

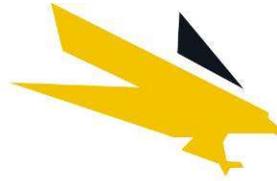
## **Appendix 22**

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### **Meadowbank Mine Waste Rock and Tailings Management Plan Version 11**

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**AGNICO EAGLE**

**MEADOWBANK GOLD MINE**

**WASTE ROCK AND TAILINGS MANAGEMENT REPORT &  
PLAN - 2020**

**APRIL 2021**

## **EXECUTIVE SUMMARY**

Agnico Eagle Mines Ltd. Meadowbank Division (AEM) is operating the Meadowbank Gold Mine (the Mine), located on Inuit-owned surface lands in the Kivalliq region approximately 70 km north of the Hamlet of Baker Lake, Nunavut. The Mine is subject to the terms and conditions of both the Project Certificate issued in accordance with the Nunavut Land Claims Agreement Article 12.5.12 on December 30, 2006, and the Nunavut Water Board Water License No. 2AM-MEA1530 issued in May 2020. This report presents the annual update of the Mine Waste Rock and Tailings Management Plan for Meadowbank mine.

The Meadowbank Mine consists of several gold-bearing deposits: Vault, Portage and Goose Island. Prior to the beginning of mining a series of dikes were built to isolate the mining activities from neighbouring lakes.

Waste rock from the Portage and Goose Island Pits is stored in the Portage Rock Storage Facility (Portage RSF), and in the Portage Pit as infill. The Portage RSF was constructed in a way to minimize the disturbed area and is capped with a 4m layer of non-acid-generating rock to constrain the active layer within relatively inert materials as part of progressive reclamation. This control strategy is designed to minimize the onset of oxidation and the subsequent generation of acid rock drainage through freeze control of the waste rock as a result of permafrost encapsulation and capping with an insulating convective layer of NAG rock. The waste rock below the capping layer is expected to freeze, resulting in low rates of acid rock drainage (ARD) in the long term. Thermistors currently installed in the Portage RSF indicate that freezing is occurring.

Mining commenced at the Vault Pit mining operation in 2014 and concluded in June 2019. Waste rock from the Vault Pit, Phaser Pit and BBPhaser Pit mining operation is stored in the Vault Waste Rock Storage Facility (Vault RSF). Geochemical predictions indicate that a capping layer will not be required at the Vault RSF as the majority of waste rock produced is NAG. To date, through the ARD testing program, it has been determined that approximately 85.5 % of the waste rock generated is NAG. As a precaution, PAG waste rock was placed in the middle of the Vault RSF and this material will be covered with at least 4m of NAG to minimize any generation of ARD and to promote freeze back.

The Tailings Storage Facility (TSF) is located with the Portage Pit Area and comprises the South Cell and the North Cell. These cells are delimited by tailings retaining dikes that are progressively built as capacity is required. The division of the TSF into cells allows tailings management in comparatively smaller areas with shorter beach lengths that reduce the amount of water that is trapped and permanently stored as ice. Operation in cells also allows progressive closure and cover.

Following the authorization of the in-pit amendment in 2019 the tailings deposition plan was reviewed to include tailings deposition in Goose Pit, Portage Pit A and Portage Pit E. This strategy will allow

storage of tailings within mined out pits to achieve the required capacity without requiring further raises of the North Cell and South Cell of the TSF.

Tailings are deposited sub-aerially and sub-aqueously as a slurry using the end of pipe technique. Tailings deposition is alternated between the North Cell, South Cell, and the approved in-pit deposition pits depending on the tailings deposition plan. In 2020, tailings deposition occurred in Goose Pit from January to mid-August, and in Pit E for the remainder of the year.

Following mine operations, a minimum 2-m thick cover of NAG rockfill will be placed over the tailings in the North Cell and the South Cell of the TSF as an insulating convective layer to confine the active layer within relatively inert materials. The final thickness of the rockfill cover layer will be confirmed in the final design based on thermal monitoring to be completed during operations. The control strategy to minimize water infiltration into the TSF and the migration of constituents out of the facility includes freeze control of the tailings through permafrost encapsulation. Progressive capping is ongoing in the North Cell since 2015.

Thermal monitoring is ongoing to observe the freezeback of the TSF and RSFs. Additional instruments will be installed at closure. Thermistors currently installed in the TSF indicate that freezing is occurring.

All infrastructures needed for mine operations, closure and reclamation, including mine waste management areas, will be re-contoured and/or surface treated during closure, according to site specific conditions, to minimize windblown dust and erosion from surface runoff.

**DOCUMENT CONTROL**

Version	Date (YM)	Section	Page	Revision
1	2009/10	All	All	Original Plan
2	2013/04	All	All	Comprehensive update to Original Plan
3	2014/03	All	All	Comprehensive update to Original Plan
4	2015/03	Section 1, 2, 3, 4, 5, 6		Updated with the actual Life of Mine (LOM) for operations ending in Q3 2017
		Section 7		Updated according to the tailings deposition plan and water balance for the actual Life of Mine (LOM) for operations ending in Q3 2017
		Section 8		Updated according to additional instruments installed and future monitoring plan
		Section 9		Updated according to additional monitoring plan for final closure design
5	2016/03	All	All	Comprehensive update to Original Plan
6	2017/03	All	All	Comprehensive update to Original Plan
7	2018/03	All	All	Comprehensive update to Original Plan
8	2019/03	All	All	Comprehensive update to Original Plan.
9	2019/07			Interim update to 2018 plan to include in-pit disposal following authorization of amendment
10	2020/03	All	All	Comprehensive update to Original Plan.
11	2021/04	All	All	Comprehensive update to Original Plan.

Prepared By: Engineering and Environmental Departments

Approved by:



Alexandre Lavallee – Environment Superintendent

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**Appendix A:** Meadowbank Mined Material Balance (2009-2020)

**Appendix B:** TSF Integrated Deposition Plan



MEADOWBANK GOLD MINE  
**2020 MINE WASTE ROCK AND TAILINGS  
MANAGEMENT PLAN**

## **1 INTRODUCTION**

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Agnico Eagle Mines Ltd. Meadowbank Division (AEM) is operating the Meadowbank Gold Mine (the Mine), located on Inuit-owned surface lands in the Kivalliq region approximately 70 km north of the Hamlet of Baker Lake, Nunavut. The Mine is subject to the terms and conditions of both the Project Certificate issued in accordance with the Nunavut Land Claims Agreement Article 12.5.12 on December 30, 2006, and the Nunavut Water Board Water License No. 2AM-MEA1530 amended on May 12, 2020.

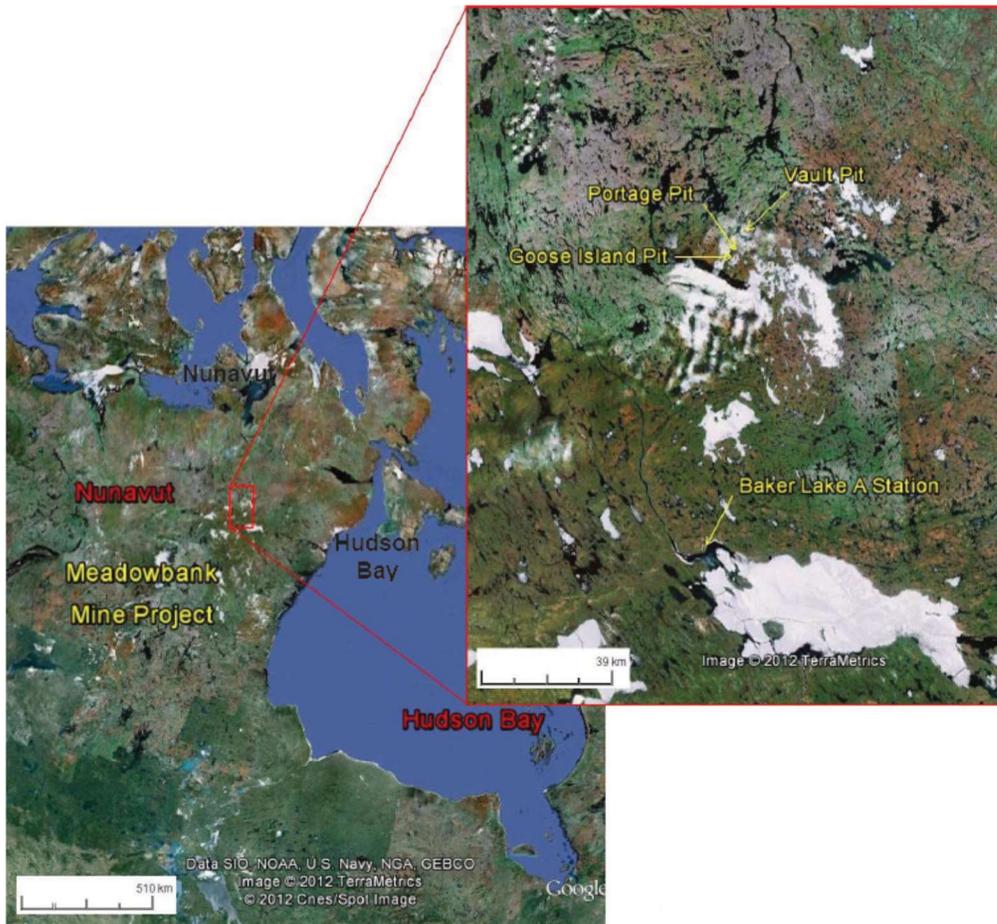
This report is an updated version of the Waste Management Plan 2019. The management, monitoring and closure strategies for both the waste rock storage facility and tailings storage facility are presented in this document.

## 2 BACKGROUND INFORMATION

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### 2.1 SITE CONDITION

The location of the Meadowbank mine site is shown in Figure 2.1.



Source: Google Earth Pro, 2012

**Figure 2-1 : Meadowbank Mine Location**

#### 2.1.1 Climate

The Meadowbank region is located within a low Arctic Eco climate described as one of the coldest and driest regions of Canada. Arctic winter conditions occur from October through May, with

temperatures ranging from +5°C to -40°C. Summer temperatures range from -5°C to +25°C with isolated rainfall increasing through September (Table 2-1).

**Table 2-1: Estimated Average Monthly Climate Data – Meadowbank Site**

Month	Max. Air Temp. (°C)	Min. Air Temp. (°C)	Rainfall (mm)	Snowfall (mm)	Total Precip. (mm)	Lake Evap. (mm)	Min. Relative Humidity (%)	Max. Relative Humidity (%)	Wind Speed (km/h)	Soil Temp. (°C)
January	-29.1	-35.5	0	11.2	11.2	0	67.1	75.9	16.3	-25.5
February	-27.8	-35.2	0	10.5	10.5	0	66.6	76.5	16.0	-28.1
March	-22.3	-30.5	0.1	14.6	14.6	0	68.4	81.4	16.9	-24.9
April	-13.3	-22.5	2.3	16.7	19.0	0	71.3	90.1	17.3	-18.1
May	-3.1	-9.9	9.8	11.3	21.1	0	75.7	97.2	18.9	-8.0
June	7.6	0.0	14.5	3.9	18.4	8.8	62.6	97.2	16.4	2.0
July	16.8	7.2	36.7	0.0	36.7	99.2	47.5	94.3	15.1	10.5
August	13.3	6.4	45.5	0.9	46.4	100.4	59.2	97.7	18.4	9.3
September	5.7	0.9	30.1	8.8	38.9	39.5	70.8	98.6	19.3	3.6
October	-5.0	-10.6	3.5	30.3	33.8	0.1	83.1	97.4	21.4	-2.8
November	-14.8	-22.0	0	23.6	23.6	0	80.6	91.1	17.9	-11.7
December	-23.3	-29.9	0	15.0	15.0	0	73.3	82.7	17.7	-19.9

*Note: Data from Baker Lake A station is available from 1946 to 2011. During this period, the data quality is good, with the exception of years 1946 to 1949, and 1993 which were removed from the compilation.*

The long-term mean annual air temperature for Meadowbank is estimated to be approximately 11.1°C. Air temperatures at the Meadowbank area are, on average, about 0.6°C cooler than Baker Lake air temperatures, and extreme temperatures tend to be larger in magnitude. This climatic difference is thought to be the effect of a moderating maritime influence at Baker Lake.

The prevailing winds at Meadowbank for both the winter and summer months are from the northwest. A maximum daily wind gust of 93 km/h was recorded on September 1, 2009. Light to moderate snowfall is accompanied by variable winds up to 70 km/h, creating large, deep drifts and occasional whiteout conditions. Skies tend to be more overcast in winter than in summer.

Table 2-1 presents monthly rainfall, snowfall and total precipitation values for the mine site. August is the wettest month, with a total precipitation of 43.4 mm, and February is the driest month, with a total precipitation of 6.1 mm. During an average year the total precipitation is 249.6 mm, split between 147.5 mm of rainfall and 102.1 mm of snowfall precipitation.

### **2.1.2 Faults**

Two main faults are inferred in the Portage deposit area and included in the groundwater model (Golder, 2011) used to estimate groundwater inflows and brackish water upwelling to the pits during mine life. These are the Bay Zone Fault and the Second Portage Fault shown in Figure 2.2 by bright blue lines.

The Second Portage fault trends to the northwest under Central Dike and the Tailings Storage Facilities (TSF), roughly parallel to the orientation of Second Portage Lake. This fault has been identified as a potential pathway for the Central Dike Seepage.

