Appendix 50

Meadowbank Closure Water Treatment Strategy

Title of document: **MEADOWBANK CLOSURE WATER TREATMENT STRATEGY**

Client: **AGNICO EAGLE MINES**

Project: **MEADOWBANK GOLD PROJECT**

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1.0 INTRODUCTION

1.1 Context

In-pit tailings deposition activities at Agnico Eagle Mines (AEM) Meadowbank mine site are planned to cease on June 2026, based on AEM 2020 Water Management Plan (WMP). The current closure plan is to treat the volume of reclaim water stored in the pit at the end of tailings deposition and discharge the treated water to Third Portage Lake (TPL). Once this activity is completed, an aggregate cover shall be placed on the tailings stored in the pits if feasible, followed by pit flooding with natural runoff and transfer of water from TPL until the water elevation in Goose and Portage Pits are at the same elevation as TPL.

1.2 Mandate

SNC-Lavalin was mandated to develop a high-level closure water treatment strategy for the Meadowbank site. The closure strategy involved the study of possible treatment options based on the water quality forecasted in Goose and Portages Pits at the end of in-pit deposition based on AEM's 2020 WMP. The objective of the present study includes:

- Identify conceptual treatment options to meet possible closure discharge criteria;
- Identify activities required for the development and implementation of the closure water treatment system; and
- Establish a preliminary schedule to develop and implement the closure water treatment system.

This information will allow AEM to understand the different requirements to develop in more detail the closure water treatment system and implement a more detailed closure water treatment strategy in the near future.

1.3 Content of the Study

The present study focuses on the treatment of the reclaim water based on the forecasted water quality that might be obtained at the end of the in-pit deposition activities. The forecasted reclaim water quality is then compared with current and future federal and site-specific water discharge criteria. Water treatment process flowsheet and options are proposed and discussed. A preliminary schedule to develop the closure water treatment system is also proposed.

2.0 PRELIMINARY WATER TREATMENT SYSTEM DESIGN FOR CLOSURE

2.1 In-Pit Water Quality and Parameters of Concern

The forecasted water quality at the end of in-pit deposition was obtained from the Water Quality Forecast (WQF) Model that was updated based on the 2020 WMP.

The forecasted reclaim water quality was compared with the Metal and Diamond Mining Effluent Regulations (MDMER) discharge criteria (current and revised version that will come into effect on June 1st, 2021) in Table 2-1. The discharge criteria in the current Water License (2AM-MEA1530, part F, item 3) were also compared since these values reflects discharge requirements to Third Portage Lake, although the discharge volume required per year may be different at closure. For comparison purposes only, CCME (Canadian Council of Ministers of the Environment) Water Quality Guidelines for the Protection of Aquatic Life is also presented in Table 2-1.

All the parameters that exceed the criteria from MDMER regulations and the current Water License are highlighted in red, while parameters that are below these values but still higher than the CCME guidelines are highlighted in orange.

Based on this analysis, the main parameters of concern are the following:

- Total dissolved solids (TDS);
- Total aluminum (Al);
- Total arsenic (As);
- Total copper (Cu);
- Total nickel (Ni);
- Ammonia: both total and non-ionized ammonia.

Other parameters that should closely be monitored include:

- Metals: silver (Ag), cadmium (Cd), chromium (Cr), iron (Fe), manganese (Mn), mercury (Hg), molybdenum (Mo), selenium (Se), zinc (Zn)
- Inorganic ions: chloride, fluoride, nitrate
- Although there is no specific criterion for sulfate, it is possible that this parameter may be a concern. Sulfate concentration in TPL is very low (5.37 mg SO_4/L on average measured in 2020) and the British Columbia Environment guidelines has established a threshold value for sulfate for the protection of aquatic life for very soft water (0-30 mg/L $CaCO_3$) at 128 mg/L.

