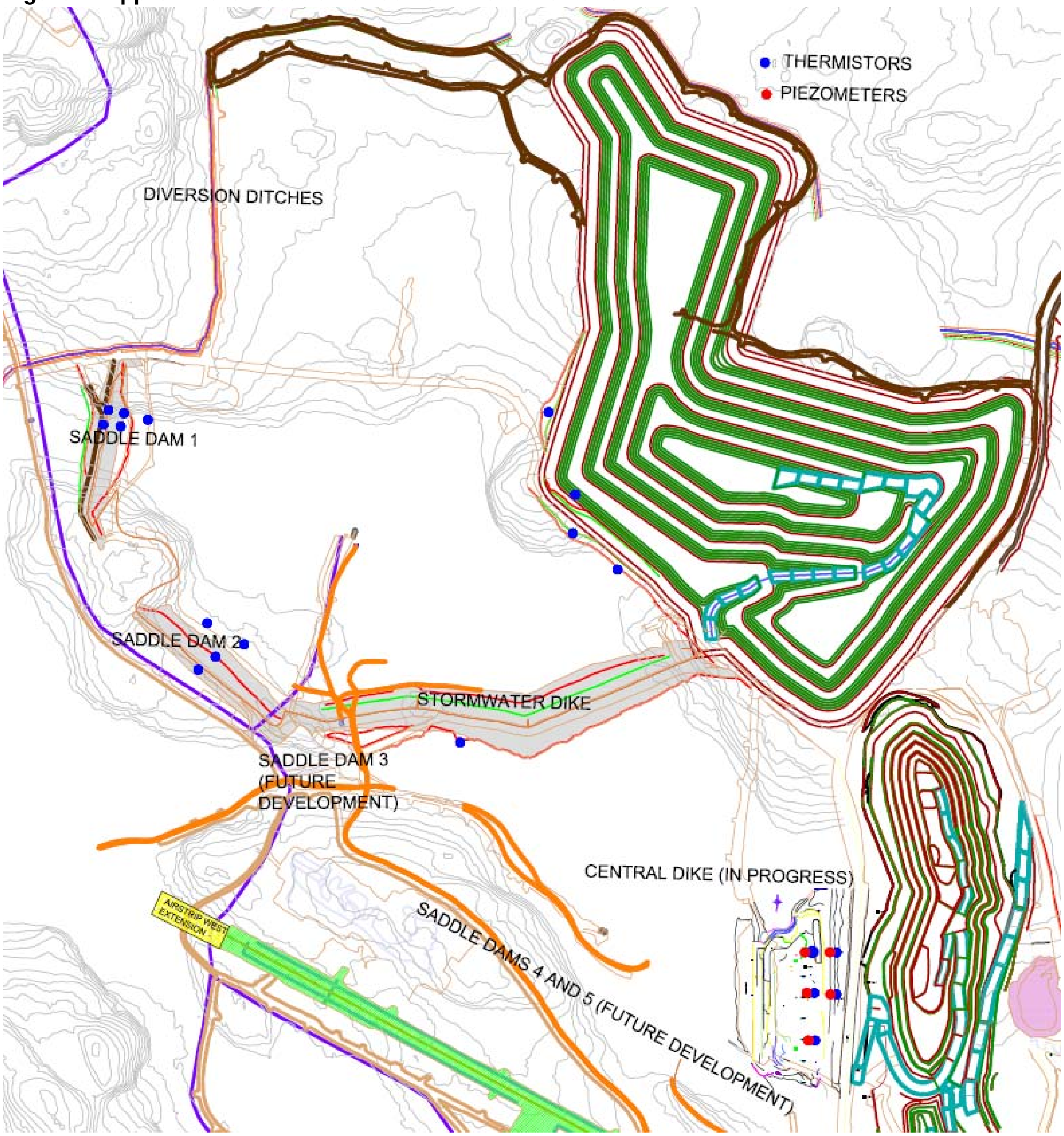
Instrumentation	*Monitored By*	*Reported To*	*Frequency*
Thermistors and Piezometers	• Manually by Engineering and Environment Personnel	Engineering and Environment Superintendent Principal Geotechnical Engineer	Weekly during winter and every three (3) days during the summer
Survey	• Manually by Engineering Personnel	Engineering and Environment Superintendent Principal Geotechnical Engineer	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 department.

