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MEADOWBANK MINE

East Dike Seepage- NWB Application for a Type A Water License Modification

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APRIL 2013

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1	April 4 2013			Version 1

Plan prepared by:

Agnico-Eagle Mines Limited- Meadowbank Division

Executive Summary

Non-contact water (receiving environment water from Second Portage Lake), is presently seeping through the East Dike and is collected by two sumps prior to pumping to the Portage attenuation pond. AEM is proposing to discharge this non-contact seepage water from Second Portage Lake pump through a separate sump collection system and diffuser, back to Second Portage Lake prior to contact with mining activity (thus minimizing site contact water). It is AEM's opinion that while the proposed East Dike seepage discharge represents a change from the condition previously approved under the NWB licensing process, the proposed discharge does not represent a significant change in environmental scope and can be managed, monitored and regulated under the Terms and Conditions contained within the existing Meadowbank Type A Water License 2AM-MEA0815 (Part F, item 4).

The overriding premise of this application for a modification is to pump clean lake water back to Second Portage Lake before it is affected by mine contact water. AEM is proposing to install a diffuser to control erosion and disturbance of the bottom sediment. Based on discharge modelling presented in the application, the discharge water quality is not expected to cause adverse effects to aquatic environment. Nevertheless, monitoring programs will follow Type A water license requirements including non-contact water monitoring, the MMER sampling (if applicable) and the Core Receiving Environment Monitoring Program.

1 Introduction

Diking, collection of water through diversion ditches, seepage collection and dewatering of non-contact water from Second and Third Portage Lakes were approved under the current terms of the NWB License 2AM-MEA0815. Receiving environment water from Second Portage Lake is presently seeping through the East Dike and is collected by two sumps prior to pumping to the Portage attenuation pond. Once this seepage water has been pumped to the Portage Attenuation Pond it is considered “contact water”, as it is mixed with site run off and collection water from the Portage and Goose Pit. As per the site Water License, any water collected in the Attenuation Pond is treated (with all the attenuation water) through the site WTP prior to discharge to Third Portage Lake. In an effort to reduce freshwater consumption, Agnico Eagle Mines (AEM) is assessing whether the East Dike seepage water can be used for milling, progressive re-flooding or dust suppression during operations. Unfortunately, this may not be feasible throughout the year as the volume of seepage from the East Dike is not large enough to successfully be pumped over long distances (i.e. to the mill).

As a contingency, AEM is applying for a modification to the Type A water license part F, item 4 to include East dike seepage water as non-contact water effluent. AEM is proposing to pump this water through a separate sump collection system and discharge pipe, back to Second Portage Lake prior to contact with mining activity (thus avoiding site contact water). Due to the water quality of the seepage and the proposed activity (akin to dewatering non-contact water), AEM is of the opinion that this is consistent with the current conditions of the NWB License 2AM-MEA0815 but to ensure compliance within the terms of the license AEM is applying for a Modification as per Part G, Item 3. The overriding premise of this application for a modification is to pump clean lake water back to Second Portage Lake before it is affected by mine contact water. A secondary but equally important concern is to prevent inefficiencies in operations related to blasting and moving pipes prior to blasting (which may result in unsafe conditions as a result of excess water).

This document provides a description of the proposed collection and discharge of east dike seepage (non-contact) water into Second Portage Lake at the Meadowbank Mine site. The application provides an overview of the seepage discharge proposal, specific locations, timing of discharge, identifies potential impacts to the environment and monitoring that will be conducted to evaluate potential effects on the receiving environment.

1.1 Modification Conformity

The following section and Table 1 summarizes the NWB License 2AM-MEA0815 Part G, *Conditions Applying to Modifications*. Part G of the License which states - 1) The Licensee may, without written consent from the Board, carry out Modifications provided that such modifications are consistent with the terms of this License and the following requirement are met:

a. The Licensee has notified the Board in writing of such proposed Modifications at least sixty (60) days prior to beginning the Modifications to include requirements of Part G, Item 3;
b. Such Modifications do not place the Licensee in contravention of the License or the Act;
c. Such Modifications are consistent with the NIRB Project Certificate;
d. The Board has not, within sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days, and
e. The Board has not rejected the proposed Modifications.

2) Modifications for which any conditions referred to in Part G, Item 1 have not been met can be carried out only with written approval from the Board.

3) Applications for Modifications shall contain the following (see Table 1 which summarizes the conformity):

Table 1 – Part G Item 3 Conformity with NWB requirements for a modification

	Conformity
Part G: Item 3. Application for modification shall contain:	
a. A description of the facilities and/or works to be constructed	Section 1.3 East Dike Seepage pg. 7 Section 1.4 Location and Description of Seepage and Outfall pg. 7
b. The proposed location of the structure(s)	Section 1.2 Meadowbank Mine Overview pg. 7
c. Identification of any potential impacts to the receiving environment	Section 3 Monitoring the Receiving Environment pg.18
d. A description of any monitoring required, including sampling locations, parameters to be measured and frequencies of sampling	Section 3 Monitoring the Receiving Environment pg.18
e. Schedule of Construction	Section 1.5 Timing of Outfall pg. 11

4) The Licensee shall provide as-built plans and drawings of the Modifications refered to in this license within ninety (90) days of completion of the Modification. These plans and drawings shall be stamped by an Engineer.