The Bay Zone Fault trends from South to North and crosses Third Portage Lake, Goose Pit and Portage Pit. This fault is a potential pathway for water infiltration from Third Portage Lake into Goose Pit.

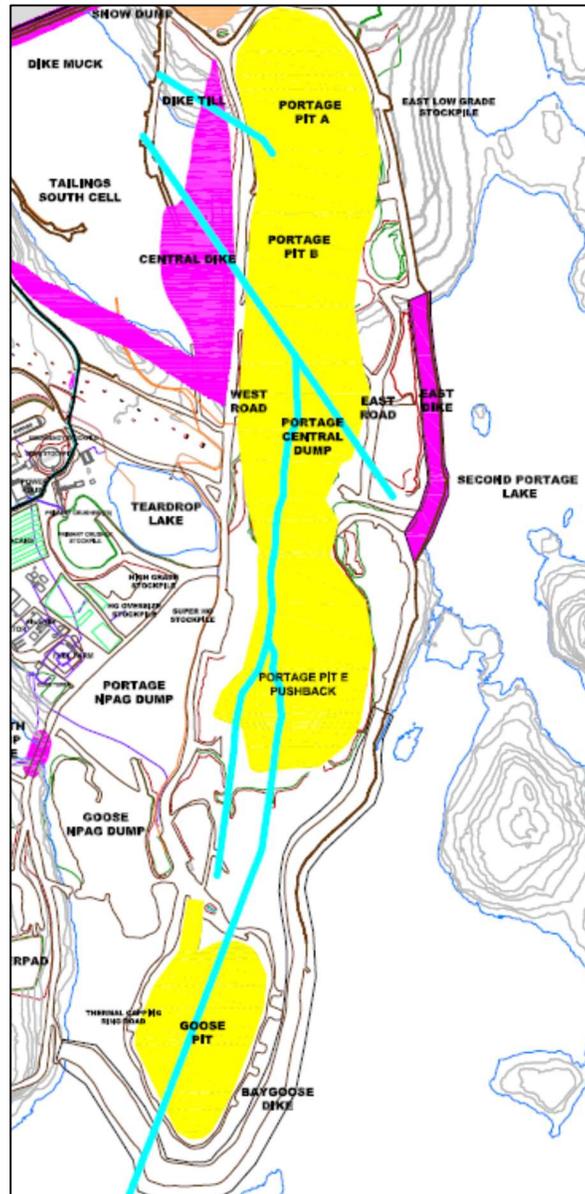


Figure 2-2 : Portage Pit Area Fault Locations

### 2.1.3 Permafrost

The Meadowbank Gold Mine is located in an area of continuous permafrost. Lake ice thicknesses between 1.5 m and 2.5 m have been encountered in mid to late spring during geotechnical investigations and sampling campaigns. Taliks (areas of permanently unfrozen ground) are expected where water depth is greater than about 2 to 2.5 m. Based on thermal studies and measurements of

ground temperatures (Golder, 2003), the depth of permafrost at site is estimated to be in the order of 450 to 550 m, depending on proximity to lakes. The depth of the active layer is about 1 to 1.5 m and varies based on stratigraphy, presence of overburden and vegetation and proximity to lakes.

Based on ground conductivity surveys and compilation of regional data, the ground ice content is expected to be low. Locally on land, ice lenses and ice wedges are present, as indicated by ground conductivity, and by permafrost features such as frost mounds. These areas of local ground ice are generally associated with low-lying areas of poor drainage.

**2.1.3.1 Impact of Climate Change on Site Conditions**

Table 2-2 presents a summary of climate change predictions used on a number of northern projects that have been reported in the engineering and scientific literature. Further studies incorporating climate change references will be done using the climate change predictions from the IPCC (Intergovernmental Panel on Climate Change) RCPs (Representative Concentration Pathways) RCP6.

**Table 2-2: Summary of Reported Climate Change Rates Used in Northern Projects Engineering Studies**

Reference	Increase in MAAT by Year 2100 (°C)	Notes
Hayley (2004)	4.7	Used in design studies for the Inuvik Regional Health Center. Reported as increase of 0.47°C per decade.
Hayley and Cathro (1996)	5.0	Used for Raglan Dam analyses.
Diavik	3.2	Used for the Processed Kimberlite Containment Facility Design
Burn (2003)	6.0	For use in the Western Arctic for pipeline design projects. Reported as increase of 1.75°C over a 29 year period
Intergovernmental Panel on Climate Change (AR5)	See Figure 2.3	RCP 6.0 to be used as base case

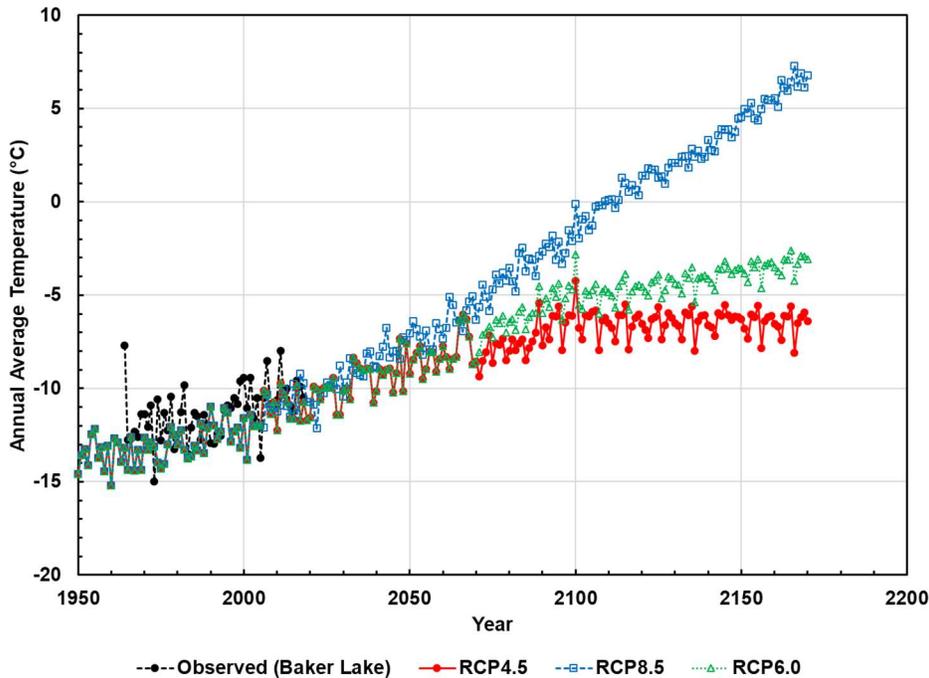
As part of the Intergovernmental Panel on Climate Change’s (IPCC) Fifth Assessment Report (AR5), the IPCC adopted new Representative Concentration Pathways (RCPs) to replace the previous emission scenarios of the Special Report on Emission Scenarios (SRES) (IPCC 2013). The four adopted RCPs differ from the SRES in that they represent greenhouse gas concentration trajectories, not emissions

trajectories. The four scenarios (RCP2.6, RCP4.5, RCP6.0 and RCP8.5) are named after the radiative target forcing level for 2100, which are based on the forcing of greenhouse gases and other agents and are relative to pre-industrial levels.

The climate change database for the Meadowbank and Amaruq projects was developed following the recommendations outlined on the Canadian Climate Data and Scenarios (CCDS) website, which is wholly supported by ECCC (CCDS, 2018). The website recommends the use of statistical downscaling to “downscale” a GCM’s (General Circulation Model) predictions to a specific location based on historical observations. Statistical downscaling is a two-step process consisting of i) development of statistical relationships between local climate variables (e.g., surface air temperature and precipitation) and large-scale predictors (e.g., pressure fields), and ii) application of such relationships to the output of GCM experiments to simulate local climate characteristics in the future. The Pacific Climate Impact Consortium (PCIC) at the University of Victoria provides statistically downscaled daily temperature and precipitation under the RCP2.6, RCP4.5 and RCP8.5 scenarios for all of Canada at a resolution of approximately 10 km (PCIC, 2018). The second-generation Canadian Earth System Model (CanESM2), developed by the Canadian Centre for Climate Modelling and Analysis (CCCma), was used as the predictor GCM to downscale and make climate change databases representative of site conditions.

Statistical downscaling is limited by the availability of large-scale predictors. Current CCCma CanESM2 model runs are limited temporally to 2100. In order to predict beyond 2100, the radiative forcing trend was applied to the temperature. RCP4.5 and RCP6.0 are expected to stabilize shortly after 2100, while RCP8.5 is expected to continue along the same trend until after 2200.

Temperatures are anticipated to rise at about the same rate (approximately 0.06°C/year) for RCP4.5 and RCP6.0 until approximately 2070, after which RCP4.5 estimates a reduction in the temperature increase rate. Under RCP8.5, temperatures are expected to increase at a higher rate (approximately 0.12°C/year) for the duration of the modelled period. All three scenarios predict an increase in precipitation with time of approximately 0.5 mm/year (75 mm total increase over 150 years) for RCP4.5, 0.6 mm/year (90 mm total increase over 150 years) for RCP6.0 and 0.7 mm/year (100 mm total increase over 150 years) for RCP8.5.



**Figure 2-3 : Annual average temperature estimated for the RCP4.5, RCP6.0 and RCP8.5 climate change scenarios. Observed temperature at Baker Lake is also shown.**

## 2.2 MINING OPERATION DESCRIPTION

Mining in the Meadowbank area pits concluded in October 2019. Mining is ongoing at the Amaruq project and the ore is transported to the Meadowbank mill for processing.

The Meadowbank Gold Mine consists of several gold-bearing deposits within reasonably close proximity to one another. The three main deposits are: Vault (including Phaser and BBPhaser), Portage (South, Center and North Portage deposits), and Goose.

### 2.2.1 Portage Pit Area

The Portage area located between the Third Portage Lake (3PL) and Second Portage Lake (2PL) contains most of the infrastructure of the Meadowbank mine site including but not limited to the Portage Rock Storage Facility (RSF), North and South Tailings Storage Facilities (NC & SC TSF), the mill, the camp and the Stormwater Management Pond.

The South Portage deposit is located on a peninsula, and extends northward under Second Portage Lake (2PL) and southward under Third Portage Lake (3PL). The North Portage deposit is located on the northern shore of 2PL. The South, Center and North Portage deposits are mined as a single pit, termed



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MANAGEMENT PLAN**

the Portage Pit, which extends approximately 2 km in a north-south direction. Subsequent renaming of the pits led to the nomenclature for each pit (A, B, C, D and E.) Portage Pit is isolated from the Second Portage Lake by the East Dike built in 2008-2009 and the Bay-Goose Dike (Pit E) built from 2009 to 2011.

Mining in Pits A, B, C, and D (representing the North and Central Portage area) is completed. In 2019, mining activities in the Portage area were only ongoing in Pit E and concluded in October 2019.

Figure 2-4 shows the Portage Pit Area and surrounding infrastructures.

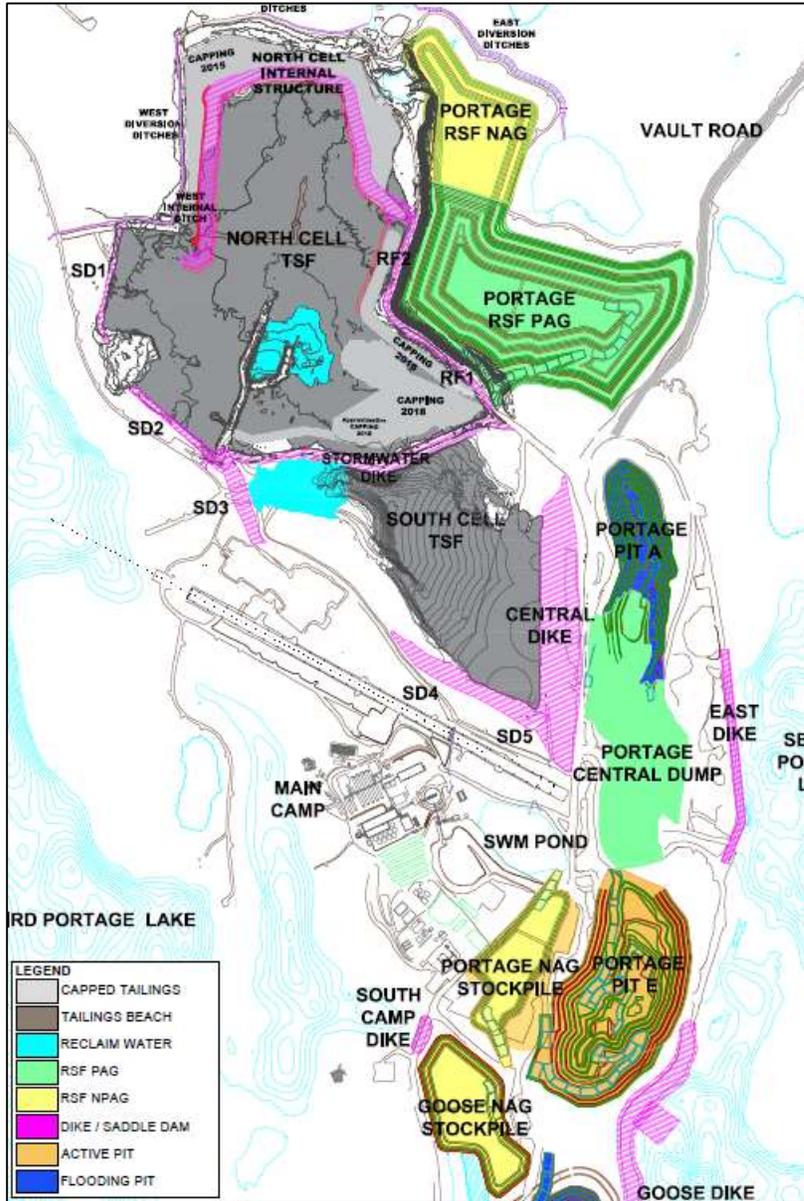


Figure 2-4 : Portage Pit and Tailings Storage Facility Infrastructures

### 2.2.2 Goose Pit Area

The Goose deposit lies approximately 1 km to the south of the Portage deposit, and beneath 3PL. The pit is isolated from the Second Portage Lake and the Third Portage Lake by the Bay-Goose Dike and the South Camp Dike constructed in 2009-2010. Mining in Goose pit began in 2012 and was completed in April 2015. The northern part of the pit was historically used as for pit infilling. The Goose Pit area and surrounding infrastructure are illustrated in Figure 2-5.