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:
    - Increase or decrease in measurements (over two or more readings) that cannot be explained by seasonal temperature variations or instrument malfunction.
- Piezometers:
    - 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 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
8. Increase monitoring frequency to assess progression of anomaly.

6.2.3 Seepage Monitoring

The seepage monitoring performed for the TSF comprises 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 action 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
7. 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 elaborated by AEM 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 Principal Geotechnical Engineer 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 Principal Geotechnical Engineer. Pumping rates during dewatering and operation shall be reported to the Engineering Superintendent and the Principal Geotechnical Engineer.

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, Principal Geotechnical Engineer Process 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;
    - Thermal- thermistor data;
    - Piezometers 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, SD6, 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 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:	Propair-Nolinor	(514)631-3000

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 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 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 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 8.4.

8.2.4 Site Emergency Procedure

As specified in the Emergency Response Plan, Ver. 6, 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 page 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 (*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.

8.3 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

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

Note: To be updated as required

8.4.2 Mobile Equipment

The following are lists of onsite mobile equipment of AEM and FGL available for use during an emergency event:

AEM Mobile Equipment List (to be updated as required)

MODEL	EQUIP. #
LOADING	
RH 40	BAC01
345CL	BAC02
307	BAC03
345D	BAC05
385C	BAC06
345DL	BAC07
RH120	BAC10
RH120	BAC11
RH120	BAC12
IT14G	LOA02
992G	LOA03
992G	LOA04
980H	LOA12
DOZER	
D8T	DOZ01
D9T	DOZ02
D9T	DOZ05
D9T	DOZ06
D9T	DOZ07
834H	DOZ08
GRADER	
16M	GRA03
16M	GRA04
HAULING	
777F	HTR01
777F	HTR02
777F	HTR03
777F	HTR04
777F	HTR05
777F	HTR06
777F	HTR07
777F	HTR08
785B	HTR20
785B	HTR21
785B	HTR22
785D	HTR23
785D	HTR24
785D	HTR25
785C	HTR26
785C	HTR27
785C	HTR28
785D	HTR29
785D	HTR30
777B	HTR10
773E	HTR09
DRILL	
DM45E	RBD01
DM45E	RBD02
DM45E	RBD03
DM45E	RBD04
CM785	RBD05
DML	RBD06
DML	RBD07
DML	RBD08
HAMMER	
V56	HAM01
V56	HAM02
BUS	
H77 (SS)	BUS01
E-350	BUS02
E-350 (SS)	BUS03
VAN E350	BUS04
32006-S (SS)	BUS05
E-350	BUS06
S30	BUS07
3800	BUS08
3800	BUS09
SITE SERVICE	
330D	BAC04
DOZER	
D6R	DOZ03
D6T	DOZ09
GRADER	
16H	GRA01
160H	GRA02

MODEL	EQUIP. #
LOADER	
IT14G (SS)	LOA01
420E (SS)	LOA05
966H (SS)	LOA06
TC44H (SS)	LOA08
966H (SS)	LOA09
980H (SS)	LOA10
420E	LOA11
TRUCK	
T800	TRK01
KENWORTH	TRK02
KENWORTH	TRK03
KENWORTH	TRK04
TRUCK (SS)	TRK05
KENWORTH	TRK06
FRD WATER	TRK07
SEPTIC	TRK08
HIAB	TRK09
CEMENT	TRK10
CEMENT	TRK11
Truck	TRK12
KENWORTH	TRK14
KENWORTH	TRK15
TRUCK (SS)	TRK16
FUEL	TRK17
GARBAGE (SS)	TRK18
FIRE TRUCK	TRK19
FUEL	TRK21
S.Plow	TRK22
S.Plow	TRK23
STEAMER	TRK24
Fountaine T.	TRK28
LUB	TRK30
Service	TRK31
AIR PLANE FUEL TANKER	TRK32
LUB	TRK33
SHOP	TRK34
FUEL	TRK35
S.Plow	TRK36
Service Truck	TRK38
GENSET	
XQ2000	GEN01
XQ2000	GEN02
XQ2000	GEN03
3412	GEN05
XQ202	GEN06
XQ202	GEN07
3508	GEN08
C6T	GEN09
C6T	GEN10
DGHE	GEN11
DGCG	GEN12
D200P	GEN13
D100P4S	GEN14
D100P1SX	GEN15
D30-8	GEN16
D25-8S	GEN17
D25-8S	GEN18
D13-4S	GEN19
D13-4S	GEN20
QAS30	GEN21
QAS30	GEN22
DSFAE	GEN23
3412	GEN24
3412	GEN25
GEH220-2	GEN26
D200P3	GEN27
DSKAA	GEN28
DSKAA	GEN29
QAS30	GEN30
QAS38	GEN31
?	GEN32
D30-10 (SS)	GEN33
QAS 30	GEN34
QAS 30	GEN35
D30-10	GEN36
6081AF001	GEN37
D30-10	GEN38
D30-8	GEN39