Table 2-1: Forecasted Water Quality Compared with Discharge Criteria and Water Quality Guidelines

PARAMETERS	UNITS	Forecasted Value based on 2020 WMP		CURRENT MDMER SCHEDULE 4 (average)	MDMER SCHEDULE 4 (1st June 2021) (average)	Water License		CCME
		PORTAGE PIT	GOOSE PIT			Average	Maximum	
pH	-			*6 to 9.5*	*6 to 9.5*	*6.0 to 9.0*	*6.0 to 9.0*	*6.5 to 9*
Turbidity	NTU					*15*	*15*	
Alkalinity	mg $CaCO_3$/L	150	79					
Hardness	mg $CaCO_3$/L	1568	506					
Total dissolved solids	mg/L	2286	832			*1400*	*1400*	
Total Aluminum (Al)	mg/L	1.73	0.66			*1.5*	*1.5*	*0.1*
Dissolved Aluminum (Al)	mg/L	0.057	0.021			*1.0*	*1.0*	
Total Silver (Ag)	mg/L	0.0024	0.00091					*0.00025*
Total Arsenic (As)	mg/L	1.49	0.51	*0.5*	*0.3*	*0.3*	*0.6*	*0.005*
Total Barium (Ba)	mg/L	0.096	0.050					
Total Cadmium (Cd)	mg/L	0.0012	0.00050			*0.002*	*0.004*	*0.00004*

PARAMETERS	UNITS	Forecasted Value based on 2020 WMP		CURRENT MDMER SCHEDULE 4 (average)	MDMER SCHEDULE 4 (1st June 2021) (average)	Water License		CCME
		PORTAGE PIT	GOOSE PIT			Average	Maximum	
Total Chromium (Cr)	mg/L	0.004	0.007					*0.001*
Total Copper (Cu)	mg/L	4.2	1.6	*0.3*	*0.3*	*0.1*	*0.2*	*0.002*
Total Iron (Fe)	mg/L	5.6	3.2					*0.3*
Total Manganese (Mn)	mg/L	1.11	0.42					*0.23*
Total Mercury (Hg)	mg/L	0.00034	0.00018			*0.0004*	*0.0008*	*0.000026*
Total Molybdenum (Mo)	mg/L	0.20	0.087					*0.073*
Total Nickel (Ni)	mg/L	0.42	0.16	*0.5*	*0.5*	*0.2*	*0.4*	*0.025*
Total Lead (Pb)	mg/L	0.014	0.005	*0.2*	*0.1*	*0.1*	*0.2*	*0.001*
Total Selenium (Se)	mg/L	0.10	0.04					*0.001*
Total Strontium (Sr)	mg/L	1.02	0.47					
Total Thallium (Tl)	mg/L	0.00012	0.00010					*0.0008*
Total Uranium (U)	mg/L	0.0095	0.0042					*0.015*
Total Zinc (Zn)	mg/L	0.04	0.02	*0.5*	*0.5*	*0.4*	*0.8*	*0.01*
Chloride	mg/L	750	206			*1000*	*2000*	*120*
Fluoride (F)	mg/L	0.38	0.39					*0.12*
Sulphate (SO4)	mg SO4/L	1762	694					
Total Cyanide (CNt)	mg/L	2.1	0.00004	*1*	*0.5*	*0.5*	*1.0*	*0.005*
Total Ammonia (NH3 + NH4)	mg N/L	37	15			*16*	*32*	*1.83*
Un-Ionized Ammonia (calculated at 10 deg C and pH 7.5)	mg N/L				*0.5*			*0.02*
Nitrate (NO3)	mg N/L	8.3	3.1			*20*	*40*	*2.94*
Nitrite (NO2)								*0.06*
Total N equivalent	*mg N/L*	45	18					
Total phosphorus	*mg P/L*					*1.0*	*2.0*	*0.004*
Total Suspended Solids	mg/L			*15*	*15*	*15*	*30*	
Total Petroleum Hydrocarbons (TPH)	mg/L					*3*	*6*	

Legend

Value higher than MDMER and Water License

Value less than MDMER and Water License but higher than CCME values

2.2 In-Pit Closure Water Management Strategy

The in-pit tailings deposition will cease in 2026 after the exploitation of Whale Tail deposit. Both the North Cell and the South Cell of the Tailings Storage Facility (TSF) will be safely covered and closed from 2027 to 2031. Portage Pits and Goose Pit will be flooded once in-pit tailings deposition is completed and the reclaim water is treated and the aggregate cover is in place, if feasible. Flooding will occur by allowing the natural accumulation of seepage and groundwater into the pits and surface water drainage reporting to the pit to remain in place. In addition, transfer of water at controlled rates from the surrounding lakes using high-capacity mechanical pump systems or siphons will contribute to the majority of the flooding.