1.2 Meadowbank Mine Overview

Since 2009, AEM has operated the Meadowbank Gold Mine, which is located 75 km north of the Hamlet of Baker Lake, Nunavut. The Meadowbank mine consists of several gold-bearing deposits that will be mined until 2018. Mining at Meadowbank is planned to occur in three open pits (Goose Pit, Portage Pit and Vault Pit), two of which are currently operational (Portage Pit and Goose Pit). Much of the pit development is located in close proximity to the mill, office and lodging infrastructure, with the exception of the Vault Pit which is approximately 10 km northeast of the main mine site. The East Dike is located to the east of the Portage Pit and was constructed to allow mining to occur in the pit that was previously part of Second Portage Lake northwest basin (Figure 1-1). As mining progresses in 2013 and 2014, Portage Pit C and D will be backfilled and the access to the east dike seepage sumps will be filled (Figure 1-2).

1.3 East Dike Seepage

The East Dike was constructed in accordance with the dike construction and engineering specifications approved by the NWB and reviewed by the Meadowbank Dike Review Board (MDRB – an independent third party) to prevent water from Second Portage Lake from flowing into pit operations. The dike has been constructed with rockfill portions of Non Potentially Acid Generating (NPAG) material and a cut-off wall that has been grouted to bedrock. Nevertheless, seepage of lake water through the dike was expected and has been occurring since 2009. As a result, AEM proposes to return this seepage, if necessary, prior to it coming into contact with mining activities, back into the Second Portage Lake from a discharge location along the East Dike.

1.4 Location and Description of Seepage and Outfall

The location of the east dike seepage and proposed discharge point is located east of the Portage pit approximately halfway along the north-south oriented East Dike (see Figure 1-1 and Figure EDS-01). This location directs discharge east towards an unnamed island approximately 110m east-north-east from the discharge location. There are two seepage collection points on the west side of the East dike. Water will be pumped from the South seepage pump installation to the North seepage pump installation through connecting, heat-traced pipes and will be discharged through a diffuser into Second Portage Lake, on the east side of the east dike, adjacent to the north seepage pump installation. A diffuser will be installed at the end of the discharge pipe to control erosion and disturbance of the bottom sediment. Water will be discharged vertically through a 90 degree elbow through the diffuser in 5m deep water at a location that will be adapted to field conditions. The diffuser will be anchored by a boulder and the 45m pipe will be anchored to the shore.

Figure 1-1 : Meadowbank General Site Layout

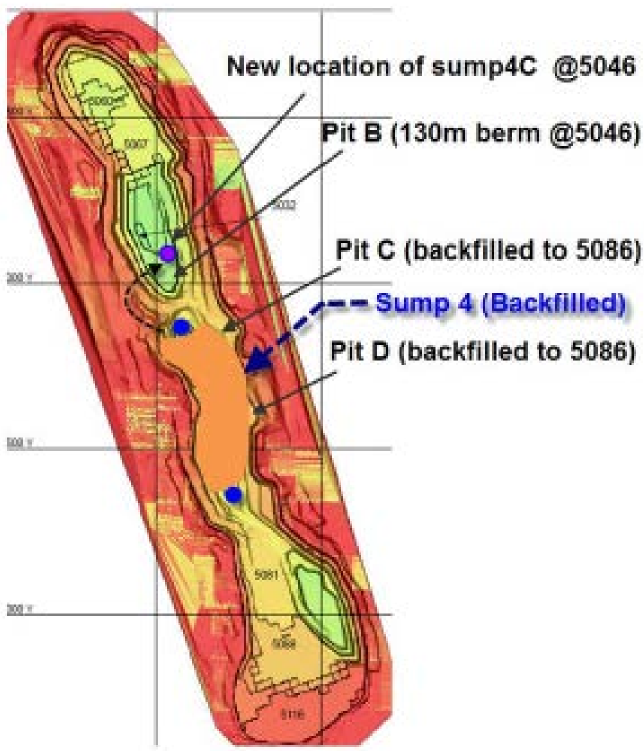

Figure 1-2: Backfilling of Portage Pit C and D in 2013 will fill Sump 4 which presently collects East dike seepage. The plan is to use Sump 4C and pump the water to the Attenuation pond. If this is not feasible, the contingency will be to collect and discharge east dike seepage into SPL.