MODEL	EQUIP. #
PICKUP	
F-350	PCK01
F-350 (SS)	PCK02
F-350	PCK03
F-350	PCK04
F-350	PCK05
F-350	PCK06
F-350	PCK07
F-350	PCK08
F-350	PCK09
F-350	PCK10
F-350	PCK11
F-350	PCK12
E-350	PCK13
F-350	PCK14
F-350	PCK15
F-350	PCK16
F-350	PCK17
F-350	PCK18
F-250	PCK19
F-250	PCK20
F-250	PCK21
F-350	PCK22
F-350	PCK23
F-250	PCK24
F-250	PCK25
F-250 (SS)	PCK26
F-250 (SS)	PCK27
F-250	PCK28
F-250	PCK29
F-250 (SS)	PCK30
F-250	PCK31
F-250	PCK32
F-250	PCK33
F-250	PCK34
F-250	PCK35
F-250	PCK36
F-250	PCK37
F-250	PCK38
E-350	PCK39
F-250	PCK40
F-250	PCK41
F-250	PCK42
F-350	PCK43
F-250	PCK44
F-350	PCK45
F-250	PCK46
F-250	PCK47
F-250	PCK48
F-250	PCK49
F-250	PCK50
F-250	PCK51
F-450 WH	PCK52
F-250	PCK53
F-250	PCK54
F-250	PCK55
F-250	PCK56
F-250	PCK57
F-250	PCK58
F-250	REN56
ATV	
	ATV02
	ATV03
	ATV05
BOAT ENGINE	
	ENG56
	ENG57
COMPACTOR	
	CPT01
	CPT02
EMERGENCY VEHICULE	
SNOWCAT	SNC01
FORK LIFT	
HYSTER RH35	FKL02
CAT (WH)	FKL03
RZ2	FKL04
CAT	FKL05
CAT (SHOP)	FKL06
740DR321T	FKL07
ETDR40TT	FKL08
HYSTER	FKL09

MODEL	EQUIP. #
FROST FIGHTER	
IDF-350	HEA01
IDF-350	HEA02
IDF-350	HEA03
IDF-350	HEA04
IDF-350	HEA05
IDF-350	HEA06
IDF-350	HEA07
IDF-350	HEA08
IDF-350	HEA09
IDF-350	HEA10
IDF-350	HEA11
IDF-350	HEA12
IDF-350	HEA13
IDF-350	HEA14
FROST FIGHTER	
MOBILE TANK	MFT01
GÉNIE	
GS3232	SCI05
S85	SCI06
Z-45/25	SCI07
Z-45/25	SCI08
S85	SCI11
S85	SCI12
S125	SCI13
S125	SCI14
S85	REN07
Crane	
120T (SS)	MCR01
80T (SS)	MCR02
35T (SS)	MCR03
90T (SS)	MCR04
25T (SS)	MCR05
200T	MCR06
LIGHT TOWER	
AL5080D	LGT01
L-20	LGT02
L-20	LGT03
L-20	LGT04
L-20	LGT05
L-20	LGT06
L-20	LGT07
L-20	LGT08
LTC4	LGT09
LTC4	LGT11
LTC4	LGT12
LT5000-4MH	LGT18
MECHANICAL SERVICE TRUCK	
SERVICE	WMM02
MULE	
OBSOLETE	VSE01
Mule	VSE02
Mule	VSE03
Mule	VSE04
Mule	VSE05
Mule	VSE06
Mule	VSE07
Kubota	VSE08
Kubota	VSE09
Kubota	VSE10
Mule	VSE11
SKID STEER	
262C	SKD01
753	SKD02
262C	SKD03
SNOW BLOWER	
SNOW BLOWER	SBL01
SNOW BLOWER	SBL02
HYSTER HANDLER	
GTH844	TPA01
GTH844	TPA02
HR45 (SS)	TPA03
PETER	TPA03P
1056C (SS)	TPA04
SPARE	TPA05
INGERSOLL RAN	REN15
COMPRESSOR	
	COM01
SULLAIR	COM02
SULLAIR	COM03