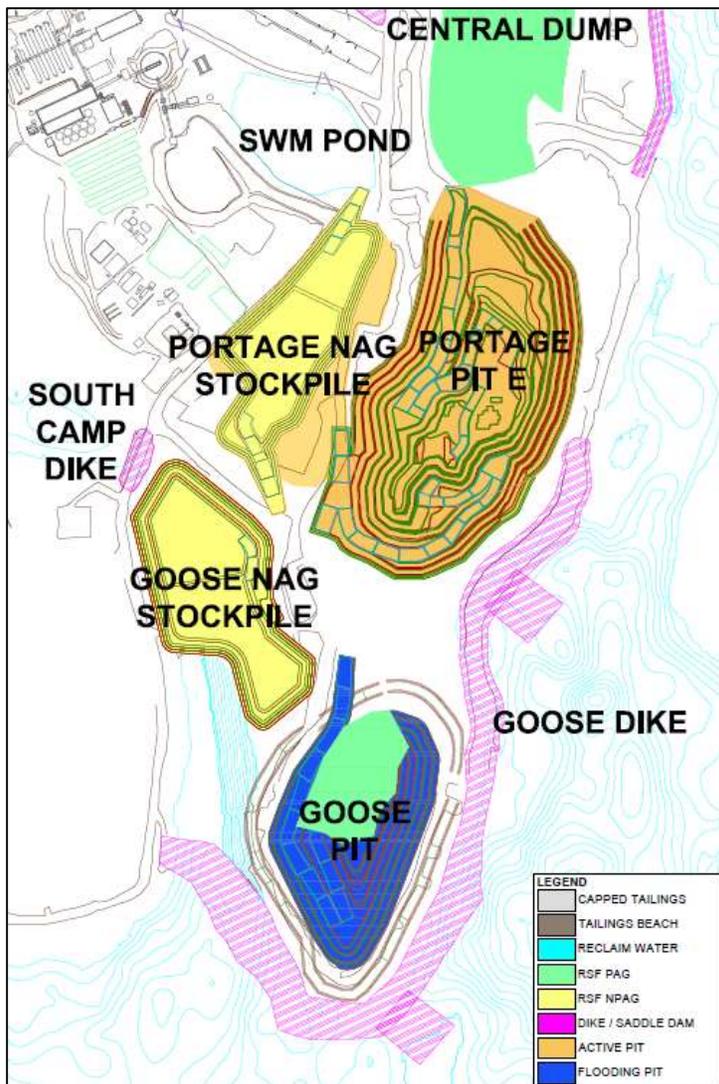


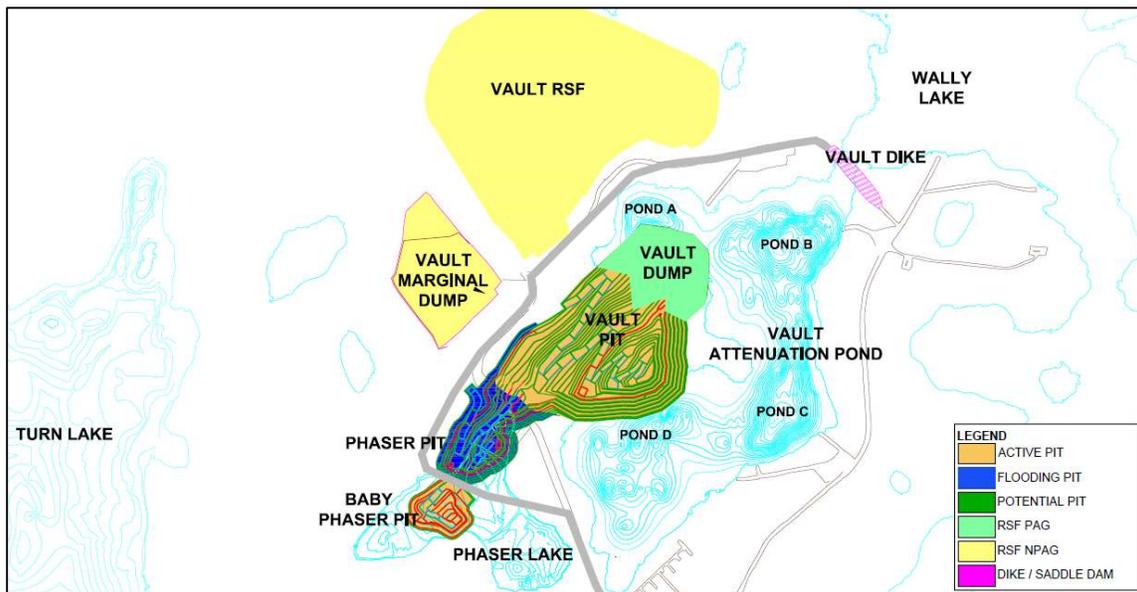
Figure 2-5 : Goose Pit Area Map

### 2.2.3 Vault Pit Area

The infrastructure of the Vault Pit area includes the Vault RSF, ore and marginal pads, Vault Dike, Vault Pit, Phaser Pit, BB Phaser Pit, Vault attenuation pond, and emergency shelter. Figure 2-6 illustrates the Vault Pit area and surrounding infrastructure.

The Vault deposit is located adjacent to Vault Lake, approximately 6 km north of the Portage deposits. The deposit is isolated from the Wally Lake by the Vault Dike built in 2013.

The Vault Pit area mining activity were completed in 2019 with the conclusion of Vault Pit in March 2019 and BB Phaser Pit in June 2019. Phaser Pit mining activities were completed in October 2018.



**Figure 2-6 : Vault Pit Area Map**

### 2.3 TAILINGS STORAGE FACILITY DESCRIPTION

The Tailings Storage Facility (TSF) is located with the Portage Pit Area and is comprised of the South Cell and the North Cell. These cells are delimited by tailings retaining dikes that are progressively built as capacity is required. The configuration of the TSF is presented on Figure 2-4. A summary of the TSF infrastructure is presented in *Table 2-3*.

Stormwater Dike, constructed in 2009-2010, is an internal dike (El. 150m) that divides the TSF into the North and South Cell.

The peripheral structures of the North Cell are SD1, SD2, RF1 and RF2 built to El 150 m from 2009 to 2010. In 2018, an internal structure was built in the Northern part of the North Cell over the existing tailings (variable El. From 152 to 154 m) to increase the tailings storage capacity. In April 2019, a permeable berm was built in the North Cell to secure the reclaim pond from tailings entering.

The peripheral structures of the South Cell are SD3, SD4, SD5 and Central Dike built to El. 145 m from 2012 to 2018.

A permeable berm was built in the South Cell in 2017, to prevent tailings from reaching the reclaim pump area. In February 2019 an additional permeable berm was built within the South Cell TSF to maintain reclaim capability.

The diversion ditches (East and West), located around the perimeter of the North Cell TSF and the Portage RSF, are designed to collect the non-contact water runoff from the surrounding watershed.

### **2.3.1 In-Pit Tailings Storage Description**

In-Pit tailings storage will occur in the mined-out areas of Goose Pit, Portage Pit A and Portage Pit E. Tailings deposition was ongoing in Goose Pit from January 2020 to August 2020, and in Pit E for the remainder of the year.

**Table 2-3 : TSF Infrastructure Description**

Containment Area	Structure	Construction date	Purpose
North Cell	Saddle Dam 1	Built to el. 141m - 2009 Raised to el. 150m - 2010	Peripheral Dike Tailings Retention
	Saddle Dam 2	Built to el. 150m - 2011	Peripheral Dike Tailings Retention
	Rockfill road structure 1 (RF1)	Built to el. 150m – 2009 Till Plug Constructed in 2013	Access Road Tailings Retention
	Rockfill road structure 2 (RF2)	Built to el. 150m - 2009	Access Road Tailings Retention
	Stormwater Dike	Built to el. 140m - 2009 Raised to el. 148m – 2010 Raised to el. 150m - 2013	Divider Dike Tailings Retention
	North Cell Internal Structure	Built to el. variable 152-154m - 2018	Internal Structure Tailings Retention
	North Cell Capping	2015 to 2019	Progressive closure
	Permeable Berm	Built to el.148.5m - 2019	Water management
South Cell	Saddle Dam 3	Built to el. 140m - 2015 Raised to el. 143m - 2016 Raised to el. 145m – 2017-2018	Peripheral Dike Tailings Retention
	Saddle Dam 4	Built to el. 140m - 2015 Raised to el. 143m - 2016 Raised to el. 145m - 2017	Peripheral Dike Tailings Retention
	Saddle Dam 5	Built to el. 143m - 2016 Raised to el. 145m - 2017	Peripheral Dike Tailings Retention
	Central Dike	Built to el. 110m - 2012 Raised to el. 115m - 2013 Raised to el. 132m - 2014 Raised to el. 143m - 2016 Raised to el. 145m - 2017-2018	Peripheral Dike Tailings Retention
	Permeable Berm 1	Built to el. 137.25 - 2017	Water management

	Permeable Berm 2	Built to el. 141.5 - 2019	Water management
In-pit deposition	Goose Pit	Commissioned in July 2019	Tailings Retention
	Pit E	Commissioned in July 2019	Tailings Retention
	Pit A	Commissioned in July 2019	Water management (reclaim water) and later Tailings Retention

### 3 MINE DEVELOPMENT PLAN

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#### 3.1 MINE WASTE PRODUCTION SEQUENCE

The current mine plan (2020) has no Meadowbank ore planned since mining operations at Meadowbank (Portage, Goose, Vault, Phaser and BBPhaser pits) are complete.

The material balances from 2009 to 2020 is presented in Appendix A. This balance indicates the distribution of the following categories of materials by rock type:

- Mine rock for construction;
- Mine rock for dike construction;
- Mine rock for capping; and
- Mine rock to RSFs and Portage Pit fill.

**Table 3-1** compares the amount of waste mined to the FEIS prediction. It is to be noted that the difference in PAG and NPAG mined compared to the FEIS does not impact the management strategy and the closure concept. Please note that since mining operations at Meadowbank are completed no material will be produced other than tailings.

NAG classified waste rock produced by pre-stripping and generic mining activities will be used for construction of the remaining mine infrastructure and dikes at the site, as has been the practice to date. Based on current material balance calculations, sufficient quantities of suitable rock fill and till borrow materials will be available for capping activities and closure/reclamation projects.

**Table 3-1 : Waste Rock Mined Compared to FEIS Prediction**

	Portage/Goose			Vault		
	Non-PAG	Uncertain	PAG <sup>1</sup>	Non-PAG	Uncertain	PAG <sup>1</sup>
FEIS Estimated Quantity (10 <sup>6</sup> tonnes)	64.3	8.9	28.8	51.0	7.5	9.5
Mined Quantity (10 <sup>6</sup> tonnes)	54.0	0	91.5	54.0	0.0	23.7

<sup>1</sup> PAG quantity includes ORE for Mined Quantity

## **4 OVERBURDEN MANAGEMENT**

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### **4.1 LAKEBED SEDIMENTS**

The lakebed sediment consists of soft, fine-grained sedimentary deposits that can be found at the bottom of lakes.

The thickness of lake bottom sediments at Meadowbank is variable and can range from a few centimeters up to 10 meters and more as suggested by geophysical surveys and information obtained from various drilling programs and construction activities.

Lakebed sediments were excavated and managed during the construction of Stormwater Dike, Central Dike and of the dewatering dikes as well as during pre-stripping of the Pits.

The strategy to manage lakebed sediment removed during construction or pre-stripping was to place it in either the Portage or Vault RSF.

### **4.2 TILL**

The remainder of the overburden materials consists of till materials (mix of silt, sand, gravel, cobbles and boulder) with alluvial deposits of silt and sand intermixed. The till material is generally described as a silty sand/gravel. It contains cobble and boulder-sized particles with an average of 30 to 40% silt particles. The average till thicknesses throughout the Mine area varies based on location and may range from zero to upwards of 18 m.

The management strategy for till was to stockpile a part of it to be used for construction of the tailings management infrastructure as required. The remaining quantity of till was placed within the RSFs and mixed with waste rock.

In 2020, no lakebed sediment and till material were mined or re-handled.

## 5 WASTE ROCK MANAGEMENT

The strategy to manage waste rock from the open pit mines, not used for site development purposes, is to store it within the Waste Rock Storage Facilities (RSFs).