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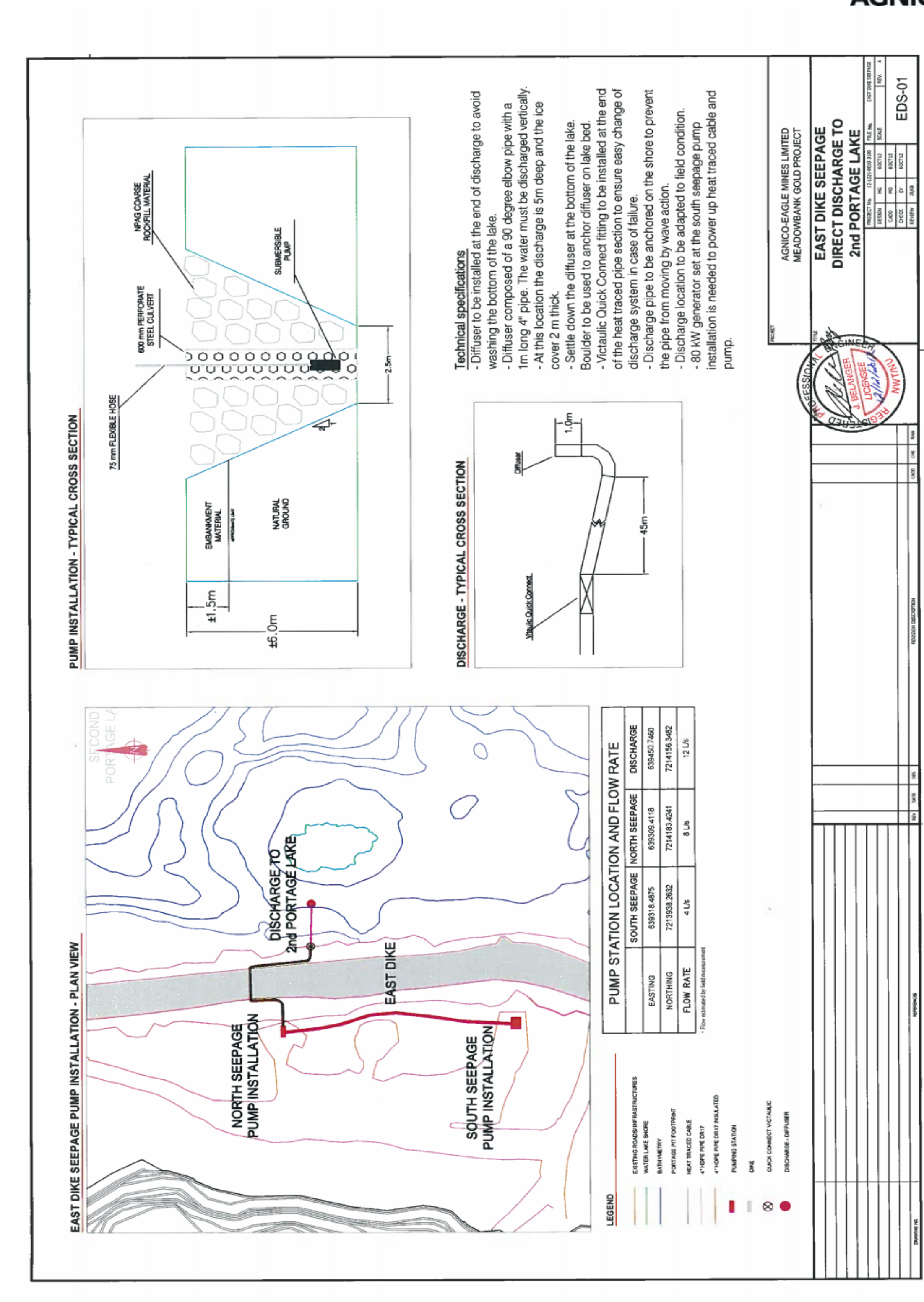

Figure EDS-01: East dike sump collection and discharge location into Second Portage Lake

1.5 Timing of Outfall

Currently, all seepage collected along the east dike is pumped into the pit (sump) and ultimately into Portage Attenuation Pond (future South Cell Tailings Area – 2015) (See figure 1-1). Construction of piping and on-ice diffuser installation will begin immediately upon acceptance by the NWB. Following the implementation of the water management plan, discharge could begin once the diffuser has been properly installed. As a contingency, discharge through the diffuser will occur year-round (during open water season and during ice cover conditions) to ensure seepage water collection volumes are managed and permit safe operations in Portage Pit. It is AEM's intent to try to manage this water on site, either to pump to the Attenuation Pond for re –use to reduce overall freshwater consumption (engineering assessment currently underway) and/or in re-flooding of the Goose pit starting in 2015 and Portage pit in 2017. However with changing mine operations in the Portage Pit the main sump for pumping to the Attenuation Pond will be moved to North Portage making it difficult to pump the East Dike seepage to the sump location. Furthermore, waste rock will be deposited starting in 2013 in mined out areas of the Portage Pit (location of sump used to pump to attenuation pond at the present time).

2 Water Quality Characteristics of Second Portage Lake

2.1 Description of Second Portage Lake

The physical characteristics of Second Portage Lake are described in Table 2.1, taken from Golder (2011). As presented in (Appendix A) some of these parameters were used for CORMIX to evaluate diffusion and establish *maximum allowable concentrations* summarized in this document.

Table 2.1- Second Portage Lake physical description.

	Description	
Surface Area	3.9 km	
Lake Volume	39.7 x 10^6 m3	
Average Depth	5m	during open water
	3m	with ice cover
Flow direction	East towards Tehek lake	
	Confluence of Third Portage Lake and Drill Trail Lake	
Water Temperature	9 ° C	during open water
	2 ° C	with ice cover
Current direction relative to discharge	Co-flowing and cross-flowing at seepage discharge	

2.2 Seepage Water Characteristics

Second Portage Lake, receiving environment water quality results from the 2011 CREMP (Azimuth, 2012) are presented in Table 2.2 and were compared to CCME Protection of Aquatic Life Guidelines (CCME 2007). Based on the 2011 results taken from twelve (12) sample events, Total Phosphorus, Cadmium and Copper exceeded CCME water quality guidelines. Minimum, mean, median, number of samples and number of below detection samples are presented; half the detection limit was used for statistical purposes. Periodic exceedances of CCME values have been reported during CREMP sampling since 2008 (AEM, 2013) in the receiving environment and in reference areas as reported in baseline sampling (BAER, 2006).