Once pit flooding completed, the Bay Goose Dike, South Camp Dike and Vault Dike will be opened provided that the water quality in the pits meets the Meadowbank closure Water License requirements, i.e. the Canadian Council of Ministers of the Environment (CCME) criteria and/or site-specific criteria for parameters not included in the CCME Guidelines. This opening or partial excavation of the dikes, named ‘‘dike reconnection’’, to reconnect the pit lakes with the adjacent lakes, will be designed to ensure long term stability of the structures and protection of the aquatic environment. Dike reconnection shall not occur until the water quality in the re-flooded area meets CCME Water Quality Guidelines for the Protection of Aquatic Life, baseline concentrations, or appropriate site-specific water quality objectives. Subject to the Board approval, if water quality parameters are above CCME Guidelines, a site-specific risk assessment must be conducted to identify water quality objectives that are protective of the aquatic environment

As the aforementioned parameters may be of concern prior to dike opening, treatment options for their removal following the end of in-pit deposition will need to be examined and will be assessed in greater details during the preparation of the Final Closure and Reclamation Plan.

Following in-pit deposition, the tailings could be covered with NPAG rock cover using the proposed approach developed at a high level by Arcadis Canada for CIRNAC (Arcadis, 2019), if feasible. The rock cover will be placed on the tailings once the pit is drained and the surface of the tailings are exposed and allowed to freeze. For Goose Pit, reclaim water will be transferred to Portage Pit. For Portage Pit, once tailings deposition is completed, the reclaim water will be treated and discharged to Third Portage Lake. Note that the proposed concept to place a granular rock cover over the tailings in the pits pose certain technical challenges. Agnico Eagle will be reviewing the proposed concept as part of the Final Closure Plan and will evaluate its requirements based on the geochemical stability of the tailings and whether it can support fish habitat in the long term. Agnico Eagle will also review the technical feasibility of this concept based on expected field conditions at closure and geotechnical stability of the tailings.

If this concept, as suggested by CIRNAC, is determined not feasible, the Interim Closure Plan and associated security will be adjusted accordingly.

The closure plan currently incorporates a water treatment plant as a contingency measure should water in the pit lakes not be suitable for release to the environment. The water management for the site will remain a close system (no discharge to the receiving environment) until the pit lakes water, the TSF runoff water and seepage water have demonstrated acceptable water quality for release to the receiving environment without further management.

The closure phase will also include a number of years following filling where water quality will be monitored prior to opening the dikes. Water quality forecast will be performed during the flooding period. Surface water quality monitoring (parameters to be sampled and frequency) and sampling locations will comply with the Meadowbank Water License monitoring requirements.

2.3 Water Treatment Objectives

The water treatment objectives shall consider the current discharge criteria outlined in the Water License. Current MDMER regulations shall also be considered for comparison purposes. Treatment technology shall be selected by applying BATEA technologies (Best Available Technology Economically Achievable) available presently in the industry.

Although treatment technology and treatment period are not definitive at this moment, the principle remains the same, which is to minimize the impact of the treated effluent on Third Portage Lake (TPL). An environmental study is recommended to better define the assimilative capacity of TPL and assess the allowable load and treated effluent quality that can be discharged. Furthermore, the location of the effluent discharge point(s), effluent diffuser design, short- and long-term monitoring plan (such as Environmental Effect Monitoring (EEM)) shall be confirmed.

2.4 Preliminary Design

2.4.1 Water Treatment Approach

Based on the results of the water quality forecast presented in Table 2-1, and a treated effluent discharge criteria similar per the Water License requirements, water treatment could be required for heavy metals (aluminum, arsenic, copper and nickel), total dissolved solids (TDS), and total ammonia, as well as for suspended solids. For the reduction of TDS, this could involve the treatment for inorganic ions such as chloride and sulfate primarily, and to a lesser extent fluoride and nitrate.