Due to the distance between the Portage mining area and the Vault mining area, two separate waste rock storage facilities are required. Waste rock from the Portage and Goose Pits is stored in a storage facility located near to these pits (Portage RSF or Goose Pits), while waste rock from the Vault, Phaser and BBPhaser Pits is be stored in a separate storage facility adjacent to the Vault Pit (Vault RSF). Waste rock is also stored within mined out areas of pits (pit-infilling).

### 5.1 WASTE ROCK PROPERTIES

The estimated quantities to be stored in each of the RSFs and other destinations as well as their geochemical classification (NAG or PAG) are summarized in Table 5-1.

**Table 5-1: Quantities of Waste Rock by Destination**

Destinations (RSF and others)	Rock Type	Quantity*
Portage RSF	Waste Rock (about 19% of NAG)	72.6 Mt**
Portage Pit Filling	Waste Rock (about 100% of PAG)	15.6 Mt
Construction	Waste Rock (NAG)	25.0 Mt
Tailings Capping	Waste Rock (100% of NAG)	16.8 Mt
Rock Garden	Waste Rock (100% of NAG)	0.3 Mt
Goose NAG Dump	Waste Rock (100% of NAG)	4.5 Mt
Vault RSF	Waste Rock (about 95% of NAG and 5% PAG)	56.1 Mt
Vault Pit Filling	Waste Rock (about 95% of NAG and 5% PAG)	3.1 Mt
Phaser Pit Filling	Waste Rock (about 95% of NAG and 5% PAG)	0.8 Mt

\*The quantities have been adjusted as the loose density assumption changed from 2.15 to 2.04.

\*\* The maximum quantity of PAG is realized at the end of mine life. The maximum quantity of NAG is realized at the end of 2018 (before the start of reclamation). The figure reported here reflects the maximum quantity at any one time, which was reached at the end of 2019. Quantities also include NAG capping.

### 5.2 WASTE ROCK MANAGEMENT STRATEGY

Waste rock is managed within the RSFs as well as within the mined-out area of Portage, Goose, Vault and Phaser Pits. The waste rock is qualified with testing as non-acid generating (NAG) or Potentially acid generating (PAG). The management strategy for NAG and PAG material is different.

Placement of waste rock within the Portage RSF commenced closest to the Portage Pit and has progressed westward over the entire footprint, then upward to further benches during the development of the mine. In 2012, an extension of the Portage WRSF was done to store NAG material within a temporary area (Figure 5-1).

Placement of waste rock within the Vault RSF commenced closest to the Vault Pit and proceeded in a northward direction, rising upward as pit development progressed.

PAG rockfill is managed within the Portage RSF, Vault RSF, Portage Pit infill and Vault and Phaser Pit infill. The PAG rockfill within the Portage RSF is placed outside of the capping area (which consist of a thickness of 4 m at surface). At the Vault RSF the majority of the rockfill is NAG with the PAG placed within the middle area.

NAG rockfill is managed as construction material, capping material for the TSF, Goose Pit infill, Vault infill, Phaser infill and within the Portage and Vault RSF. At the Portage RSF the NAG is stored within a temporary NAG stockpile area and is also used as capping for the PAG material. In the Vault RSF, NAG material consists of the majority of the RSF.

### **5.3 WASTE ROCK STORAGE FACILITY CHARACTERISTICS**

Table 5-2 summarizes the overall (final) physical dimensions and aspects of the Portage and Vault RSFs.

***Table 5-2: Details of Rock Storage Facilities***

<b>Descriptors</b>	<b>Portage Rock Storage Facility</b>	<b>Vault Rock Storage Facility</b>
Storage volume	39.3 Mm <sup>3</sup>	29.1 Mm <sup>3</sup>
Final crest elevation	254 m	246 m
Final height	100 m	80 m
Maximum elevation of adjacent topography	192 m	190 m
Footprint area	80.8 ha	61.0 ha

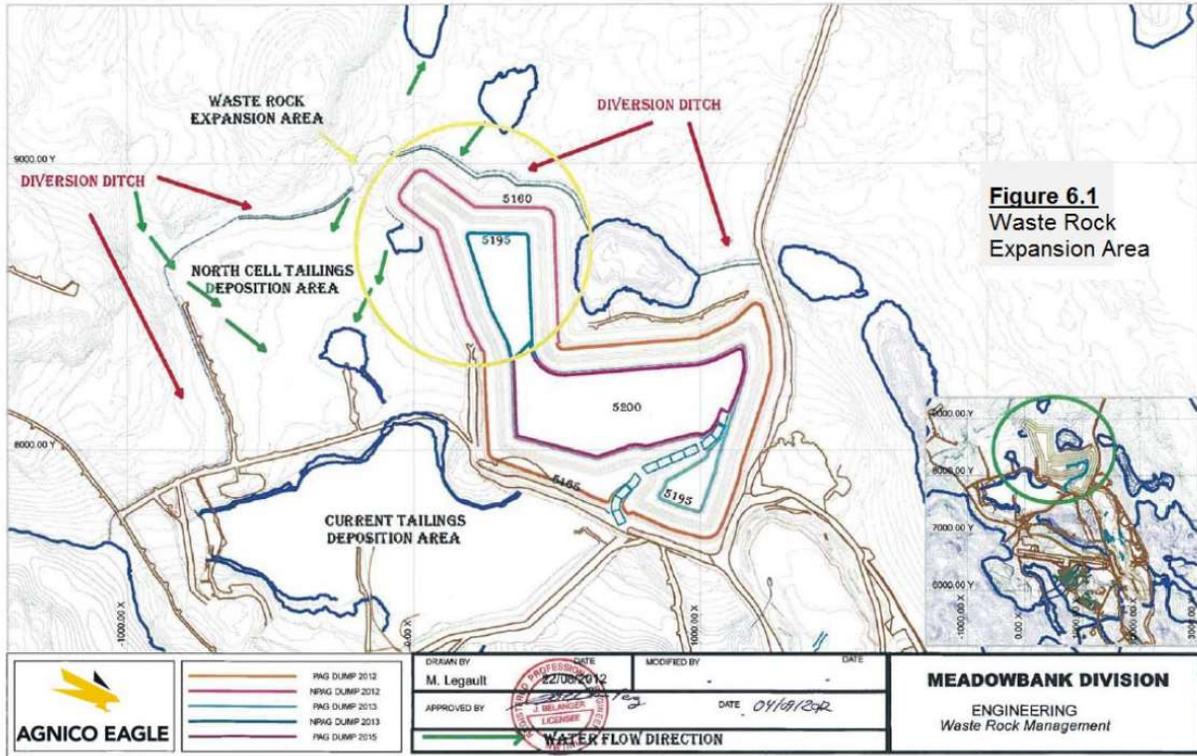


Figure 5-1: Waste Rock Expansion Area (Temporary NAG Storage Area)

## **6 TAILINGS MANAGEMENT**

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Tailings are the material by-product of the gold recovery process produced by the process plant. Tailings are pumped as a slurry from the process plant to the Tailings Storage Facility or to the mined-out area of Goose and Portage Pits.

The tailings storage facility (TSF) is a permanent storage facility for tailings produced during the operation of the mine. It is located north of the Process Plant Site within the dewatered portion of the northwestern arm of Second Portage Lake.

Tailings containment in the TSF is achieved by the construction of a series of dikes. The structures of the TSF are raised as additional tailings capacity is required. The maximum allowed El. of the North Cell and South Cell peripheral structures is El. 150 masl, while the maximum allowed El. of the North Cell Internal Structure is El. 154 m. Refer to Section 2.3 for description of the tailings containment infrastructures and their current elevation.

Tailings containment through in-pit deposition is achieved by depositing tailings in the mined-out areas of Goose Pit and Portage Pit.

### **6.1 TAILINGS MANAGEMENT STRATEGY**

Tailings deposition is done using end of pipe deposition with one active point at a time. The deposition point location and duration are determined from the tailings deposition plan. Changing between deposition points on a given line consist of stopping the flow of tailings in the line, redirecting it through a by-pass, flushing the line, relocating the deposition point pipe and then switching tailings from the by-pass to the newly installed deposition line.

#### **6.1.1 TSF Tailings Management Strategy**

The TSF was designed in two cells (North and South) in order to allow tailings management in smaller areas with shorter beach lengths, reducing the amount of water that is trapped and permanently stored as ice, which would result in losing TSF capacity. Operation in cells also allows progressive closure, cover trials, and cover construction.

Due to the arid climate and permafrost environment, tailings in the TSF are disposed in a manner promoting freezeback. Given the length of time that water at the site is ice covered, sub aqueous disposal is preferred. It is anticipated that the tailings will eventually become encapsulated by permafrost; thus, limiting oxygen diffusion and water infiltration into the tailings, seepage from the tailings, and the generation of acid mine drainage. Refer to the 2020 water management plan for information on how water is managed within the TSF.

When discharging tailings in the TSF, planning is aligned with the tailings management strategy and considers the following aspects:

- The deposition sequence informs the dike construction activity and ensures enough capacity to store the life of mine tailings while maintaining adequate freeboard (2.0m for water and 0.5m for tailings);
- The deposition sequence maintains a reclaim pond with sufficient depth for efficient operation of the reclaim pumping system while minimizing pond volume as TSF operation best practices;
- The deposition sequence maintains beaches on the upstream faces of perimeter dikes;
- The deposition sequence promotes sub-aqueous deposition in winter to limit ice entrapment;
- The deposition sequence promotes freezing of the tailings during the operating period and;
- The deposition sequence maximizes certain areas of the TSF earlier in order to promote rockfill capping during operation.

### **6.1.2 In-Pit Tailings Management Strategy**

In-pit tailings disposal will occur in Goose Pit, Pit E, and Pit A. The deposition strategy is to start in-pit tailings deposition in Goose Pit, then in Pit E and then to eventually alternate tailings deposition between Pit E and Pit A as to limit the gradient between these two pits and the Portage Central Dump. In-pit tailings deposition commenced in Goose Pit in July 2019.

In-pit tailings disposal was originally planned to occur using crest and ramp deposition points, with the long-term strategy to use crest deposition in summer, and discharge along the pit ramp in winter, in order to facilitate water transfers. In 2020, all deposition occurred from the crest and summer and winter discharge was the same.

The in-pit tailings deposition strategy will ensure the respect of these freeboard criteria:

- 8 m tailings freeboard with Third Portage Lake water elevation (maximum tailings El. 125.6masl). This freeboard is required to ensure a minimum water cover of 8 m at closure;
- Portage Pit A and Pit E water elevation to maintain a 2 m freeboard with the lowest point of the West Road (which is planned to be raised as required);
- Goose Pit tailings freeboard to respect a highest elevation of 120masl, to ensure a 13.6m freeboard near Bay Goose Dike.

During in-pit tailings deposition, reclaim water is pumped to the mill from either Portage Pit A or Pit E. Reclaim water is pumped from a location that allow a low levels of Total Suspended Solid (TSS) to be returned to the mill. The volume that is reclaimed will be adjusted to ensure a minimum water cover of 3 m during in-pit deposition.

In addition, to ensure that the water level in Goose Pit remains below 128 masl during operation and provide enough volume for the reclaim in Pit A, water from Goose Pit is transferred to Portage Pit A or Pit E as required. Water transfer from Goose Pit only occurs during the summer period. Switch of pit for tailings deposition are scheduled as needed during planned extended mill shutdowns, generally in March or September.

The tailings deposition plan is aligned with the tailings management strategy.

## **6.2 TAILINGS DEPOSITION – 2020**

**Table 6-1** presents the history of tailings deposition in the TSF and pits. Deposition was done according to the deposition plan, which considers various factors such as construction sequence, remaining capacity and limiting ice entrapment during winter deposition.

**Table 6-2** presents the amount of tailings deposited in 2020 and their properties measured at the mill. It should be noted that the tailings densimeter broke in June 2020 and that assumed density values have been used after June 8<sup>th</sup>.

In 2020 tailings deposition occurred in Goose Pit from January to mid-August, and in Pit E for the remainder of the year.

In 2020, the deposition strategy in the pits was to discharge tailings in the pits from the crest in both pits. At the end of March 2020, the tailings deposition was interrupted due to a mill shutdown during the onset of the COVID-19 pandemic. At this time, the mill was still recirculating water. Deposition of tailings resumed at the end of May 2020 in Goose Pit.

**Table 6-1: Deposition Location (Realized)**

Date	Deposition location	Tailings deposited (dried tonnes)
February 2010 to November 2014	North Cell	16.0Mt
November 2014 to July 2015	South Cell	2.7Mt
July 2015 to October 2015	North Cell	1.0Mt
October 2015 to August 2018	South Cell	10.8Mt
August 2018 to October 2018	North Cell	0.5Mt
October 2018 to April 2019	South Cell	1.4Mt
April 2019 to July 2019	North Cell	0.6Mt
July 2019 to December 2019	Goose Pit	1.4Mt
January 2020 to August 2020	Goose Pit	1.4 Mt
August 2020 to December 2020	Pit E	1.2 Mt

**Table 6-2: 2020 Processed Tailings Volume and Associated Properties**

	Total Dry Tailings (tonnes)	Density of Tailings (% solid)	Density of Slurry (tonnes / m <sup>3</sup> )	Tailings Placed in TSF (m <sup>3</sup> )
January-20	220,316	58.2%	1.63	135,163
February-20	198,217	54.4%	1.63	121,606
March-20	160,266	48.9%	1.63	98,323
April-20	0	N/A	N/A	0
May-20	30,296	57.2%	1.63	18,587
June-20	281,982	46.4%	1.63	172,995
July-20	300,850	46.5%	1.63	184,571
August-20	292,719	46.5%	1.8	162,622
September-20	313,712	46.5%	1.8	174,284
October-20	219,600	46.5%	1.8	122,000
November-20	275,307	46.5%	1.8	152,948
December-20	309,563	46.5%	1.8	171,979
<b>TOTAL-20</b>	<b>2,602,828</b>	<b>48.1%</b>		<b>1,515,077</b>

### **6.2.1 Parameter Analysis – 2020**

Bathymetries of Goose Pit were performed in August 2020. No parameter analysis of the South Cell and North Cell were completed as no deposition occurred during the year. When deposition restarts in a cell, a parameter analysis will be performed at that time, in order to fine tune the model. Results of historical parameter analysis of the TSF are presented in **Table 6-3**. These analyses were performed in 2019 by comparing the results to the previous realized bathymetry.