Water quality of East Dike seepage water collected at the sumps was monitored throughout 2012. These data are presented in Table 2.3 and were compared to the CCME Guidelines. Nitrate, Aluminum, Arsenic, Copper, Fluoride, Iron, Molybdenum, Lead and Zinc periodically exceeded CCME water quality guidelines based on the 2012 results. The East Dike was constructed from NPAG rock generated at the Airstrip Quarry and not from active mining areas on site and these trace levels are indicative of native rock formations. The water quality analysis indicates that seepage through NPAG rockfill material and storage in the sump are consistent with Second Portage Lake baseline data, as periodic exceedances of CCME values have been reported. Overall, the concentrations are very low, several magnitudes less than the current discharge criteria as stated in the Water License, and are not expected to impact aquatic biota in the receiving environment.

Table 2.2- Second Portage Lake Receiving Environment Water Quality Characteristics from CREMP monitoring data 2006-2010.

Parameter	Name	Unites	Drinking Water Guidelines (RRNWT 1990)	Aquatic Life Guidelines (CCME 2007)	MMER Guidelines (MMER 2002)	Water Quality at Second Portage Lake (East Dike)				
						Minimum	Median	Maximum	Number of Water Samples	Number of Non-Detectable Concentration
TDS	Total Dissolved Solids	mg/L	500	-	-	<10	16	24	59	8
Ag	Silver	mg/L	0.05	0.0001	-	<0.00002	<0.00002	0.27	61	58
Al	Aluminum	mg/L	-	0.1 (b)	-	<0.005	0.03	1.2	62	4
As	Arsenic	mg/L	0.05	0.005	0.5	<0.0001	<0.0005	0.0005	62	60
Ba	Barium	mg/L	1	-	-	<0.01	<0.02	<0.02	62	61
Cd	Cadmium	mg/L	0.01	0.000017 (c)	-	<0.000017	<0.000017	0.006	62	58
Cl	Chloride	mg/L	250	-	-	<0.5	0.57	0.83	62	20
Cr	Chromium	mg/L	0.05	0.001	-	<0.0005	<0.001	0.004	62	60
Cu	Copper	mg/L	1	0.002 (d)	0.3	<0.001	<0.001	0.003	62	57
F	Fluoride	mg/L	1007	-	-	0.05	0.07	0.10	57	0
Fe	Iron	mg/L	0.3	0.3	-	<0.01	0.04	1.3	62	21
Hg	Mercury	mg/L	-	0.000026	-	<0.00001	<0.00002	<0.0005	62	62
Mn	Manganese	mg/L	0.05	-	-	<0.005	0.002	0.02	62	2
Mo	Molybdenum	mg/L	-	0.073	-	<0.00005	<0.001	<0.001	62	62
NH4-N	Ammonia	mg/L	-	0.68 (e)	-	<0.005	<0.02	0.09	62	50
Ni	Nickel	mg/L	-	0.25 (d)	0.5	<0.001	<0.001	0.003	62	59
NO3-N	Nitrate	mg/L	45	2.9 (c), (f)	-	<0.001	0.007	0.08	62	24
Pb	Lead	mg/L	0.05	0.001 (d)	0.2	<0.00005	<0.0005	0.003	62	58
Se	Selenium	mg/L	0.01	0.01	-	<0.0005	<0.001	<0.001	62	62
S04	Sulfate	mg/L	250	-	-	<1	2.2	4.0	62	2
Tl	Thallium	mg/L	-	0.0008	-	<0.00005	<0.0002	<0.1	62	62
Zn	Zinc	mg/L	5	0.03	0.5	<0.001	<0.005	0.005	62	61

(b) Guidline based on ambiant water pH

(c) Interim Guideline

(d) Guideline based on ambient water hardness

(e) Guideline based on ambient water pH and Temperature

(f) Guideline applied to the nitrogen fraction of nitrate (i.e. measured from water samples).