Treatment of the Reclaim Water in the pits could start during the operation or at the end of in-pit tailings deposition.

The closure water treatment system will be designed to treat the specific parameters of concern and could consist of one or a combination of the following treatment approaches:

- If high metal concentrations persist, such as iron, copper, aluminum and nickel, they can be removed through the following process
  - Hydroxide precipitation: caustic soda (NaOH) or lime can be added to the effluent to increase the pH to 9, causing the formation of metal hydroxide precipitates, which settle out. The different treatment options that may be considered to implement the precipitation of heavy metals are listed below:
    - A water treatment plant (WTP) will need to be installed close to Portage Pit, and it will be designed for metal precipitation with the addition of lime or caustic dosing system. The water from Portage Pit can be pumped to the WTP for treatment, with the treated water discharged to TPL via a diffuser.
    - Treatment in-situ at Portage Pit (i.e. batch lime treatment).
    - pH adjustment of the treated water will be required prior to its release.
    - TSS removal will be an important part of the treatment system. It is expected that a fraction of the metal present in the water column is as a particulate.
    - If required, additional pre-treatment steps can be added, depending on the actual water quality to be treated, such as an oxidation step to help oxidize any metal complexes, or post-treatment such as media filter for final polishing.
  - Organosulfide precipitation: organosulfide product can precipitate heavy metal into sulfides solids and with the aid of a typical coagulation/flocculation process, these precipitates can settle out from the water. It is to be noted that this process may be combined with caustic/lime precipitation.

  - Ion exchange: the heavy metal contaminants in form of cations can also be removed by ion exchange resin (IX). Prior to IX process, raw water needs to be filtered to remove suspended solids which may cause resin fouling.
  - Membrane separation: heavy metals can be removed by membrane techniques including nanofiltration and reserve osmosis. Prior to the membrane process, raw water needs to present very low suspended solids and turbidity and thus multimedia filtration or microfiltration is required.
- If fluoride and/or arsenic concentrations are an issue, one of the most efficient techniques to reduce their concentration is by coagulation-clarification/filtration process. Possible treatment options include the following:
  - For fluoride, aluminum sulphate can be used to adsorb the ion and co-precipitate onto the aluminum hydroxide floc.
  - For arsenic, it can be co-precipitated using an iron-based coagulant, such as ferric sulphate, to form a ferric-arsenate precipitate.
- For total dissolved salts, such as chloride and sulfate, membrane separation such as nanofiltration or reverse osmosis can be applied.
- If high total nitrogen concentrations persist, even after simulating or testing during one summer with the effects of natural degradation in the pits at Meadowbank, more active treatment solutions could be implemented, such as:
  - Mechanical aerations could be installed in Portage pit.
  - The Reclaim Water in Portage Pit can be treated “in-situ” by either stripping or biological treatment process.
  - Alternative treatment technology like snow making could be considered.
  - pH adjustment of the treated water, near neutral pH, to ensure that most of the ammonia present is as ammonium (NH_4^+) instead of un-ionized ammonia (NH_3).
- Sludge generated from the treatment process could be thickened and/or dewatered and stored in the North Cell or South Cell tailings storage facilities and capped with NPAG rockfill at closure.

The technologies described above should be studied and evaluated in more detail to determine if they can be implemented at the Meadowbank site and achieved the desired treated effluent quality. Laboratory and/or in-situ pilot tests are recommended to validate the treatment method to be selected.

Figure 2-1 presents a preliminary process flowsheet of the closure water treatment system that proposes three (3) distinct blocks to treat the main parameters of concern identified in Section 2.1, specifically.

- Cyanide and total ammonia;
- Heavy metals: copper, nickel, iron, arsenic; and
- Total dissolved solids (TDS).

Natural degradation of cyanide and ammonia can take place in pit lakes and TSF ponds, especially during summer months. Continuous monitoring in the pit lakes as well as North and South Cell TSF ponds should be done to make sure that these two contaminants are below the future discharge criteria.

As Meadowbank is familiar with equipment such as ballasted floc clarifier (i.e. Actiflo®), this same process can be used to precipitate heavy metals, coprecipitate arsenic with ferric coagulant and for TSS removal.