Goose Pit bathymetry presented results based on the first full year of data. The parameters are presented in **Table 6-4**. In 2021, bathymetries are planned in all the pits. The tailing dry density bathymetric results gave a value of 1.8 t/m<sup>3</sup>, higher than the design value of 1.45 t/m<sup>3</sup>. Beach slope was measured to have 2-3% gradient in the first 75m around the deposition point. Lastly, in-pit waste rock dumps porosity was not calculated since 2019, when the results approached SNC's estimation of 30%, and as such, this value was kept.

**Table 6-3: Yearly Tailings Deposition Parameter Evolution – TSF**

	Tailings Dry Density (t/m <sup>3</sup> )	Sub-aerial beaches (%)	Sub-Aqueous beaches (%)	Ice entrapment (%)
<b>2014</b> (North Cell and South Cell)	1.28	0.45	4.00	60%
<b>2015</b> (South Cell)	1.45	1.10	3.60	36%
<b>2016</b> (South Cell)	1.48	0.88	3.03	39%
<b>2017</b> (South Cell)	1.30	0.73	2.95	38%
<b>2018</b> (South Cell)	1.26	0.58	2.36	61%
<b>2018</b> (North Cell)	1.28	0.45	2.36	61%

Note: Yearly averages are presented

**Table 6-4: Yearly Tailings Deposition Parameter Evolution – IPD**

	Tailings Dry Density (t/m <sup>3</sup> )	Sub-Aqueous Beaches - First 100m (%)	Sub-Aqueous Beaches – Post 100m (%)	Waste Rock Porosity (%)
<b>2019</b> (Goose Pit)	1.45	10.0	1.00	30%
<b>2020</b> (Goose Pit)	1.8	10.0	1.00	30%

Note: Yearly averages are presented

### 6.3 TAILINGS DEPOSITION PLAN – 2020-2026

An updated version of the tailings deposition plan from January 2020 until the end of milling, July 2026, is presented in Appendix B. This updated tailings deposition plan considers up to date tailings parameters. The water management strategy related to this deposition plan is also presented in Appendix B.

As mill processing rates and tailings characteristics may fluctuate over the life of the mine, the tailings deposition plan will continue to evolve based on changes in design parameters including mill process rates, tailings beach slopes, waste rock porosity, tailings specific gravity and tailings in-situ densities. These parameters are re-evaluated every time the deposition plan is updated. **Table 6-5** presents the input parameters that were used to update the tailings deposition plan. The key input parameters that impacts the performance of the tailings deposition are the following:

- Tonnage profile;
- Tailings beach slope;
- In-situ dry density;
- Tailings specific gravity
- Waste rock porosity.

**Table 6-6** presents a summary of the deposition strategy from 2021 to 2026 based on the output of the deposition modelling. The strategy of this tailings deposition plan was to minimise freshwater consumption, and ensure operational flexibility to react to potential new challenges brought by the in-pit deposition.

The deposition plan demonstrates the remaining capacity after 2026 for additional in pit deposition.

*Table 6-5: Input Parameters for Tailings Deposition Plan – 2021-2023 Deposition Plan*

Period	Dried Tonnage (tonnes)	IPD Specific Gravity (t/m <sup>3</sup> )	IPD TDD (t/m <sup>3</sup> )	Tailings Beach Slope – First 75m	Tailings Beach Slope – Post 75m
Jan-21	302,120	2.96	1.8	10%	1%
Feb-21	272,240	2.96	1.8	10%	1%
Mar-21	302,120	2.96	1.8	10%	1%
Apr-21	232,980	2.96	1.8	10%	1%
May-21	290,120	2.96	1.8	10%	1%
Jun-21	292,160	2.96	1.8	10%	1%
Jul-21	302,120	2.96	1.8	10%	1%
Aug-21	286,350	2.96	1.8	10%	1%
Sep-21	292,160	2.96	1.8	10%	1%
Oct-21	228,980	2.96	1.8	10%	1%
Nov-21	277,160	2.96	1.8	10%	1%
Dec-21	302,120	2.96	1.8	10%	1%
Jan-22	316,680	2.96	1.8	10%	1%
Feb-22	285,360	2.96	1.8	10%	1%
Mar-22	316,680	2.96	1.8	10%	1%
Apr-22	293,262	2.96	1.8	10%	1%
May-22	361,828	2.96	1.8	10%	1%
Jun-22	361,504	2.96	1.8	10%	1%
Jul-22	373,828	2.96	1.8	10%	1%
Aug-22	354,315	2.96	1.8	10%	1%
Sep-22	361,504	2.96	1.8	10%	1%
Oct-22	289,262	2.96	1.8	10%	1%
Nov-22	346,504	2.96	1.8	10%	1%
Dec-22	373,828	2.96	1.8	10%	1%
Jan-23	353,012	2.96	1.8	10%	1%
Feb-23	353,012	2.96	1.8	10%	1%
Mar-23	353,012	2.96	1.8	10%	1%
Apr-23	345,935	2.96	1.8	10%	1%
May-23	345,935	2.96	1.8	10%	1%
Jun-23	345,935	2.96	1.8	10%	1%
Jul-23	360,857	2.96	1.8	10%	1%

**Table 6-6: Deposition Plan– Summary**

<b>Date</b>	<b>Discharge Location</b>	<b>Dry Tonnes Deposited</b>	<b>Comments</b>
January 2021 -July 2022	Pit E	5.70 Mt	<ul style="list-style-type: none"> <li>• Reclaim water from Pit A               <ul style="list-style-type: none"> <li>a. Reclaim system optimization early in 2021. Increase reclaim capacity by 50 to 100 m3/h</li> </ul> </li> <li>• June to August 2021 and July 2022: Water transfer from Goose Pit to Pit A</li> </ul>
August 2022 – July 2023	Pit A	4.18 Mt	<ul style="list-style-type: none"> <li>• Reclaim water from Pit E</li> <li>• July 2023: Water transfer from Goose Pit to Pit E</li> </ul>
August 2023 – July 2025	Pit E	8.50 Mt	<ul style="list-style-type: none"> <li>• Reclaim water from Pit A</li> <li>• July 2024: Water transfer from Goose Pit to Pit A</li> </ul>
August 2025 – July 2026	Pit A	3.40 Mt	<ul style="list-style-type: none"> <li>• Reclaim water from Pit E</li> <li>• August 2025: Water transfer from Goose Pit to Pit E</li> </ul>

#### **6.4 MONITORING OF TAILINGS SEEPAGE**

Following dewatering of 2PL Arm and during investigations and construction of the TSF perimeter dikes, several investigative procedures were used to identify the location and hydraulic properties of faults that are inferred to be present beneath the North Arm of 2PL including mapping of exposed bedrock and packer testing in boreholes.

The results of the investigations were used to locate monitoring wells and thermistors that are and will be installed within the dikes, and between the Central Dike and crest of the Portage Pit. Thermal data is monitored to evaluate seepage from the TSF and freezeback of the TSF, and of the Central Dike, Saddle Dam and Rockfill perimeter containment foundations. More information regarding thermal data and monitoring is located in the Thermal Monitoring Plan and the 2020 Thermal Monitoring Report, both included in the 2020 Annual Report.

- If monitoring indicates flow rates and water qualities of concern, then mitigation measures would be undertaken. Collection of any seep water will be required for pumping it back to the TSF. The potential mitigation action would be dependent on observed flow rates and water quality data;
- If, during monitoring, the freezeback of the dike and tailings deposit is found to be occurring at a rate less than predicted, then enhancement by artificial freezing methods (i.e. thermosyphons) may be considered.

Refer to the 2020 Water Management Plan and Report for details on the Central Dike seepage and to the Tailings Storage Facilities OMS Plan for seepage monitoring and mitigation actions, both included in the 2020 Annual Report.

#### **6.5 MONITORING OF TAILINGS DUST**

Since tailings deposition has been switched from the South Cell and North Cell to the Pits, the tailings surface has been progressively drying out, especially in the North Cell where less water is retained. As a result, the surface is more prone to erosion by the wind in the absence of continuous deposition. In October 2020, high winds combined with the dry tailings surface generated a significant dust event. A communication was sent to the DFO and mitigation measures are in the process of being implemented to prevent further dust generation from erosion. The generation of tailings dust is being closely monitored.

## **7 CONTROL STRATEGIES FOR ACID ROCK DRAINAGE – COVER DESIGN**

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Some rock lithologies from the Meadowbank mining activity are potentially acid generating (PAG) which can raise the concern of generating acid drainage. This section describes the control strategy used at Meadowbank to limit acid rock drainage from the tailings and waste rock.

During selection of the acid rock drainage control strategies for the disposal of the mine waste at the Meadowbank Gold Mine, consideration was given to control strategies that are effective in Arctic regions.

Common control strategies for the prevention or reduction of acid mine drainage in cold regions are:

1. Control of acid generating reactions;
2. Control of migration of contaminants; and
3. Collection and treatment.

In assessing the overall control strategies for the Meadowbank Gold Mine, emphasis has been placed on methods that satisfy (1) and (2), which then has an impact on (3) by potentially reducing the requirements for these activities. Table 7-1 presents various acid mine drainage control strategies for Arctic conditions that can be found in the literature.

**Table 7-1: Acid Mine Drainage Control Strategies of the Arctic**

Strategy	Tailings	Waste Rock
Freeze Controlled	Total or perimeter freezing options can be considered. Can freeze up to 15 m annually if freezing in thin layers. Freezing rate decreased proportionately with depth. Process chemicals could cause high unfrozen water content.	Requires considerable volumes of non-acid waste rock for insulation protection. Better understanding of air and water transport through waste rock required for reliable design.
Climate Controlled	May not be a reliable strategy for saturated tailings.	Requires control of convective airflow through waste rock, infiltration control with modest measures and temperature controls. Better understanding of waste rock air, water, and heat transport for reliable design.
Engineered Cover	Special consideration for freeze-thaw effects. Availability and cost of cover materials are major impediments.	
Subaqueous Disposal	Special considerations for winter ice conditions and pipeline freeze-up.	Very difficult to dispose of waste rock beneath winter ice.
Collection and Treatment	Costly to maintain at remote locations Long term maintenance cost.	
Segregation and Blending	Tailings are normally geochemically homogeneous.	May be very effective. Research and development on-going.

**Reference:** (MEND 1.61.2, 1996)

The acid rock drainage control strategy for in-pit deposition is subaqueous disposal.

The acid rock drainage control strategies retained at Meadowbank for the TSF and RSF is freeze control and climate control strategies. These strategies involve placing a sufficiently thick cover of non-potential acid generating (NAG) waste rock over the PAG material to provide insulation protection so that the PAG material stays frozen while the active layer is maintained within the NAG material. Based on the quantity of available NAG rock now that production has ceased, there is sufficient NAG rock available to provide cover over the Portage RSF. For the TSF cover this will be confirmed in the upcoming year. The Vault RSF capping is complete. The TSF and RSF cover thickness design will be different as the thermal phenomena within each facility will be different. For example, the tailings are much finer than the waste rock, which will impact the convective airflow model due to lower air conductivity and higher water content.

Freeze control strategies rely on the immobilization of pore fluids to control acid mine drainage reactions, and the potential migration of contaminated pore water outside of the storage facility.

The climate conditions at the Meadowbank Gold Mine site are suitable to freeze control strategies. In addition to immobilization of pore fluids, permafrost can reduce the hydraulic conductivity of materials by several orders of magnitude.

Climate control strategies rely on cold temperatures to reduce the rate at which oxidation occurs. The low net precipitation in permafrost regions limits infiltration of water into waste rock and tailings disposal areas. Consequently, the climate of the Meadowbank Gold Mine area will act as a natural control to reduce the production of acid mine drainage. Climate control strategies are best applied to materials placed at a low moisture content such as waste rock to reduce the need for additional controls on seepage and infiltration.

Research activities have been undertaken since 2014 in collaboration with the Research Institute Mines and Environment (RIME) to optimize the control strategies to be used in Meadowbank for the RSF's and the TSF's.

Thermistors are installed in the Portage RSF and TSF North Cell to monitor thermal behavior as an adaptive management technique. More information regarding thermal data and monitoring is in the Thermal Monitoring Plan and the 2020 Thermal Monitoring Report, both included in the 2020 Annual Report.

## **7.1 TSF COVER DESIGN**

Capping trials and test pads have been constructed on the TSF North Cell in 2014 and 2015, in collaboration with the Research Institute on Mines and the Environment (RIME) to gather data that will help determine the most appropriate design for the site conditions. The design of the cover for the North Cell and South Cell has been initiated in 2015 and 2016. The design is still in progress and the final design will be presented in the Final Closure and Reclamation Plan.