Table 2.3 – Seepage Water Quality Characteristics from 2012 sampling

Parameter	Name	Unites	Drinking Water Guidelines (RRNWT 1990)	Aquatic Life Guidelines (CCME 2007)	MMER Guidelines (MMER 2002)	2012 East Dyke Seapage Quality				
						Minimum	Median	Maximum	Number of Water Samples	Number of Non-Detectable Concentration
TDS	Total Dissolved Solids	mg/L	500	-	-	36	37	38	3	1
Ag	Silver	mg/L	0.05	0.0001	-	<0.0002	0.0001	0.0343	25	22
Al	Aluminum	mg/L	-	0.1 (b)	-	<0.006	0.0785	0.773	25	4
As	Arsenic	mg/L	0.05	0.005	0.5	<0.0005	0.00025	0.0094	25	15
Ba	Barium	mg/L	1	-	-	<0.02	0.00715	0.0312	25	2
Cd	Cadmium	mg/L	0.01	0.000017 (c)	-	<0.00002	0.00001	0.0003	25	21
Cl	Chloride	mg/L	250	-	-	<0.0006	1.2	5	25	4
Cr	Chromium	mg/L	0.05	0.001	-	<0.0006	0.00135	0.0144	25	12
Cu	Copper	mg/L	1	0.002 (d)	0.3	<0.0005	0.00105	0.013	25	9
F	Fluoride	mg/L	1007	-	-	<0.02	0.08	0.33	25	2
Fe	Iron	mg/L	0.3	0.3	-	<0.01	0.07	0.57	25	5
Hg	Mercury	mg/L	-	0.000026	-	<0.00001	0.000005	0.00001	25	24
Mn	Manganese	mg/L	0.05	-	-	<0.0005	0.00525	0.0358	25	4
Mo	Molybdenum	mg/L	-	0.073	-	<0.0005	0.00025	0.0839	25	19
NH4-N	Ammonia	mg/L	-	0.68 (e)	-	<0.01	0.04	1	16	2
Ni	Nickel	mg/L	-	0.25 (d)	0.5	<0.0005	0.0012	0.0053	25	7
NO3-N	Nitrate	mg/L	45	2.9 (c), (f)	-	0.05	0.145	5.4	25	1
Pb	Lead	mg/L	0.05	0.001 (d)	0.2	<0.0003	0.00015	0.0491	25	17
Se	Selenium	mg/L	0.01	0.01	-	<0.001	0.0005	0.005	25	25
S04	Sulfate	mg/L	250	-	-	<1	5	102	25	2
Tl	Thallium	mg/L	-	0.0008	-	<0.001	0.0025	0.02	25	24
Zn	Zinc	mg/L	5	0.03	0.5	<0.001	0.002	0.032	25	12

(b) Guidline based on ambiant water pH
(c) Interim Guideline
(d) Guideline based on ambient water hardness
(e) Guideline based on ambient water pH and Temperature
(f) Guideline applied to the nitrogen fraction of nitrate (i.e. measured from water samples).

2.3 Second Portage Lake Outfall Characteristics

As previously described, the outfall is a single pipe discharging horizontally below the lake surface at approximately 5m depth. For modelling purposes the water release to Second Portage Lake was estimated (current seepage pumping) at 1000 m^3/day (Appendix A) with a proposed pumping rate at the discharge pipe of 12 L/s (Figure EDS-01).

2.3.1 Mixing Potential

As reported in Appendix A, since lake conditions are not known with certainty and lake characteristics change seasonally, several model cases were simulated to account for changes and differences that may occur in Second Portage Lake. A total of 96 different model cases were run for seepage discharges for East Dike. Appendix A provided predicted mixing factors at 30 m from all scenarios and the mixing model provided the following observations for Second Portage Lake seepage outfall:

- High discharge velocity promotes mixing of seepage water in Second Portage Lake water column, resulting in higher mixing factors as discharge velocity is higher.
- Stratification in the lake is relatively weak (i.e. approximately 1 °C). This stratification was predicted to have little impact on mixing. Mixing factors, for modelled stratified and non-stratified scenarios, were similar in almost all scenarios.
- Co-flowing scenarios were predicted to have smaller mixing factors than those of the cross-flowing scenarios.
- Mixing factors for cross-flowing scenarios are smaller with increasing ambient velocity. A higher ambient velocity would impose a greater deflection of the discharge plume that limit mixing.
- The lowest mixing factors occur at both lakes for scenarios of a stratified water column and ambient velocity generated by a 10- year peak hourly wind (0.6 m/s). These scenarios are however considered unlikely to occur, since a high ambient velocity from a high wind is likely to create mixing conditions in lakes that would negate or prevent stratification. The mixing factors for these scenarios were therefore not considered further.
- For the estimation of seepage water maximum allowable concentrations, the most stringent (i.e. lowest) mixing factors of the valid scenarios were considered for discharge velocity in Second Portage Lake.

2.3.2 Water Quality Predictions at Diffuser

The results reported in Golder (2011) of the East dike seepage modelled water quality at the edge of the 30m mixing zone. The results determined:

- Maximum allowable concentration should not be higher than the thresholds set in the Metal Mine Effluent Regulations (MMER 2002). Specifically, nickel and zinc maximum allowable concentration must not be higher than 0.5 mg/L.
- Maximum allowable concentrations are the highest for discharge velocity of 9 m/s, these high values remain only incremental compared to concentrations for a discharge velocity of 6 m/s. It is therefore recommended that discharge velocity not exceed 6m/s to further minimize the potential for lake- bottom erosion.