The third block includes filtration steps and membrane separation designed for removing TDS, such as sulfate and chloride. It is to be noted that current water concentration in TDS is already higher than the discharge criterion defined in the current Water License. Although there are no criteria defined in the MDMER regulation (Schedule 4 tables) and CCME guidelines for TDS, a specific criterion could be required based on the receiving water body assimilative capacity. Trade-off studies are recommended to assess if the reclaim water should be treated during operation and discharged to the receiving environment to prevent a build-up of dissolved solids in the future.

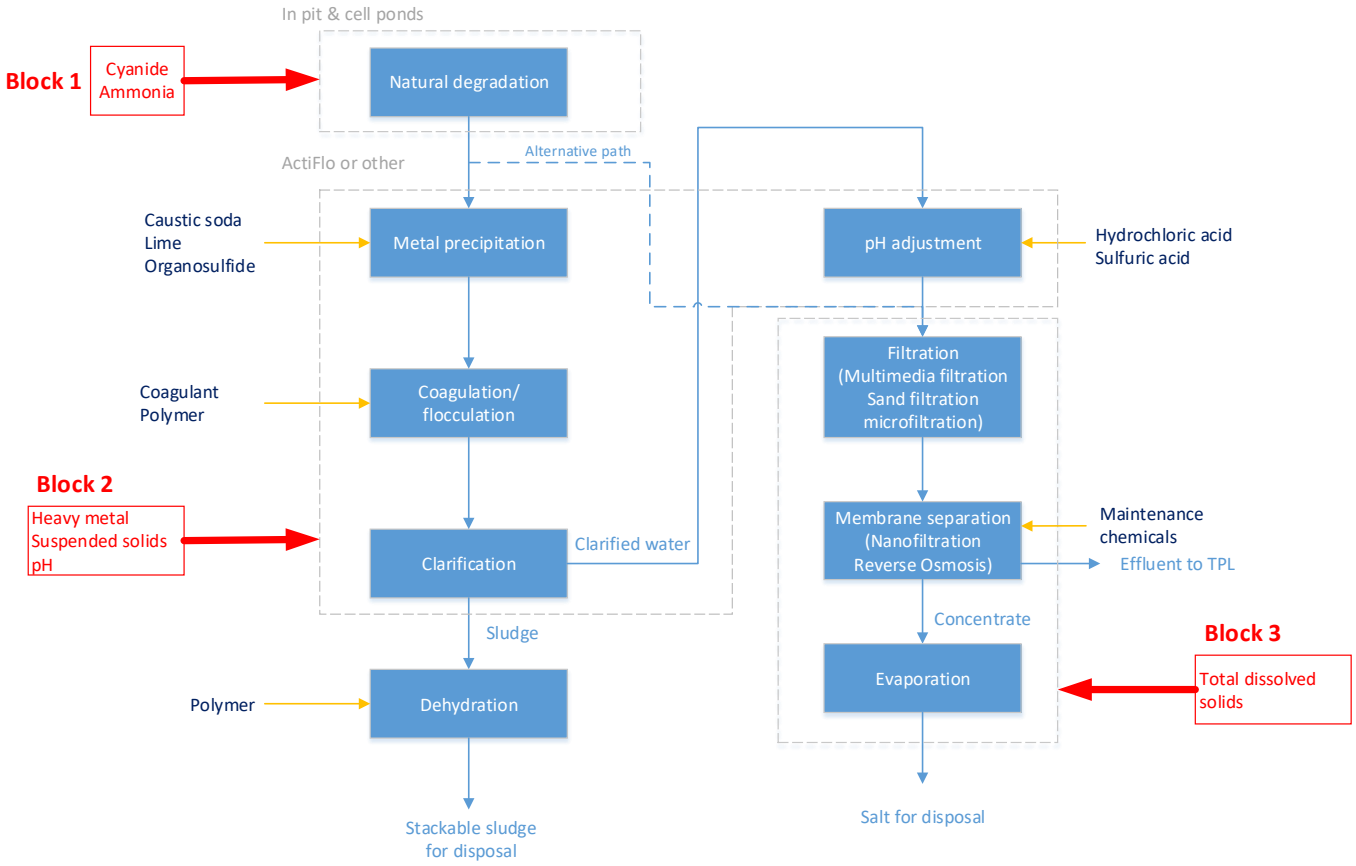

Figure 2-1: Treatment Process Flowsheet

2.4.2 Design Flowrate

According to the 2020 WMP water balance model, the water volume accumulated in Portage and Goose Pits at the end of in-pit deposition is projected to be approximately 28,000,000 m^3 (volume to be confirmed). As mentioned in Section 2.3, separate environmental studies will evaluate the annual volume and contaminant load that can be discharged to Third Portage Lake based on its assimilative capacity. The annual volume that will be treated at the closure water treatment system should be in line with the results from these environmental studies.

Before these data can be obtained, a preliminary treatment flowrate was evaluated based on the existing water treatment plant installed at the Amaruq site, which consists of two Actiflo® clarifiers that could be re-used and modified for closure at the Meadowbank site. Table 2-2 summarizes this preliminary assessment, assuming year-round treatment.

Table 2-2: Preliminary Treatment Capacity

Parameter	Unit	Value
Total volume to be treated	m^3	Approx. 28,000,000 (volume to be confirmed)
Flowrate	m^3/h	1,600 (800 x 2 Actiflo®)
	m^3/day	38,400
Utilization rate		0.8
Approximate Treatment period (assuming year-round operation)	day	911
	year	2.5 to 3

Please note that the proposed treatment approach assumes that the treatment of the reclaim water can be done in one step (i.e. arsenic, metal and TSS removal). Laboratory testing is recommended to confirm this treatment approach. If a two-step approach is required, then an additional treatment stage will be needed with similar treatment capacity.

2.4.3 Other Design Considerations

According to the preliminary process flowsheet, Blocks 1 and 2 are very common treatment process in the mining industry. Block 3, related to the treatment of total dissolved solids (TDS), requires membrane technologies which may not be a BATEA technology according to industry benchmarking, especially if a large volume of water needs to be treated.