Design criteria specific to the cover system design include:

- The tailings material placed within the North Cell should be entirely frozen after a period of 10 years following completion of the capping (frozen defined as tailings temperature <0°C).
- The freezing front should continue at depth into the lakebed sediments and the bedrock underlying the North Cell, thus eliminating the talik currently in place. The time required for this phenomenon to take place will be determined from modelling and is to be corroborated by monitoring of ground temperatures following closure.
- The tailings are to remain frozen for a period of over 150 years following closure, taking into account the agreed-upon climate change scenario. This will be based on modelling and monitoring of ground temperatures following closure of the facility.
- Ground temperature monitoring should be conducted for a minimum of ten years following closure of the TSF and data compared to the modelled scenario. Model

parameters are to be adjusted based on monitoring data and then the future ground temperature predictions are to be refined.

- For 90% of the TSF surface area, the active layer shall remain within the constructed NAG cover system and the underlying tailings material shall remain frozen for a warm year event with a return period of 1 in 100 years, accounting for the climate change scenario.
- In areas where the active layer extends into the tailings material, the thawed layer should be limited to the upper 30 cm of the tailings mass and saturation of the tailings should remain above 85% to limit oxidation of the tailings.
- As an additional method to reduce tailings reactivity, the degree of saturation within the tailings mass should remain above 85%. This will reduce the tailings reactivity should part of the upper region of the tailings mass thaw during a warm year event.

Conceptual cover system designs previously modelled (Golder, 2008) and presented in the interim closure plan (Golder, 2014) rely on aggradation of the tailings material into the surrounding permafrost to limit the production of Acid Mine Drainage (AMD) and the movement of contaminants through surface water and groundwater. The construction of a cover system consisting of non-acid generating granular material (NAG) over the tailings material ensures that the active layer (material going through freeze-thaw cycles, overlying permafrost) remains within the benign material. The objectives of the cover system are to maintain the tailings material below 0°C under most conditions and to maintain saturation above 85%.

The design for the engineered cover system is a layer of compacted NAG waste rock (ultramafic) with a minimum thickness of 2.0 m. The design was developed as a result of soil-plant-atmospheric (S-P-A) modelling, as well as thermal and seepage modelling. Visual observations in the field show that the ultramafic material is heterogeneous with coarser and finer zones so it will be possible that some part of the capping is more insulative than others. As the capping is done in winter over frozen tailings using such a material will have an advantage as it will allow to better preserve the freezing condition of the tailings while limiting water infiltration in the cover.

Thermal modelling shows that the tailings material beneath the minimum 2.0 m thick cover will remain frozen for all years (excluding the warmest years) from the 100-year database, accounting for climate change. The unfrozen tailings are segregated in the upper 0.5 m of the TSF and remain above 85% saturation, thus reducing the risk of oxidation until the material freezes back into the permafrost over time.

The TSF closure design will also include a landform that promotes water shedding from all surfaces covered. TSF landform material placement will be achieved by backfilling using the same material as the cover. With this strategy, the current closure landform plan indicates that the cover thickness over most of the landform will generally be significantly thicker than 2 m reaching up to 8.0 m in certain portions due to the tailings topography.

Additional thermal monitoring and analysis will be required to verify the performance of the cover system against the design intent and inform on the final cover design. Final cover details for the TSF will be subject to modification depending on the results obtained from the site trials as well as from data provided from the Thermal Monitoring Program.

Results of the modelling and the cover design will be provided in the Final Closure and Reclamation plan for the Meadowbank site.

## **7.2 IN-PIT COVER DESIGN**

An 8 m water cover will be maintained at closure for in-pit tailings. This will be achieved by maintaining an 8 m water freeboard from the highest tailings point to normal 3PL elevation (133.6masl) and by performing pit flooding at closure. This water cover depth will ensure that the tailings will not be re-suspended due to wave effect and ice formation, and will limit access of aquatic life to it.

## **7.3 RSF COVER DESIGN**

For the Portage waste rock storage, the current plan considers a cover of NAG rock placed over the PAG material present in the waste rock piles. The majority of the Portage RSF was covered with NAG material during operations. For Vault, the waste rock is mainly NAG, and the PAG waste rock was encapsulated in the center of the pile during operations.

Based on the results of the initial thermal modelling, it is expected that the material within the RSFs will freeze within two years of placement. The use of coarse rockfill material within the waste dump will allow the development of convective cooling during winter, and insulation through trapped air within voids during summer. Given the high evaporation rate and low annual average precipitation at the site, the water infiltration into the pile is expected to be low.

The RSF cover design from the FEIS consists of a 4 m thick layer of non-acid generating (NAG) rockfill to contain the active layer within the NAG cover. The depth of cover was selected based on thermal modelling and instrumentation to assess the probable thickness of the active layer at closure including climate change. The NAG cover will not be compacted during construction, but this is considered in the thermal model and in the thickness of the cover.

Additional thermal monitoring and analysis will be required to verify the performance of the cover system against the design intent and inform on the final cover design. Final cover details for the RSF will be subject to modification depending on the results obtained the Thermal Monitoring Program.

## **8 MONITORING AND CLOSURE**

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Mine closure and reclamation will utilize accepted management practices and appropriate mine closure techniques that comply with accepted protocols and standards. Closure will be based on project design and operation to minimize the area of surface disturbance, stabilize disturbed land surfaces and permafrost against erosion, and return the land to post-mining uses for traditional pursuits (MMC, 2007a). An updated Interim Closure and Reclamation Plan was prepared by Golder in March 2020. The document was included as part of AEM's 2019 Annual Report.

All infrastructure associated with waste management facilities will be re-contoured and/or surface treated according to site specific conditions to minimize windblown dust and erosion from surface runoff, avoid acid rock drainage and to enhance the re-establishment of natural vegetation and wildlife habitat. A Final Reclamation and Closure Plan will be issued in accordance with the Water License.

The post-closure general concept for the Meadowbank site is illustrated in Figure 8-1. Mine waste rock storages for Portage and Vault and the North Cell TSF will be progressively closed during and after mine operations.

### **8.1 TSF RECLAMATION**

The ultimate goals for reclamation of the TSF are to mitigate long-term environmental effects to the aquatic receiving environment and to establish a landform similar to that of the natural surrounding area.

To achieve the goals and criteria for the reclaimed TSF, the final design will consist of a landform that promotes water shedding from all surfaces covered by an engineered cover system. During the post-closure period, the tailings are predicted to freeze with time, resulting in permafrost encapsulation.

The final landform will consist of two watersheds in the North Cell, each one having its own outlet, and one landform for the South Cell. Around half of the North Cell area discharges through a first outlet in a sump and ditch at the North leading to 3PL. The second outlet discharges via a spillway to the lower South Cell cover. From this point, this water is mixed with the South Cell watershed going through a sump and ditch system in such a way that water is drained from both covers, in line with closure requirements. Design objectives are to minimize cover material volumes and tailings excavation by taking advantage of the tailings surface and balancing the required excavation and cover system material volumes. Several scenarios were prepared on both the North Cell and South Cell to minimize rockfill volumes and the most optimal ones were chosen.

The facility minimum slope angle for the cover surface is 1%. Water is moved off the cover using a surface water management system consisting of grading the plateau areas towards engineered surface runoff drainage channels. The runoff drains have a minimum slope of 0.5%.

The surface water management plan for the reclaimed TSF is to minimize erosion, thus reducing suspended sediment loading to the receiving environment, and to safely convey runoff water in the event of a storm event coupled with spring snowmelt. To achieve this, the surface water management system will be constructed using riprap-lined drainage channels and riprap-lined aprons at the outlet of each catchment. It should be noted that run off water will be directed to the South Cell or to the Portage Pit until it meets criteria for direct discharge to Third Portage Lake. This is discussed in the 2020 Water Management Plan.

At closure water will be removed from the South Cell and North Cell of the TSF. Once the North Cell and South Cell TSF reclaim ponds will be dewatered, the migration of seep water into the talik beneath the North Arm of Second Portage Lake can only occur by diffusion. The rate of advance of the freezing front into the talik beneath the 2PL is expected to exceed the rate of advance of diffusive transport.

North Cell progressive capping occurred from winter of 2015 to 2019 using mainly ultramafic rockfill from the Portage Pit operation. No capping was done in 2020. Capping will be completed once the operation of the North and South Cell is completed. AEM is evaluating on a regular basis favorable locations for progressive capping.

## **8.2 IN-PIT CLOSURE**

The closure strategy for in-pit tailings deposition areas consist of pit flooding and dike breaching once the water quality is met. Details of this strategy are presented in the water management plan.

### **8.2.1 Pore Water Quality**

The Pore Water Quality Monitoring Program will serve to characterize and monitor the chemical composition of existing IPD tailings pore water. This will be used to monitor, update, and calibrate, if required, hydrogeological and contaminant transport models previously developed. Samples are collected at the mill on a monthly basis during first year of operation. Once Goose Pit reaches full storage capacity, pore water quality will be collected directly from the in-pit tailings, once safe to do so. For more details, refer to Pore Water Quality Monitoring Program.

## **8.3 RSF CLOSURE**

For the Waste Rock Storage Facility, the current closure plan consists of the placement of a 4m cover of NAG rock placed over the PAG material. This capping was continually built around the perimeter as parts of the RSF reached their limits. To date, approximately 90% of the Portage RSF has been covered. The final capping will be completed at closure. Based on the results of the planned thermal monitoring and additional thermal modeling it is possible that additional capping will be required to achieve performance of the cover meeting design intent. Details of the Portage RSF closure will be presented in the Final Closure and Reclamation Plan.

For Vault, the waste rock stored is mainly NAG, and the PAG waste rock is encapsulated in the center of the pile during operations resulting in a thickness of NAG larger than 4 m acting as a cover.

The surfaces of the Portage and Vault RSFs will be contoured where required to direct drainage respectively to the TSF (see **Figure 8-2Error! Reference source not found.**) and towards Vault Pit (see **Figure 8-3**). Note that Section A in **Figure 8-2Error! Reference source not found.** is conceptual and does not represent the completed design work of the TSF North Cell cover. The runoff water from the Vault and Portage RSFs will be monitored at closure.