MODEL	EQUIP. #
TRAILER	
TANKER	TRL01
LOW BED	TRL04
LOW BED	TRL05
FUEL TANK	TRL06
FUEL TANK	TRL07
LOW BOY	TRL08
FIRE PUMP TRAILER	TRL09
WELDING MACHINE	
400D	SMD01
WITH AIR PACK	SMD02
500P WT AIR	SMD03
WITH AIR PACK	SMD05
RH120 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
345 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
385 BUCKET	
Bucket 01	
Bucket 02	
992 BUCKET	
Bucket 01	
Bucket 02	
Bucket 03	
Bucket 04	
TRUCK BOX REPAIR	
TRUCK BOX	BOX01
TRUCK BOX	BOX02
TRUCK BOX	BOX03
TRUCK BOX	BOX04
TRUCK BOX	BOX05
TRUCK BOX	BOX06
TRUCK BOX	BOX07
TRUCK BOX	BOX08
TRUCK BOX	BOX09
TRUCK BOX	BOX10
TRUCK BOX	BOX11
TRUCK BOX	BOX12
TRUCK BOX	BOX13
TRUCK BOX	BOX14
TRUCK BOX	BOX15
TRUCK BOX	BOX16
TRUCK BOX	BOX17
TRUCK BOX	BOX18
TRUCK BOX	BOX19

FGL Mobile Equipment List (to be updated as required)

Qamanittuaq SANA FGL HEAVY EQUIPMENTS

SHOVELS

TYPE	UNIT NUMBER	Models
PC 1250	11-0303	Komatsu
385	395	Caterpillar
385	1333	Caterpillar
365	1313	Caterpillar
345	11-0301	Caterpillar
345	393	Caterpillar

GRADER

TYPE	UNIT NUMBER	OPERATOR NAME
14-M	513	Caterpillar

HAULING TRUCKS

TYPE	UNIT NUMBER	OPERATOR NAME
773	1516	HTR 773F
773	1517	HTR 773F
773	1518	HTR 773F
773	1519	HTR 773F
773	1520	HTR 773F
773	1535	HTR 773F
773	1536	HTR 773F
740	1522	HTR 740
740	1530	HTR 740
100T	11-1001	TR 100
100T	11-1002	TR 100
100T	11-1003	TR 100
100T	11-1004	TR 100