There is an opportunity to reduce the total reclaim water volume in the pits by using evaporators during operation. This will result in a lower volume to treat but with a higher TDS concentration in the reclaim water that might still be acceptable for the membrane process. Laboratory testing is required to confirm the treatability.

2.5 Bench Scale Laboratory and On-site Testing

To help define the water treatment process required for closure, bench scale laboratory and on-site testing are recommended. The bench scale laboratory testing and on-site testing program shall have the following objectives:

- Confirm the treatability of reclaim water with regard to current Water License discharge criteria;
- Confirm if there is an opportunity to treat individual streams before it reports to the pit, such as the mill process water;
- Validate the BATEA (Best Available Technology Economically Achievable);
- Evaluate if current equipment at Amaruq site can be used for the treatment;
- Assess the consumption of chemical products required for the whole closure period; and
- Assess CAPEX and OPEX investments.

The testing program could be conducted in two (2) phases:

- Phase 1: scoping bench scale laboratory testing. This can be carried out by AEM R&D team or other third-party external laboratories.

- Phase 2: extensive pilot testing and characterization of all generated waste streams. Pilot unit can be mobilized to the site during summer months to assess treatment performance and operating conditions. Also, sufficient quantity of sludge, concentrate or any other waste stream should be produced for characterization and to assess their long-term disposal.

In the Phase 1 testing, the following activities are recommended:

- Complete characterization of water samples in the Portage pit and Goose pit lakes, and other process streams if required, such as the mill effluent stream;
- Sample water and prepare spiked water with added metal or salts to simulate future quality;
- Perform Jar tests and evaluate heavy metal removal efficiency. Minimally, the following chemicals should be tested:
  - Test both caustic soda and lime to increase pH;
  - Test coagulation with iron and aluminum-based coagulants at a minimum with two different dosing concentrations;
  - Test flocculation with several polymer products and at two different dosing concentrations. Floc size and settling velocity shall be observed and documented;
  - Test coprecipitation with organosulfide products (minimally 2 products);
  - Characterization of supernatant water from the Jar tests;
  - Perform membrane separation and predict dissolved solid removal efficiency with nanofiltration and/or reverse osmosis, including assessment on pre-treatment requirement; and
  - Characterize permeate and concentrate produced.