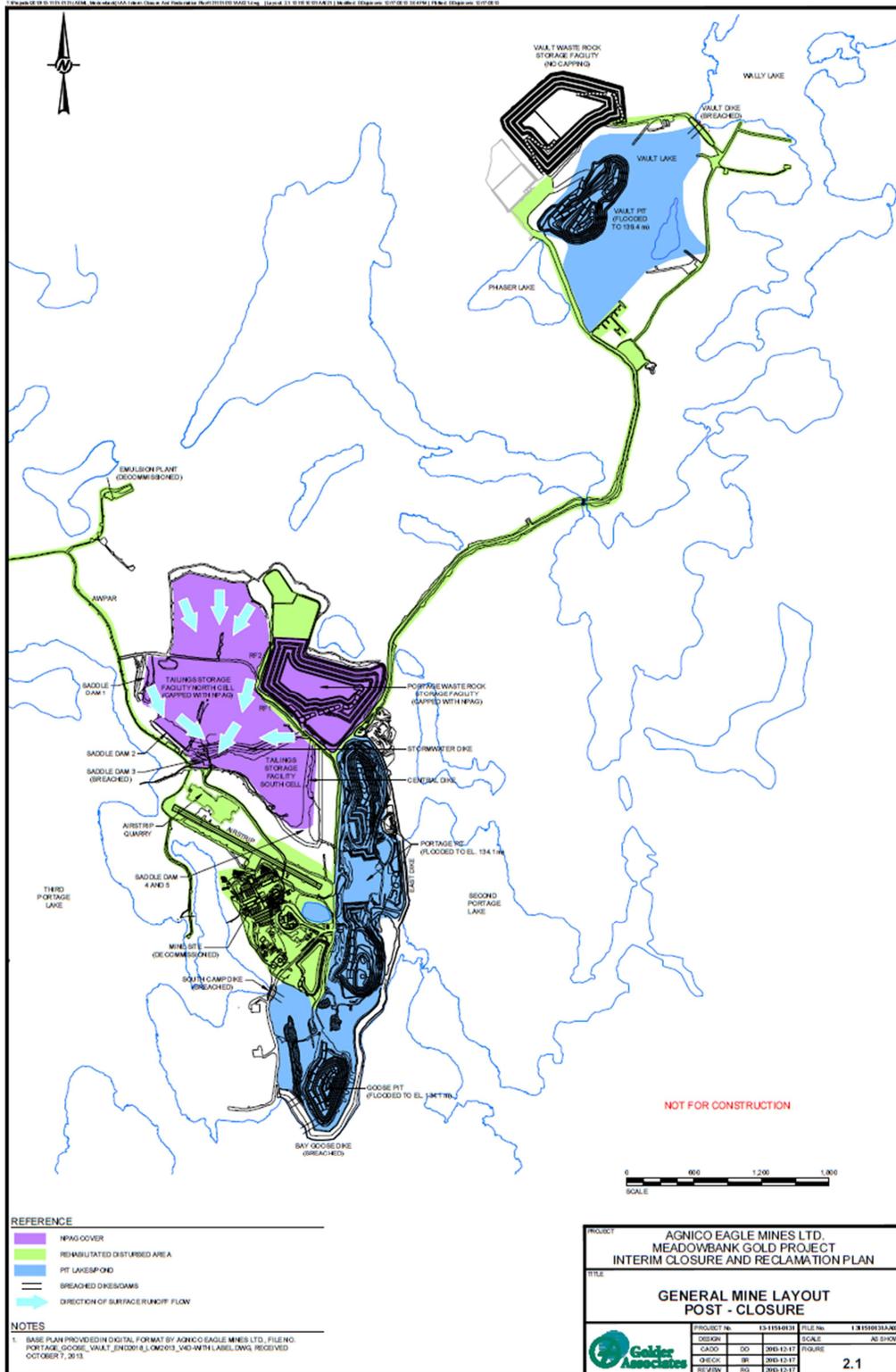
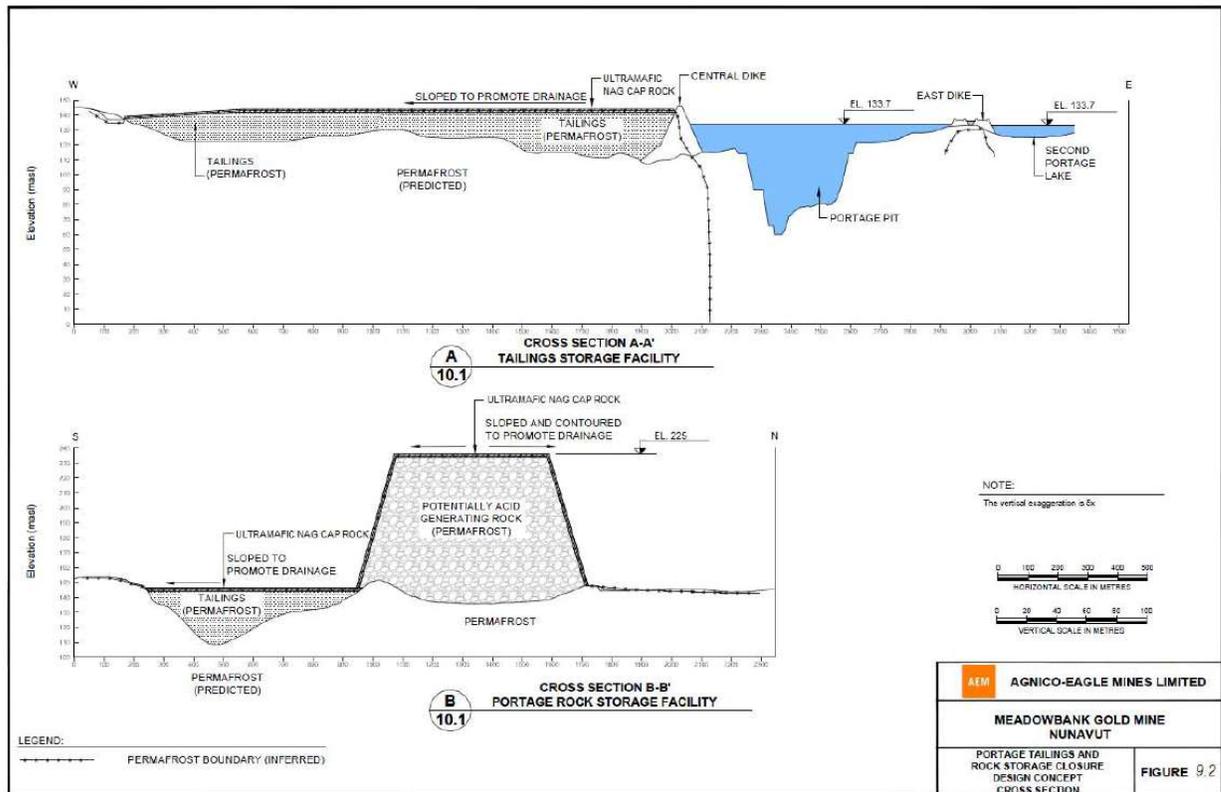
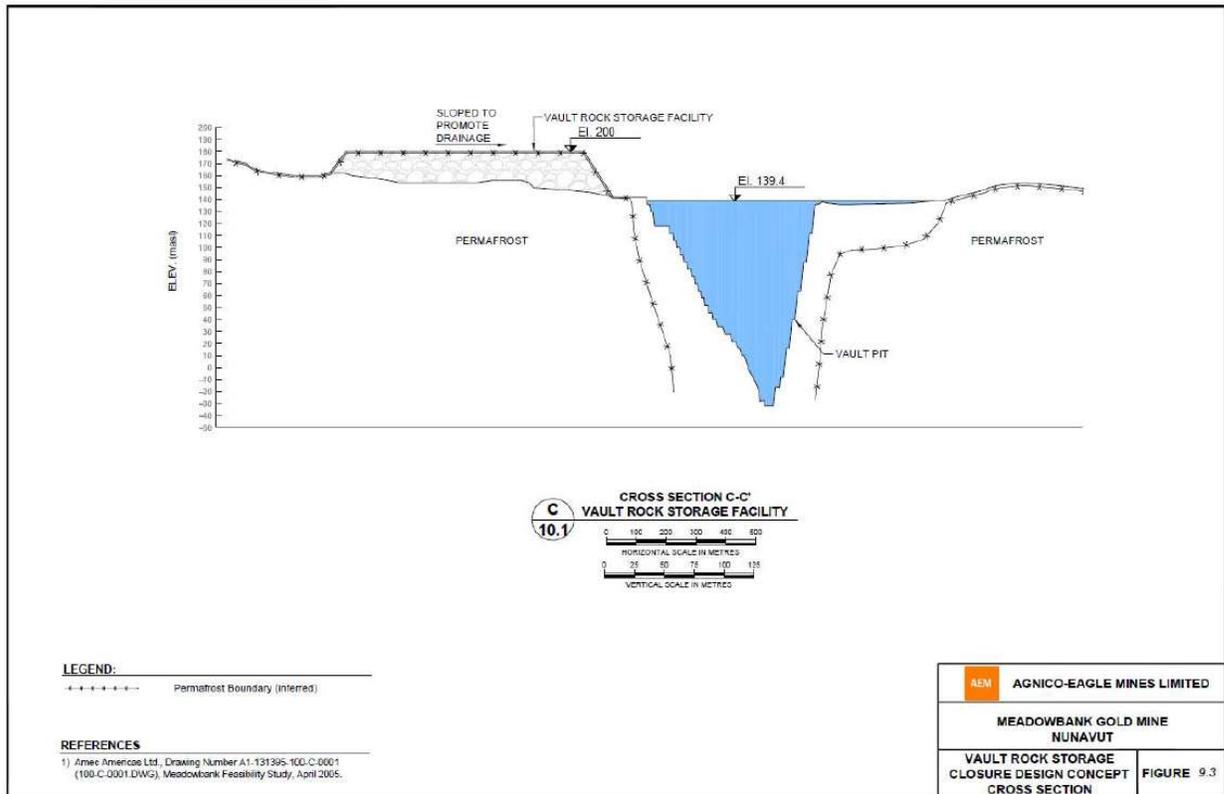


Figure 8-1: Site Post Closure Concept



**Figure 8-2: Portage Tailings and Rock Storage Closure Design Concept Cross Section**



**Figure 8-3: Vault Rock Storage Closure Design Concept Cross Section**

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MEADOWBANK GOLD PROJECT  
UPDATED MINE WASTE ROCK AND  
TAILINGS MANAGEMENT PLAN

**APPENDIX A**

**Meadowbank Mined Material Balance (2009-2020)**

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**Table A: Meadowbank Mined Tonnages for 2009**

	North Portage (Tonnes)			South Portage (Tonnes)			Total (Tonnes)
	Rock	Ore	Waste	Rock	Ore	Waste	-
January	160,294	-	-	-	-	-	-
February	103,323	-	-	-	-	-	-
March	256,972	-	280	-	-	-	-
April	388,725	12,733	1,306	-	-	-	-
May	516,829	-	-	-	-	-	-
June	531,933	729	-	-	-	-	-
July	584,364	5,910	6,820	-	-	-	-
August	741,518	-	-	-	-	-	-
September	528,191	9,618	4,445	-	-	-	-
October	640,295	42,452	250	19,778	-	2,548	-
November	378,005	33,247	3,167	601,807	94,848	4,061	-
December	322,641	6,307	-	341,547	339,991	-	-
<b>TOTAL</b>	<b>**5,153,090</b>	<b>***110,996</b>	<b>*16,268</b>	<b>**963,132</b>	<b>***434,839</b>	<b>*6,609</b>	<b>6,684,934</b>
*Total Waste Rock Transferred to Waste Dump							22,877
**Total Rock Used for Construction Purposes (road, dikes, etc.)							6,116,222
***Total Ore							545,834

**Table B: Meadowbank Mined Tonnages for 2010**

	Portage Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	97,446	223,842	190,281	156,162	173,736	-	-	-	744,021	-
February	43,979	281,368	46,654	123,727	359,649	-	32,298	1,295	844,991	47,745
March	75,333	503,299	107,635	-	197,125	23,540	-	-	831,599	163,399
April	116,940	258,416	63,100	171,451	428,814	-	-	6,196	927,977	176,857
May	136,444	258,481	10,019	148,576	672,724	-	-	50,073	1,139,873	177,610
June	152,606	534,039	24,748	126,155	401,748	-	-	12,632	1,099,322	215,389
July	236,768	471,106	176,169	127,379	237,095	-	-	-	1,011,749	193,422
August	225,467	493,626	506,385	168,085	115,930	-	-	-	1,284,026	215,559
September	272,675	503,624	606,044	161,673	214,866	5,621	-	-	1,491,828	227,502
October	232,888	235,924	595,322	56,337	461,627	53,522	-	-	1,402,832	198,394
November	247,401	3,813	104,087	8,991	963,805	-	-	-	1,080,596	218,260
December	323,641	-	299,167	8,991	1,118,767	-	-	-	1,426,925	214,400
<b>TOTAL</b>	<b>2,161,588</b>	<b>3,767,538</b>	<b>2,729,611</b>	<b>1,257,527</b>	<b>5,345,886</b>	<b>82,683</b>	<b>32,298</b>	<b>70,196</b>	<b>13,285,739</b>	<b>2,048,537</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit

**Table C: Meadowbank Mined Tonnages for 2011**

	Portage Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	231,025	-	113,259	37,096	1,109,543	-	-	2,544	1,262,442	193,748
February	133,165	-	25,308	51,280	766,807	-	-	404	843,798	213,313
March	86,161	-	21,288	33,271	662,028	-	-	1,044	717,631	221,615
April	235,303	-	77,596	85,064	1,497,859	-	-	11,504	1,672,024	223,041
May	207,399	-	64,171	137,980	1,448,630	-	-	49,069	1,699,851	186,811
June	326,108	8,744	291,067	176,248	1,592,345	-	-	26,615	2,095,019	257,401
July	340,966	54,927	99,513	74,750	1,869,449	-	-	19,140	2,117,779	284,295
August	326,808	122,696	4,674	117,745	1,484,613	-	-	2,384	1,732,111	275,766
September	412,783	333,829	27,199	148,545	1,724,305	-	-	22,884	2,256,762	306,020
October	389,418	22,085	136,862	53,614	1,791,385	-	-	162,725	2,166,671	306,756
November	321,180	12,725	29,518	83,943	1,972,577	-	-	110,214	2,208,976	214,868
December	334,768	164,399	55,516	52,137	1,913,103	-	-	53,454	2,238,609	294,088
<b>TOTAL</b>	<b>3,345,084</b>	<b>719,404</b>	<b>945,971</b>	<b>1,051,671</b>	<b>17,832,645</b>	-	-	<b>461,981</b>	<b>21,011,673</b>	<b>2,977,722</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit

**Table D: Meadowbank Mined Tonnages for 2012**

	Portage Pit, Goose Pit & Vault Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	312,546	-	25,347	853	1,707,100	-	-	568,896	2,302,196	275,186
February	320,370	-	57,299	-	1,859,479	-	-	276,030	2,192,808	307,134
March	311,938	-	4,574	33,835	1,760,145	-	-	374,271	2,172,825	304,740
April	318,550	-	29,748	171,964	2,187,929	-	-	183,366	2,573,007	285,702
May	253,947	37,372	200,732	103,650	2,000,982	-	-	231,500	2,574,236	320,542
June	276,731	78,343	281,403	64,460	1,866,369	-	-	226,695	2,517,270	294,829
July	354,765	9,991	342,978	134,006	1,791,752	-	-	268,051	2,546,777	337,110
August	271,444	260,083	261,459	214,516	1,327,154	-	-	720,701	2,783,914	352,831
September	364,410	674,872	515,804	7,309	1,446,572	-	-	273,284	2,917,841	313,014
October	119,100	-	488,259	-	2,163,147	-	-	590,936	3,242,342	358,860
November	133,041	6,880	281,560	7,439	2,081,931	-	-	337,974	2,715,783	356,646
December	176,287	105,724	142,448	-	2,178,832	-	-	577,195	3,004,199	314,317
<b>TOTAL</b>	<b>3,213,129</b>	<b>1,173,266</b>	<b>2,631,610</b>	<b>738,031</b>	<b>22,371,392</b>	<b>-</b>	<b>-</b>	<b>4,628,899</b>	<b>31,543,198</b>	<b>3,820,911</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit & Goose Pit