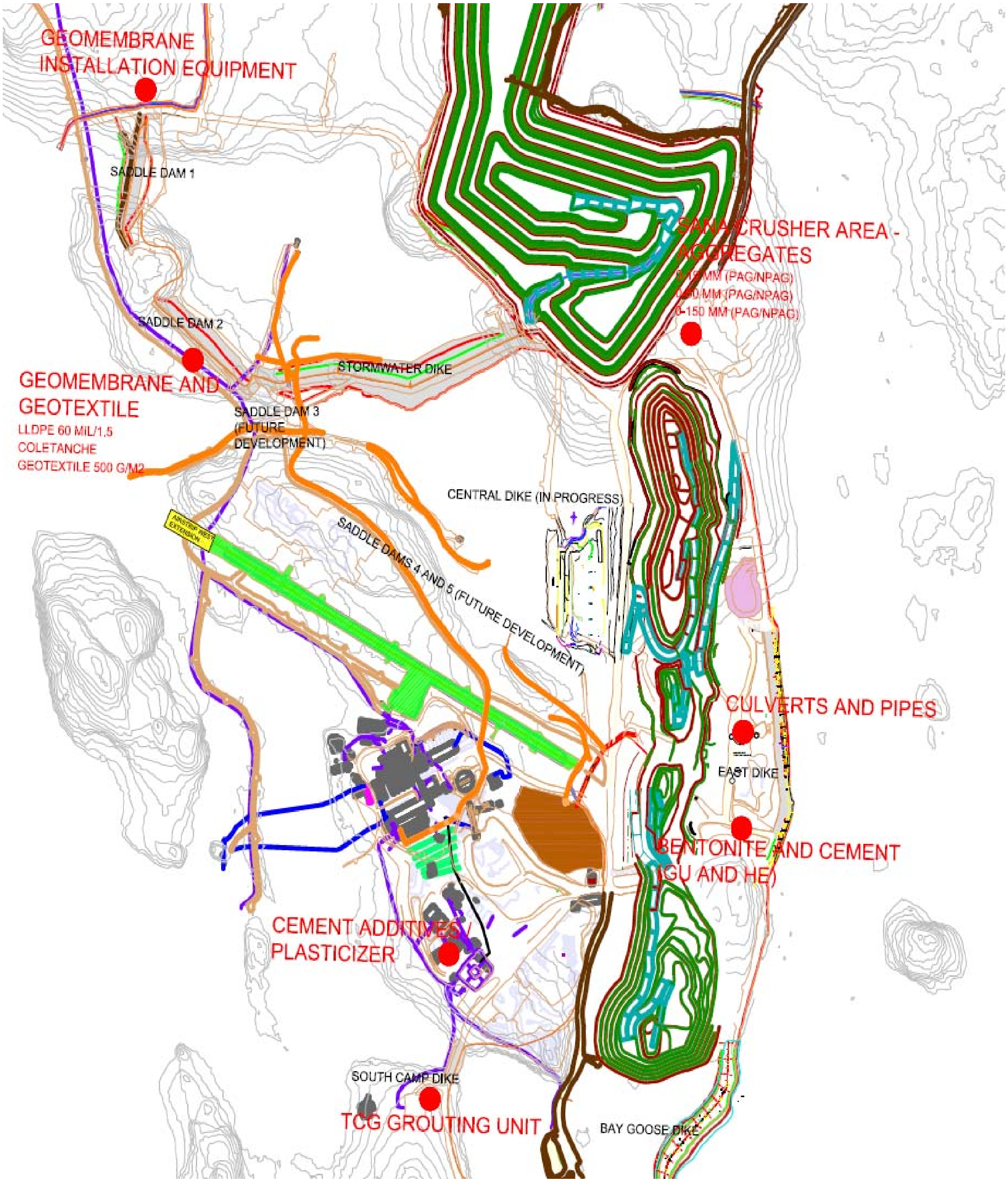
DOZERS

TYPE	UNIT NUMBER	OPERATOR NAME
D6	441	Caterpillar
D8T	438	Caterpillar
D8T	443	Caterpillar

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 6, August 2013
Emergency Preparedness Plan	In TSF OMS Manual, Version 2, August 2013

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
	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
Action Required			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
Personnel Notified		Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor (if required), Mine Operations Manager, Environment Superintendent, Mine Manager, Discuss at MDRB Meeting.	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Mine Operations Manager, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel, if required).	Principal Geotechnical Engineer, Engineering Superintendent, Engineering Assistant Superintendent, Corporate Environment Director, Designer (Golder or SNC), Specialized Contractor, Mine Operations Manager, Environment Superintendent, Mine Manager, Dike Review Board, Mine Inspector, Health and Safety, ERT (Emergency Personnel).