In the Phase 2 testing, the following activities are recommended:

- Finalize water treatment flowsheet;
- Mobilize pilot plant to treat continuously or semi-continuously raw water or spiked raw water;
- Confirm the efficiency of selected chemical products and their dosages;
- Collect sufficient quantity of sludge generated from the coagulation and flocculation and send for testing at manufacturer or laboratories equipped with centrifuge filter or filter press;
  - Collect filtered sludge and characterize for chemical assay, humidity, standard environmental leaching test such as TCLP, SPLP;
  - Collect filtrate water for characterization;
- In the case that membrane separation should be selected, more laboratory test work shall be conducted to develop strategies for possible evaporation process to produce stable salts or underground injection. Pilot testing at a manufacturer may also confirm the technology chosen.

Before implementing Phase 2 testing, preliminary results from environmental studies as well as potential treatability and economic assessments should be obtained to support the Water License amendment process. Once a clearer picture is obtained on the discharge volume and treated water quality to meet at closure, this information will be used to develop Phase 2 testing.

3.0 PRELIMINARY SCHEDULE

The design and the implementation of a closure water treatment system require an extensive bench-scale and/or pilot testing, environmental studies to assess Third Portage Lake assimilative capacity and define the discharge location and diffuser design, engineering to support the pre-selection of water treatment technologies and development of pre-feasibility and detailed engineering deliverables, and finally the construction, commissioning and operation of the system.

Table 3-1 presents a preliminary schedule of the main activities required for the design and implementation of the closure water treatment system, as well as other major milestones during operation and closure. Note that this schedule is tentative and should be revisited annually based on current mine site activities and planning.

Table 3-1: Preliminary Schedule for Design and Implementation of Water Treatment Plant for Closure

ACTIVITY	START DATE[1]	END DATE[1]
Tailings Storage Facility Operations		
North Cell	January 2010	July 2019
South Cell	November 2014	April 2019
Goose pit (in pit tailings deposition)	July 2019	August 2020
Portage pits (in pit tailings deposition)	August 2020	June 2026
Closure Water Treatment System Design and Implementation		
Laboratory / Pilot Testing	Q3 2021	Q3 2023
Environmental Studies	Q3 2021	Q4 2022
Feasibility and Detailed Engineering	Q4 2023	Q4 2024
Procurement Period	Q1 2025	Q2 2025
Shipment and Installation	Q3 2025	Q2 2026
Commissioning and Testing	Q2 2026	Q3 2026
Other Key Activities		
Mill Operations	January 2010	June 2026
Reclaim Water Treatment – Goose Pit	2027	2027
Reclam Water Treament – Portage Pit	2027	2029
In-Pit Cover Construction (if feasible)	2027	2029
North and South Cell TSF Cover Construction	2027	2031
Flooding of Portage Pit[2],	2029	2036
Flooding of Goose Pit[2],	2027	2028
Dike Reconnection	n/a	2037 only if water criteria are met

Notes:

1. Periods are given from the beginning of the starting month or quarter to the end of the ending month or quarter.
2. Artificial flooding only with a combination of pumps and siphons, natural run off inflow as part of re-flooding not accounted in this table.

3.1 Schedule for Testing

The testing schedule may take around two years' time starting from summer 2021.

Phase 1: bench scale testing including sampling and preliminary laboratory testing at AEM R&D center and other specialized laboratories (Summer 2021 to Spring 2022).

Phase 2: additional laboratory testing to confirm the discharge criteria after receiving environmental study results and pilot plant testing on the site (Summer 2022 to Fall 2023).

3.2 Schedule for Feasibility and Detailed Engineering

Following the laboratory and pilot testing, one or two treatment options are to be developed in preliminary feasibility study and a trade-off study will confirm the option to be selected: Fall 2023

After this preliminary feasibility, a definitive feasibility study and a detailed engineering study will be required:

- Definitive feasibility study: Q1 and Q2 2024
- Detailed engineering study: Q3 and Q4 2024
- Procurement period: Q1 to Q2 2025

3.3 Closure Water Treatment System Installation/Commissioning/Testing

The period between Q3 2025 to Q3 2026 is preliminarily planned for equipment fabrication, shipment to the mine site, installation, followed by commissioning and testing period so that the closure water treatment system is ready to be operated in 2027.