Table 2.4 Seepage Water Maximum Concentrations

Parameter	Name	Unites	Drinking Water Guidelines (RRNWT 1990)	Aquatic Life Guidelines (CCME 2007)	MMER Guidelines (MMER 2002)	Seepage Water		
						3 m/s	6 m/s	9 m/s
TDS	**Total Dissolved Solids**	*mg/L*	500	-	-	7700	11000	13000
Ag	**Silver**	*mg/L*	0.05	0.0001	-	0.001	0.002	0.002
Al	**Aluminum**	*mg/L*	-	0.1 (b)	-	1.1	1.6	1.8
As	**Arsenic**	*mg/L*	0.05	0.005	0.5	0.08	0.11	0.13
Ba	**Barium**	*mg/L*	1	-	-	16	24	27
Cd	**Cadmium**	*mg/L*	0.01	0.000017 (c)	-	0.0001	0.0002	0.0002
Cl	**Chloride**	*mg/L*	250	-	-	3900	6000	6700
Cr	**Chromium**	*mg/L*	0.05	0.001	-	0.008	0.013	0.014
Cu	**Copper**	*mg/L*	1	0.002 (d)	0.3	0.02	0.04	0.04
F	**Fluoride**	*mg/L*	1007	-	-	26	39	44
Fe	**Iron**	*mg/L*	0.3	0.3	-	4.1	6.3	7.1
Hg	**Mercury**	*mg/L*	-	0.000026	-	0.0004	0.0006	0.0007
Mn	**Manganese**	*mg/L*	0.05	-	-	0.77	1.2	1.3
Mo	**Molybdenum**	*mg/L*	-	0.073	-	1.2	1.8	2
NH4-N	**Ammonia**	*mg/L*	-	0.68 (e)	-	11	16	18
Ni	**Nickel**	*mg/L*	-	0.25 (d)	0.5	0.39	0.59	0.66
NO3-N	**Nitrate**	*mg/L*	45	2.9 (c), (f)	-	46	69	78
Pb	**Lead**	*mg/L*	0.05	0.001 (d)	0.2	0.01	0.02	0.02
Se	**Selenium**	*mg/L*	0.01	0.01	-	0.02	0.02	0.03
S04	**Sulfate**	*mg/L*	250	-	-	3900	6000	6700
Tl	**Thallium**	*mg/L*	-	0.0008	-	0.01	0.02	0.02
Zn	**Zinc**	*mg/L*	5	0.03	0.5	0.44	0.66	0.75

(b) Guidline based on ambiant water pH
(c) Interim Guideline
(d) Guideline based on ambient water hardness
(e) Guideline based on ambient water pH and Temperature
(f) Guideline applied to the nitrogen fraction of nitrate (i.e. measured from water samples).
(g) At the Discharge outfalls

2.3.3 Conclusions and Recommendations from the Seepage Water Quality Outfall Modelling

Under the possible ranges of Second Portage Lake ambient and seepage characteristics, the modelling of the outfall of the east dike seepage water into Second Portage Lake determined that drinking water guidelines and guidelines for the protection of aquatic life were met at the edge of the 30m mixing zone around the diffuser outfall. AEM has designed the diffuser, pumping rate, erosion protection and monitoring based on the following conclusions and recommendations (Appendix A) that state:

- Modelling predictions are valid for the rate of 1000 m3/day into Second Portage Lake, or lower when discharge velocities are between 3 and 9 m/s are maintained. The proposed discharge rates of 12L/s (figure EDS-01) meet these parameters and AEM recognizes that higher discharge rates would require a re-assessment.
- Consistent with reference conditions and baseline water quality, maximum water quality of non-contact water periodically exceed CCME (2007) guidelines. Estimated concentrations for TDS and chloride in Golder (2011) at the discharge indicated an upper limit of 1500 and 250 mg/L, respectively, however, to date all data has not exceeded MMER (2002) thresholds.
- The direction of the diffuser in Second Portage Lake will not be directed toward an island or bay and will be directed to the south-east to allow conveyance of outfall water toward the main body of the lake.
- The diffuser should be directed to minimize erosion of the lake bottom of the dike walls and the protrusion of the pipe and final location of the diffuser into the lake will be adjusted depending on field conditions.

3 Monitoring the Receiving Environment

Local fish and fish habitat in the receiving environment will be monitored to evaluate the potential impact of seepage discharge as proposed in this design. Although most of the impacts will be mitigated by use of a diffuser and discharge will be directed to minimize effects to the aquatic environment in Second Portage Lake, physical habitat (water quality and sediment quality), food supply (benthic invertebrates), and fish health could be altered. To prevent impacts to the receiving environment, sediment and erosion control measures will be implemented. Furthermore, monitoring programs will be conducted to evaluate both the physical and biological impacts - Type A Water License for non-contact discharge, if applicable MMER monitoring, and Core Receiving Environmental Monitoring Program (CREMP) monitoring. The mitigation and monitoring programs are discussed in the following text.

3.1 Sediment and Erosion Control Measures

The pipe and diffuser will be installed on-ice, anchored with large boulders and allowed to sink once the ice has melted in the spring[1]. This will prevent any in-water construction activity and significantly reduce any sediment disturbance during the installation of the diffuser in accordance with Department of Fisheries and Oceans guidance.

The diffuser will be installed and directed to minimize erosion of the lake bottom or dike face (i.e. horizontal with the water surface and away from the dikes). The protrusion of the pipe into the lakes will be adjusted depending on field conditions. The direction of the discharge will ensure conveyance of the discharge water toward the main body of Second Portage Lake and away from the adjacent island or nearby bay to avoid erosion. Flow rates and pump volumes will be monitored to ensure the protection of the receiving environment and minimize erosion.

3.2 NWB Type A Water License Monitoring

The NWB Type A License 2AM-MEA0815 Part F – conditions applying to waste disposal and management, Item 4 states – *prior to discharge, state that all water collected within the non-contact water diversions during operations at stations ST-5 (within second portage lake) shall not exceed the following Effluent quality limits*:

Table 3.2: Effluent water quality limits for non-contact water diversions during operations at ST-5 (adapted from the Type A License).

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

As per the Type A water license, AEM will collect monthly water samples of the non-contact water at the discharge as per the Type A License ST-5 conditions and analyse for TSS, Group 5 and aluminum monthly during discharge.