Table 9-4 Communication Charts for Each Emergency Level

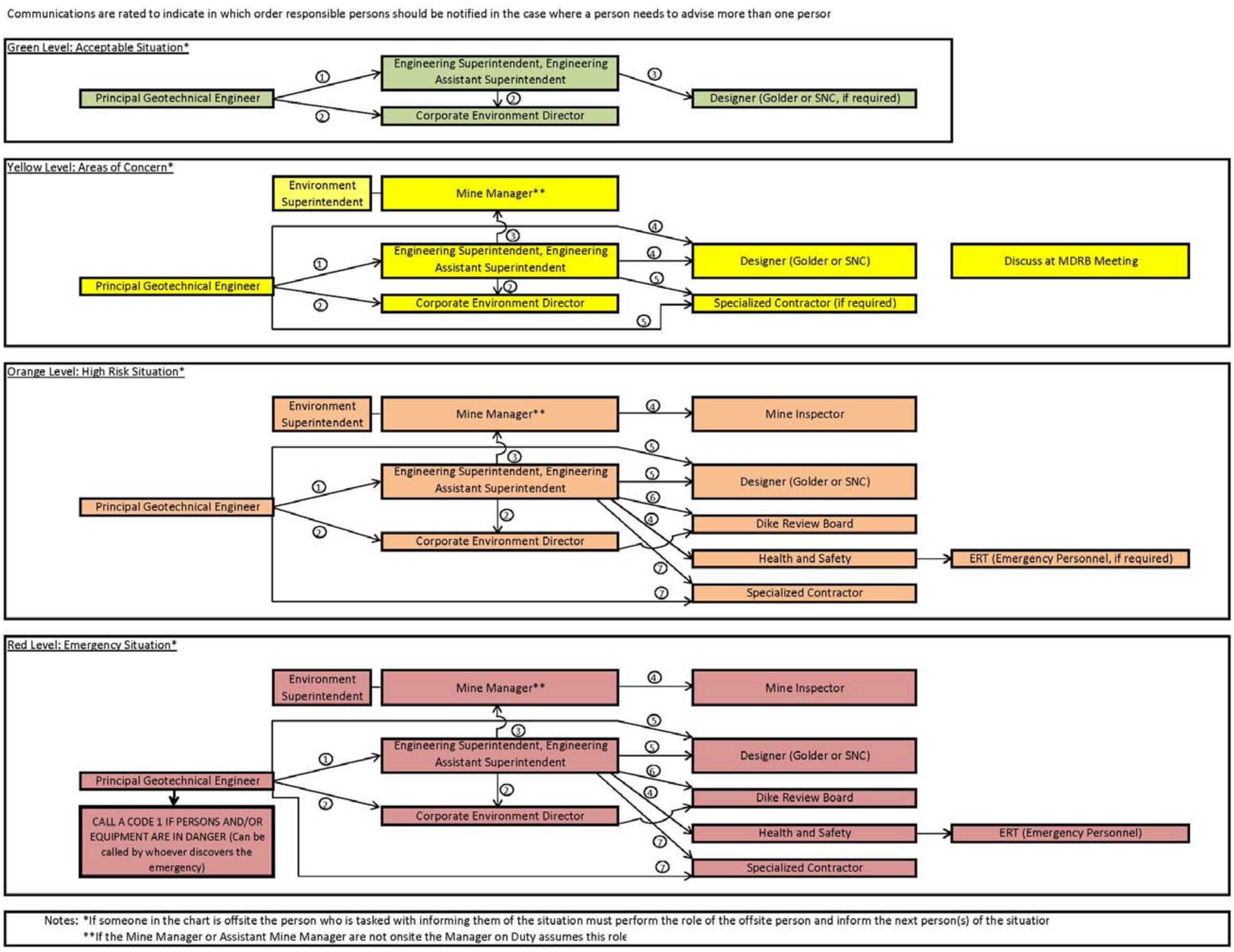


Table 9-5 Responsibilities of Persons for Each Emergency Level

	Decision Making	Mobilization	Performing the Action to be Taken
Green **Acceptable Situation**	Principal Geotechnical Engineer	Principal Geotechnical Engineer	Geotechnical Team*
Yellow **Areas of Concern**	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC)	Principal Geotechnical Engineer	Geotechnical Team* Specialized Contractor (if required)
Orange **High Risk Situation**	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety (if required)	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent	Geotechnical Team* Specialized Contractor ERT (if required)
Red **Emergency Situation**	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Designer (Golder or SNC) Corporate Environment Director Dike Review Board Mine Manager Health and Safety	Principal Geotechnical Engineer Engineering Superintendent Engineering Assistant Superintendent Mine Manager Health and Safety	Geotechnical Team* Specialized Contractor ERT

*The Geotechnical Team consists of the Principal Geotechnical Engineer, the Dewatering and Pit Geotechnical Engineer/Geologist, Water Management, and the Geotechnical Technician.

Table 9-6 Names and Contact Details (to be updated as required)

Internal Emergency Response Contact Information Chart		
Position	**Name/Location**	**24-Hour Contact #**
Principal Geotechnical Engineer	Erika Voyer	Ph: 867-793-4610 ext. 6837 cell: 581-982-7107
	Thomas Lepine	Ph: 867-793-4610 ext. 6837 cell: 418-473-8077
Engineering Superintendent	Julie Belanger	Ph: 867-793-4610 ext. 6721 cell: 819-856-1667
Engineering Assistant Superintendent	Stephane Frechette	Ph: 867-793-4610 ext. 6721 cell: 819-856-3152
Corporate Environment Director	Michel Julien	Ph: 416-947-1212 ext. 3738 cell: 514-244-5876
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: 867-793-4610 ext. 6963 Ph: 418-615-0559
Environment Superintendent	Kevin Buck	Ph: 867-793-4610 ext 6838 Cell: 819-856-1956
Mine Manager	Jean Beliveau	Ph: 867-793-4610 ext. 6901 cell: 819-856-5605
	Alexandre Proulx (asst.)	Ph: 867-793-4610 ext. 6843 cell: 819-860-6389
Dike Review Board	Anthony Rattue Norbert Morgenstern Don Hayley	Anthony.Rattue@snclavalin.com norbertm@ualberta.ca dhayley@eba.ca
Mine Inspector	Martin VanRooy	Martin.vanRooy@wscc.nu.ca_contact1
Health and Safety	Normand Ladouceur	Ph: 867-793-4610 ext. 6720 cell: 819-860-6258
	Yves Levesque (asst.)	Ph: 867-793-4610 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: 867-793-4610 ext. 6809 cell: 819-355-2191 Channel #1
	Normand Ladouceur	Ph: 867-793-4610 ext. 6720 cell: 819-860-6258 Channel #1