It is not certain at this stage if membrane technologies shall be required for the closure water treatment system. Thus, contingency in the schedule should be added to accommodate for this equipment if required.

The existing Actiflo® clarifiers can be moved from the Amaruq site to Meadowbank during the same period (2025 to 2026). The re-use of the existing clarifiers will have to be assessed based on the closure requirements and timeline at the Amaruq site.

The commissioning of the water treatment plant can be realized in summer/fall 2026.

3.4 Water Treatment Operation

Considering the treatment capacity based on the existing Actiflo® clarifiers, about 2.5 to 3 years are required to treat the total volume of 28,000,000 m^3 in Portage and Goose pits, assuming year-round treatment.

The duration of the treatment shall need to be re-evaluated based on the results from the environmental studies on the assimilative capacity of Third Portage Lake. The design capacity required for the closure water treatment system can then be adjusted to meet the required closure schedule for the pits.

4.0 CONCLUSION

4.1 Results summary

Following the end of in-pit deposition, scheduled for June 2026, the current closure plan involves the treatment and discharge of the reclaim water in the pits, followed by the installation of an aggregate cover on the tailings, if feasible, and pit flooding through natural runoff and water transfer from Third Portage Lake.

This technical note compared forecasted reclaim water quality in Goose and Portage pits at the end of in-pit deposition against current/possible future discharge criteria. Based on this assessment, the following parameters of concern in the reclaim water would require further treatment: Total dissolved solids (TDS), certain heavy metal, arsenic and ammonia.

Ammonia concentration could be removed by natural degradation, while, heavy metals, arsenic and total suspended solids could be treated by conventional precipitation/coagulation process. The reduction in TDS, however, may require membrane technologies which could pose some technical challenges due to the high volume of water to be treated.

To continue the development and implementation of the closure water treatment system, a preliminary high-level strategy was developed and consists of the following main activities:

- Conduct bench scale laboratory and on-site testing to define the water treatment technologies required for closure;
- Realize environmental studies to assess the assimilative capacity of Third Portage Lake. The results from these studies will help define the allowable annual discharge volume and treated effluent requirements.
- Evaluate discharge location and diffuser design;
- Develop feasibility and detail engineering deliverables for the closure water treatment system.

A preliminary schedule was proposed for implementation of these activities and will be revisited annually based on the current mine site activities and planning.

4.2 Opportunities

Mill operations and in-pit tailings deposition is planned to end in five (5) years from now. There is enough time to perform environmental studies on Third Portage Lake and all laboratory testing on the reclaim water to determine the best path forward for the closure water treatment system that shall be acceptable to all stakeholders.

Furthermore, the proposed treatment period starts from 2027. Treatment of the reclaim water could start before the closure if required, which could result in less contaminants accumulation in the reclaim water, specifically regarding total dissolved solids.

Finally, reclaim water volume to manage at the end of in-pit deposition could potentially be reduced by using enhanced evaporators.

4.3 Recommandations

To advance the development of the closure water treatment system, the following recommendations are made:

> Continue to sample water across the site, especially in Goose and Portage pits. It is suggested to analyze water chemistry at different depth in Goose pit to observe if there is any natural stratification of the denser reclaim water. Note that there are currently no tailings deposition activities in Goose Pit;

- Follow the schedule mentioned in Section 3.0 to gather information from bench-scale and laboratory/pilot testing before feasibility and detailed engineering studies;
- Perform environmental assessment of the receiving water body (Third Portage Lake) on its assimilative capacity and determine allowable effluent volume and contaminant load that can be discharged during closure;
- Perform diffuser studies in Third Portage Lake to assess diffuser location and design for closure;
- Carry out trade-off studies to assess strategies to minimize the accumulation of dissolved solids in the reclaim water;
- Continue annual water balance and water quality forecast modelling to better assess the water quality at closure (2026).