3.3 MMER Monitoring

The Metal Mine Effluent Regulation (MMER) were promulgated under the Fisheries Act in 2002 and have undergone several amendments, most notably in 2006 with the Regulations

[1] This method of installation was successfully completed for the Third Portage Lake diffuser during the spring of 2012.

Amending the Metal Mining Effluent Regulations (MMER). Before starting to discharge to the lake, AEM will verify with Environment Canada if MMER will be applied to this discharge. If the MMER is applicable to this discharge, AEM will conduct:

1. Routine effluent monitoring at a location that meets MMER requirements in Second Portage Lake. Monitoring will include:
   - Chemical analyses of effluent
   - Acute lethal toxicity testing of effluent
   - Effluent volume and flow rate measurements
   - Calculation of mass loadings of deleterious substances to receiving waters.

2. Emergency response plans have been developed, which includes:
   - Site risk analysis
   - Organization scheme for emergency responses
   - Altering and notification procedures
   - Inventory of spill-response equipment, including the location of that equipment
   - Training plan for mine personnel.

3. Environmental effects monitoring (EEM) will be conducted at stations to meet EEM guidelines. The EEM Program is a cyclical receiving-environment monitoring program (cycles range from 2 to 6 years) to evaluate the effects of metal mining effluents on fish health and fish habitat. AEM will complete EEM at stations in Second Portage Lake and appropriate reference stations (i.e. Innug or Pipedream lake). The EEM will include:

   - Part 1 – Effluent and water quality monitoring studies
   - Part 2 – Biological monitoring studies, including a site characterization, a fish survey, and a benthic invertebrate community survey.

It should be noted that AEM will add this location to our current MMER and EEM study program and incorporate Environment Canada recommendations.

3.4 Core Receiving Environmental Monitoring

The Core Receiving Environmental Monitoring Program (CREMP) is the core, broad scale program that is aimed at detecting potential impacts due to mining at the scale of lakes or basins. It is commonly referred to as an Aquatic Effects Management Program (AEMP) at other mines in the NWT and NT. It is intended to monitor large-scale basin-wide changes in physical and biological variables to evaluate potential impacts from all mine related stressors to the receiving environment. It therefore serves as the most important monitoring program for evaluating short-term and long-term potential impacts, for which other programs provide additional support and verification.

The CREMP requirements are derived from conditions specified in the Nunavut Water Board Type A Licence # 2AM-MEA0815 and Nunavut Impact Review Board Project Certificate – NIRB-004 for the Meadowbank Gold Mine, which is based on the following:

- Nuvavut Water Board (NWB; i.e., board decision after public hearings).
- Baselines AEMP approach (AEMP, 2005) (i.e., the approach for monitoring presented during the Nunavut Impact Review Board [NIRB] environmental impact assessment process).
- Core Receiving Environment Monitoring Program (CREMP- AEM, 2012), 2010 Plan Updated to reflect changes in AEMP structure and CREMP
- Aquatic Effects Monitoring Program Meadowbank Mine (Azimuth, 2012)
- Core Receiving Environmental Monitoring Program (CREMP): Design Document 2012 – Meadowbank Mine (Azimuth, 2012)

As discussed in Azimuth (2012), the CREMP study design was tailored based on our understanding of mine construction, operation and infrastructure (e.g., dikes, effluents, stream crossings, roads, etc.) and was developed to detect mine-related impacts at temporal and spatial scales that are ecologically relevant. The program targets general limnology, water and sediment quality, primary productivity (phytoplankton), and benthic community structure. The core program initially focused solely on the project lakes (i.e., those in close proximity to the mine site), but was expanded to Baker Lake in 2008 to ensure that monitoring was also in place to track project-related activities in that area related primarily to barge traffic and shipping. To date, monitoring has been conducted throughout the year where ice conditions permitted.

In addition to MMER sampling (if applicable), CREMP monitoring and data collection will evaluate the basin wide water quality effects that may be caused by seepage discharge. The CREMP consists of the following general elements:

- Sampling Components – limnology, water and sediment chemistry, phytoplankton, and benthic invertebrate community.
- Sampling Areas – Near-field stations include: Third Portage North, Third Portage East, Second Portage Lake, Wally Lake and Baker Lake stations (BBD and BPJ); far-field

stations include: Tehek Lake, Tehek FarField; reference stations include: Third Portage South, Innug lake, Pipedream Lake and Baker Lake station (BAP).

- Timing – water sampling (including limnology and phytoplankton) will be conducted up to 6 months of the year. The exception to this will be during periods when ice conditions are not deemed safe (i.e., likely June and October, but may vary).
- Sampling through-ice will take place in May and December at all stations and at least once in the winter at locations closest to the mine site. Open-water sampling will take place in July, August and September. Sediment chemistry and benthic invertebrate sampling will be conducted in August only.
- Spatial coverage – water sampling within each lake basin is randomly distributed and possibly replicated to quantify the horizontal and vertical components of spatial variability (high intensity events only). The intensity (number of samples) of the events alternate between high (all areas, full reps) and low (all areas, no reps) both during open-water and through-ice sampling.