Emergency Measures Counsellor	André Rouleau	Ph: 867-793-4610 ext. 6809 cell: 819-355-2191
Health Professionals / Medical Clinic	Medical Clinic 1	Ph: 867-793-4610 ext. 6734
	Medical Clinic 2	Ph: 867-793-4610 ext. 6751
AEM Management Representative	Dominique Girard	Ph: 867-793-4610 ext. 6901 cell: 819-277-4080
Human Resource Superintendent	Krystel Mayrand	Ph: 867-793-4610 ext 6723 cell: 819-856-9556

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.

Golder 2009. Stormwater Dike and Saddle Dam 1 Geomembranes, Meadowbank Gold Project. July 20, 2009. Doc. 917 Ver. 0.

Golder 2011. 2011 Tailings Deposition Plan Update, Meadowbank Gold Project. July 18, 2011. Doc. 1272 Ver. 0.

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.6, August 2013

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:* ____________

DAM/DIKE INFORMATION:

Dam ☐ Dike ☐ ________________ Crest Elevation: ________ Head Pond Elevation ________
Tailing elevation ________

DAM / BERM

A) Crest

cracking	☐ none	☐	
settlement	☐ none	☐	
erosion	☐ none	☐	
other movement	☐ none	☐	

B) Downstream Slope and Toe Area

erosion	☐ none	☐	
settlement	☐ none	☐	
bulging	☐ none	☐	
sloughing	☐ none	☐	
slope protection	☐ good	☐	
animal burrows	☐ none	☐	
seepage	☐ none	☐	location 1: ________

rate: ☐ damp ☐ trickle ☐ steady ____ (L/s)
clarity: ☐ clear ☐ muddy ________
sample taken: ☐ yes ☐ no

location 2: ________
rate ☐ damp ☐ trickle ☐ steady ____ (L/s)
clarity ☐ clear ☐ muddy ________
sample taken ☐ yes ☐ no
type: ________

sand boils ☐ none ☐ location(s) ________

C) Upstream Slope and Tailings Surface

erosion	☐ none	☐ wave induced	☐ surface runoff
		location(s):	
		degree ☐ minor ☐ moderate ☐ severe	
geomembrane	☐ none	☐	
settlement	☐ none	☐	
bulging	☐ none	☐	
sloughing	☐ none	☐	
slope protection	☐ good	☐	
slope vegetation	☐ none	☐	
animal burrows	☐ none	☐	
sinkholes	☐ none	☐	
tailings surface	☐ water covered	☐	

DAM / DIKE INSTRUMENTATION: (plot any newly installed instrumentation on relevant plans and cross-sections)

	Operational	Damaged	Measurement Taken
☐ none	☐	☐	☐
☐ piezometers	☐	☐	☐
☐ monitoring well	☐	☐	☐
☐ survey stakes	☐	☐	☐
☐ other Thermistors (4)	☐	☐	☐ every 3-4 days

COMMENTS AND RECOMMENDATIONS:

☐ Action Required: ☐ none ☐ further monitoring ☐ immediate remediation
☐ Plan or Sketch Attached ____________________
☐ Photographs (number) ____________________

Review Officer: ____________ Review Agency: ____________ Date Reviewed: ____________
(DD/MM/YR)

REVIEW COMMENTS: ☐ ***none***

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 2.2 below.

Table 2.2: 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.

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.

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 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 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.

<u>Potential Effect</u>

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 Mm^3 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 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 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.

<u>Potential Effect</u>

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.

<u>Mitigation, Management, and Monitoring</u>

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.