More specifically, the CREMP will monitor receiving environment at randomly selected stations throughout Second Portage Lake (See Figure 3.1, taken from 2011 CREMP report, Azimuth, 2012) and include the following components:

- Water chemistry data will be collected up to 6 months per year (April, May, July, August, September and November/December -depending on logistical constraints - e.g., snow and ice conditions). Two randomly located subsamples will be collected at each station in each month. All samples are surface samples (3 m from the surface). In addition to the core water chemistry program, basic water quality data will be collected at key near-field areas (including Second Portage Lake) at least once mid-winter to reduce uncertainty regarding the potential occurrence of changes over winter.
- Sediment chemistry core sampling for the CREMP is intended to detect long term trends, therefore a sampling frequency of approximately every three years is recommended or will be aligned with the sampling times for benthic invertebrates required for the EEM program.
- Sediment chemistry grab sampling that matches benthic invertebrate sampling (i.e., once per year) are collected to ensure basic physical variables (e.g., particle size) not covered by sediment core sampling (due to volume limitations) but which may nevertheless affect benthic invertebrates.
- Phytoplankton is collected at the same time as the water chemistry data are collected, but only the open water samples (July to September). Two randomly located

subsamples will be collected at each station for each sampling event. All samples should be surface samples (3m from the surface).

- Benthic invertebrates are collected once per year in August at all stations, with 5 subsamples per station.

The CREMP monitoring program is an iterative process and the study design is revisited periodically based on accumulated data to ensure the ability of the CREMP to detect impacts to the receiving environment. Between erosion control measures, routine MMER monitoring and CREMP monitoring, the potential impacts to the receiving environment due to seepage discharge will be evaluated.

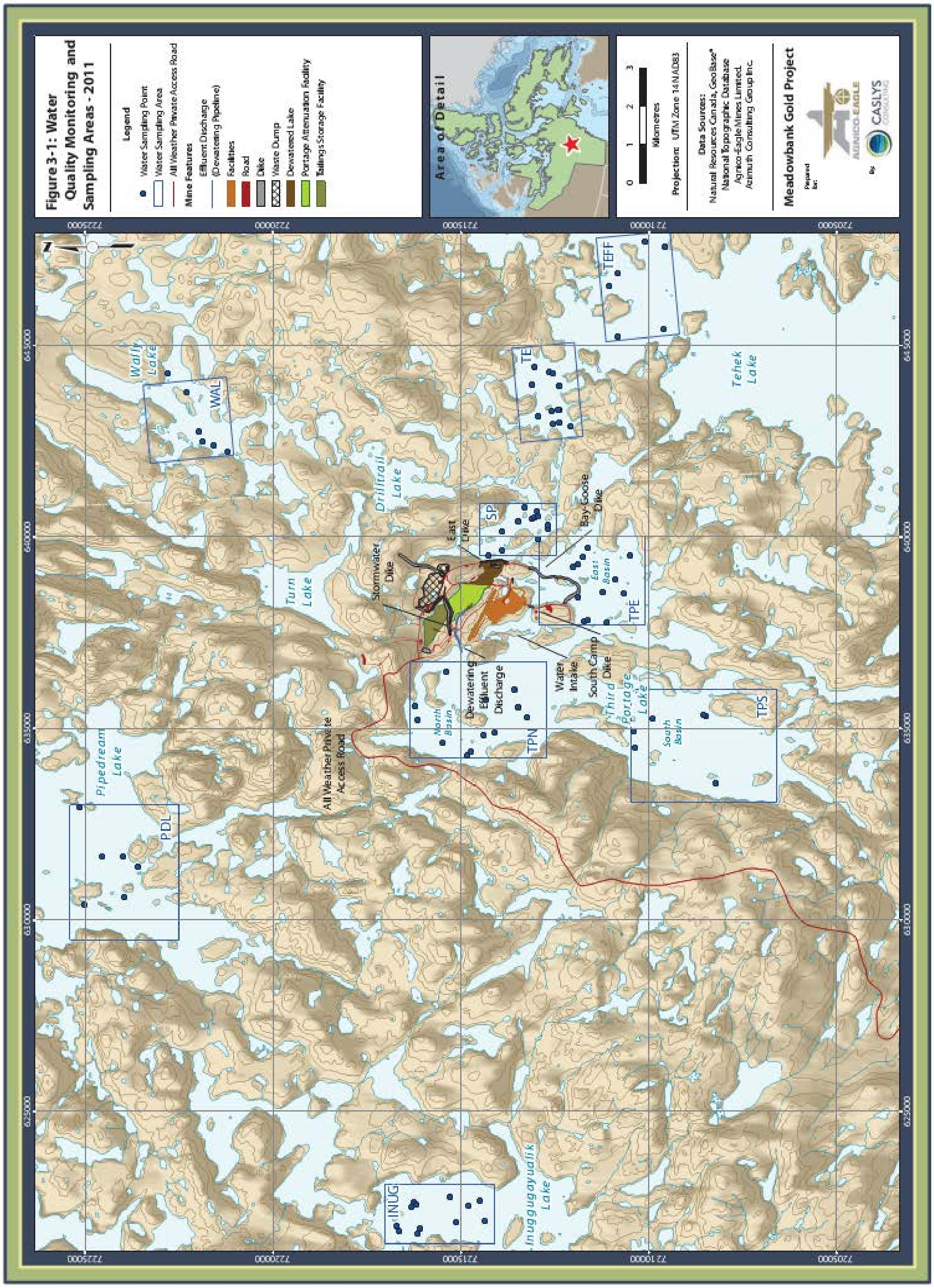

Figure 3.1: CREMP water quality sampling locations

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APPENDIX A