**Table E: Meadowbank Mined Tonnages for 2013**

	Portage Pit, Goose Pit & Vault Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	184,536	-	14,052	531	2,486,541	-	-	222	2,501,346	320,729
February	196,802	-	61,036	8,913	2,495,018	-	-	-	2,564,967	329,709
March	311,380	1,520	58,325	393	2,691,265	-	-	294	2,751,797	368,323
April	271,823	317,845	79,530	77,730	2,071,408	-	-	82,810	2,629,323	309,458
May	336,532	269,930	51,645	-	2,299,765	-	-	29,650	2,650,990	363,625
June	249,724	397,170	252,710	153,310	1,443,285	-	-	494,975	2,741,450	355,498
July	330,024	54,525	16,010	111,360	2,234,897	-	-	340,655	2,757,447	368,058
August	316,136	-	92,460	145,385	2,824,875	-	-	125	3,062,845	321,294
September	307,532	-	61,465	5,940	2,774,724	-	-	98,255	2,940,384	357,595
October	353,697	-	33,470	-	2,504,101	-	-	188,000	2,725,571	377,118
November	282,046	-	35,365	-	2,637,689	-	-	-	2,673,054	300,779
December	299,298	-	18,490	-	2,073,386	-	-	125	2,092,001	370,655
<b>TOTAL</b>	<b>3,439,530</b>	<b>1,040,990</b>	<b>774,558</b>	<b>503,562</b>	<b>28,536,954</b>	<b>0</b>	<b>0</b>	<b>1,235,111</b>	<b>32,091,175</b>	<b>4,142,841</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit & Goose Pit

**Table F: Meadowbank Mined Tonnages for 2014**

	Portage Pit, Goose Pit & Vault Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	223,588	-	-	-	1,731,954	-	-	28,475	2,187,943	364,275
February	291,542	-	-	-	1,032,536	-	-	5,554	1,876,728	314,877
March	400,472	-	246	-	1,768,995	-	-	7,891	2,681,239	303,462
April	314,088	49,640	-	98,086	1,792,686	-	-	21,683	2,598,780	355,557
May	239,028	40,939	-	40,939	1,435,491	-	-	332,704	2,673,027	339,395
June	337,659	123,348	-	123,348	1,852,273	-	-	348,606	2,573,438	356,065
July	347,514	470,324	-	470,365	1,052,263	-	-	810,414	2,650,362	361,983
August	333,746	284,388	-	284,389	1,117,766	-	-	728,531	2,602,482	341,168
September	307,532	-	-	-	1,473,602	-	-	397,963	2,431,958	354,171
October	360,860	451	-	-	1,534,790	-	-	33,932	2,214,199	308,014
November	324,971	-	-	-	1,565,615	-	-	57,065	2,265,457	349,780
December	350,972	-	-	-	1,441,827	-	-	5,447	1,960,172	369,259
<b>TOTAL</b>	<b>3,987,859</b>	<b>969,093</b>	<b>246</b>	<b>98,086</b>	<b>17,799,797</b>	<b>0</b>	<b>0</b>	<b>2,778,266</b>	<b>28,715,785</b>	<b>4,118,006</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit, Goose Pit, & Vault Pit

**Table G: Meadowbank Mined Tonnages for 2015**

	Portage Pit, Goose Pit & Vault Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	386,670	240	105,275	240	1,210,880	-	382,115	328,000	2,413,420	363,485
February	319,494	-	3,836	2,894	1,340,755	-	376,732	220,739	2,264,450	304,126
March	413,718	-	164,531	15,439	1,535,819	-	79,336	246,948	2,455,791	322,865
April	326,603	-	45,986	19,698	1,701,286	-	38,059	941,986	3,073,618	301,220
May	421,329	7,743	87,127	1,155	1,550,668	-	417,637	914,675	3,400,334	358,783
June	300,844	15,732	19,602	19,438	1,654,038	-	476,220	522,338	3,008,212	359,079
July	383,427	282,843	96,679	68,334	1,447,386	-	549,248	308,208	3,136,125	353,824
August	293,046	234,032	24,069	45,617	2,149,965	-	460,273	129,812	3,336,814	361,766
September	298,214	102,009	54,488	25,549	2,675,549	-	230,741	136,669	3,523,219	280,235
October	361,340	31,103	137,850	-	2,839,411	-	156,915	-	3,526,619	354,968
November	350,347	783	11,090	-	2,438,493	-	184,551	43,385	3,028,649	358,507
December	289,204	-	84,473	7,331	2,651,063	-	-	-	3,032,071	313,994
<b>TOTAL</b>	<b>4,144,236</b>	<b>674,485</b>	<b>835,006</b>	<b>205,695</b>	<b>23,195,313</b>	<b>-</b>	<b>3,351,827</b>	<b>3,792,760</b>	<b>36,199,322</b>	<b>4,032,852</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit, Goose Pit, & Vault Pit

**Table H: Meadowbank Mined Tonnages for 2016**

	Portage Pit & Vault Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	292,365	17,453	155,335	45,232	2,353,611	0	43,056	21	2,614,708	346,009
February	234,713	108,151	476,263	23,721	1,814,074	0	50,523	27	2,472,760	300,954
March	244,497	51,826	67,814	116,657	2,345,902	0	18,217	112	2,600,527	298,552
April	260,323	31,133	98,223	43,404	2,491,605	0	45,545	130	2,710,040	330,863
May	327,610	128,385	21,503	3,734	2,522,759	0	57,936	36,009	2,770,327	351,932
June	311,403	68,802	94,678	19,090	2,640,740	0	86,615	122	2,910,047	310,702
July	398,530	49,347	520	38,145	2,571,022	0	107,503	28	2,766,566	356,517
August	410,800	14,305	273,580	170,705	2,120,975	0	103,675	129	2,683,369	325,639
September	377,414	79,939	23,053	169,733	2,099,627	0	95,243	27	2,467,621	279,249
October	364,792		117,665	335	1,994,464	0	6,456	17	2,118,937	339,157
November	438,954	6,741	8,294	16,164	1,834,572	0	17,275	1,036	1,884,082	326,841
December	370,247	17,092	346	17,786	1,544,266	0	23,590	165	1,603,246	348,687
<b>TOTAL</b>	<b>4,031,648</b>	<b>573,175</b>	<b>1,337,274</b>	<b>664,707</b>	<b>26,333,617</b>	<b>0</b>	<b>655,634</b>	<b>37,823</b>	<b>29,602,230</b>	<b>3,915,102</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit & Vault Pit

**Table I: Meadowbank Mined Tonnages for 2017**

	Portage Pit & Vault Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	386,298	45,991	0	12,301	1,498,959	0	14,815	6	1,572,073	331,889
February	374,894	6,084	22,937	23,998	1,251,365	0	404,648	2,977	1,712,008	314,269
March	376,855	167	8,508	12,614	919,668	0	483,332	583	1,424,872	279,684
April	355,410	0	10,674	17,671	1,002,425	0	655,770	10	1,686,550	328,391
May	437,319	0	135,889	84,180	933,559	0	434,648	27,889	1,616,165	344,961
June	401,035	12,537	14,316	88,241	977,125	0	522,816	2,588	1,617,623	322,939
July	334,363	183,868	66,559	6,647	1,016,081	0	523,311	0	1,796,466	336,222
August	391,414	485,008	12,182	2,361	1,271,636	0	97,549	19,925	1,888,662	326,409
September	343,504	13,148	107,454	14,945	1,246,694	0	509,366	189	1,891,796	275,754
October	364,663	259,074	57,565	528	1,169,063	0	255,796	1,991	1,744,017	328,028
November	321,403	21,676	653	5,395	1,406,720	0	69,651	1,362	1,505,456	330,465
December	352,291	0	401	571	1,781,334	0		7	1,782,313	334,023
<b>TOTAL</b>	<b>4,439,449</b>	<b>1,027,553</b>	<b>437,137</b>	<b>269,453</b>	<b>14,474,629</b>	<b>0</b>	<b>3,971,701</b>	<b>57,528</b>	<b>20,238,001</b>	<b>3,853,034</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit & Vault Pit

**Table J: Meadowbank Mined Tonnages for 2018**

	Portage Pit & Vault Pit (tonnes)									Ore Processed in Mill (tonnes)
	Ore	Waste Rock								
		Dikes	Roads	Crushers	Waste Dump <sup>1</sup>	Landfill	Stockpiles	Other	Total	
January	298,411	308	8,958	1,292	1,286,572	0	378	41,538	1,637,457	290,277
February	236,865	0	83,624	27,237	1,199,432	0	251	149,036	1,696,445	288,375
March	256,063	675	5,961	22,917	1,310,619	0	1,446	165,562	1,763,243	246,416
April	225,990	56,338	440	101,881	1,228,920	0	86,609	229,113	1,929,291	254,528
May	230,283	0	50,282	0	1,198,847	0	13,831	150,173	1,643,416	301,915
June	222,227	0	3,360	0	929,405	0	1,112	119,259	1,275,363	287,319
July	190,331	0	2,918	0	681,804	0	3,196	166,296	1,044,545	347,236
August	179,509	0	7,002	0	606,678	0	661	49,324	843,174	303,191
September	210,884	0	3,482	0	609,036	0	12,180	126,692	962,274	237,935
October	174,656	0	2,510	0	494,411	0	272	118,340	790,189	239,674
November	194,071	0	1,768	0	532,824	0	336	119,821	848,820	215,299
December	204,293	0	1,066	0	508,417	0	3,392	69,652	786,820	244,500
<b>TOTAL</b>	<b>2,623,583</b>	<b>57,321</b>	<b>171,371</b>	<b>153,327</b>	<b>10,586,965</b>	<b>0</b>	<b>123,664</b>	<b>1,504,806</b>	<b>15,221,037</b>	<b>3,256,665</b>

1. Waste Rock disposed at the waste dump includes overburden stripped for exploitation of Portage Pit & Vault Pit

**Table K: Meadowbank Mined Tonnages for 2019**

Month	Portage Pit & Vault Pit (tonnes)								Ore Processed in Mill (tonnes)
	Ore	Waste Rock							
		Dikes	Roads	WRSF	Backfill	Stockpiles	Other	Total	
January	144,114	86	565	39,778	140,693	269	96,170	277,561	251,914
February	111,814	0	435	24,953	148,716	83	39,017	213,204	208,736
March	120,143	0	131	3,641	256,068	0	3,682	263,522	176,931
April	100,456	0	9065	22,390	169,688	296	52,685	254,124	213,095
May	83,237	0	20,906	15,132	76,700	0	0	112,738	191,880
June	46,290	0	7,766	12,490	99,907	8,265	0	128,427	224,028
July	44,584	0	348	6,873	49,797	0	24,795	81,813	334,437
August	55,282	0	9,244	9,803	95,245	696	110,604	225,592	70,519
September	10,965	0	348	0	49,961	174	2,436	52,919	0
October	30,659	0	1,974	2,233	15,498	336	462	20,503	6,280
November	0	0	1,680	0	0	0	0	1,680	119,445
December	0	0	0	0	0	0	0	0	6,091
<b>TOTAL</b>	<b>747,544</b>	<b>86</b>	<b>52,461</b>	<b>137,293</b>	<b>1,102,273</b>	<b>10,118</b>	<b>329,851</b>	<b>1,632,083</b>	<b>1,803,356</b>

**Table L: Meadowbank Mined Tonnages for 2020**

		2020
Portage Pit	<b>Total Waste Rock (t)</b>	<b>0</b>
	<i>NAG (~ %)</i>	N/A
	<i>PAG (~ %)</i>	N/A
	Till (t)	0
	Ore (t)	0
Vault Pit	<b>Total Waste Rock (t)</b>	<b>0</b>
	<i>NAG (~ %)</i>	N/A
	<i>PAG (~ %)</i>	N/A
	Till (t)	0
	Ore (t)	0
BB Phaser Pit	<b>Total Waste Rock (t)</b>	<b>0</b>
	<i>NAG (~ %)</i>	N/A
	<i>PAG (~ %)</i>	N/A
	Till (t)	0
	Ore (t)	0

Note: Difference between pit mill feed and total mill feed is due to stockpiled material to be processed.

**Table M: Projected Meadowbank Mined Tonnages (2021)**

		2021
Portage Pit	<b>Total Waste Rock (t)</b>	<b>0</b>
	<i>NAG (~ %)</i>	N/A
	<i>PAG (~ %)</i>	N/A
	Till (t)	0
	Ore (t)	0
Vault Pit	<b>Total Waste Rock (t)</b>	<b>0</b>
	<i>NAG (~ %)</i>	N/A
	<i>PAG (~ %)</i>	N/A
	Till (t)	0
	Ore (t)	0
BB Phaser Pit	<b>Total Waste Rock (t)</b>	<b>0</b>

<i>NAG (~ %)</i>	N/A
<i>PAG (~ %)</i>	N/A
Till (t)	0
Ore (t)	0

Note: Difference between pit mill feed and total mill feed is due to stockpiled material to be processed.



MEADOWBANK GOLD PROJECT  
UPDATED MINE WASTE ROCK AND  
TAILINGS MANAGEMENT PLAN

**APPENDIX B**

**TSF and Pits Integrated Deposition Plan**

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# IN-PIT TAILINGS 2021 OFFICIAL DEPOSITION PLAN

MEADOWBANK COMPLEX

PLAN UPDATE : JAN 17<sup>th</sup> 2021

# TABLE OF CONTENTS

- **Plan Objective**
- **Parameters and Assumptions**
  1. Tailing properties
  2. Mill Water requirement
  3. MBK Water Management
  4. Reclaim Pump Performance
- **Deposition Sequence**
  1. Current state
  2. Deposition Schedule
  3. Mill Throughput forecast
  4. Yearly projection
- **Path forward**
  1. Engineering
  2. Operations
  3. Construction



Meadowbank – Aug 2020

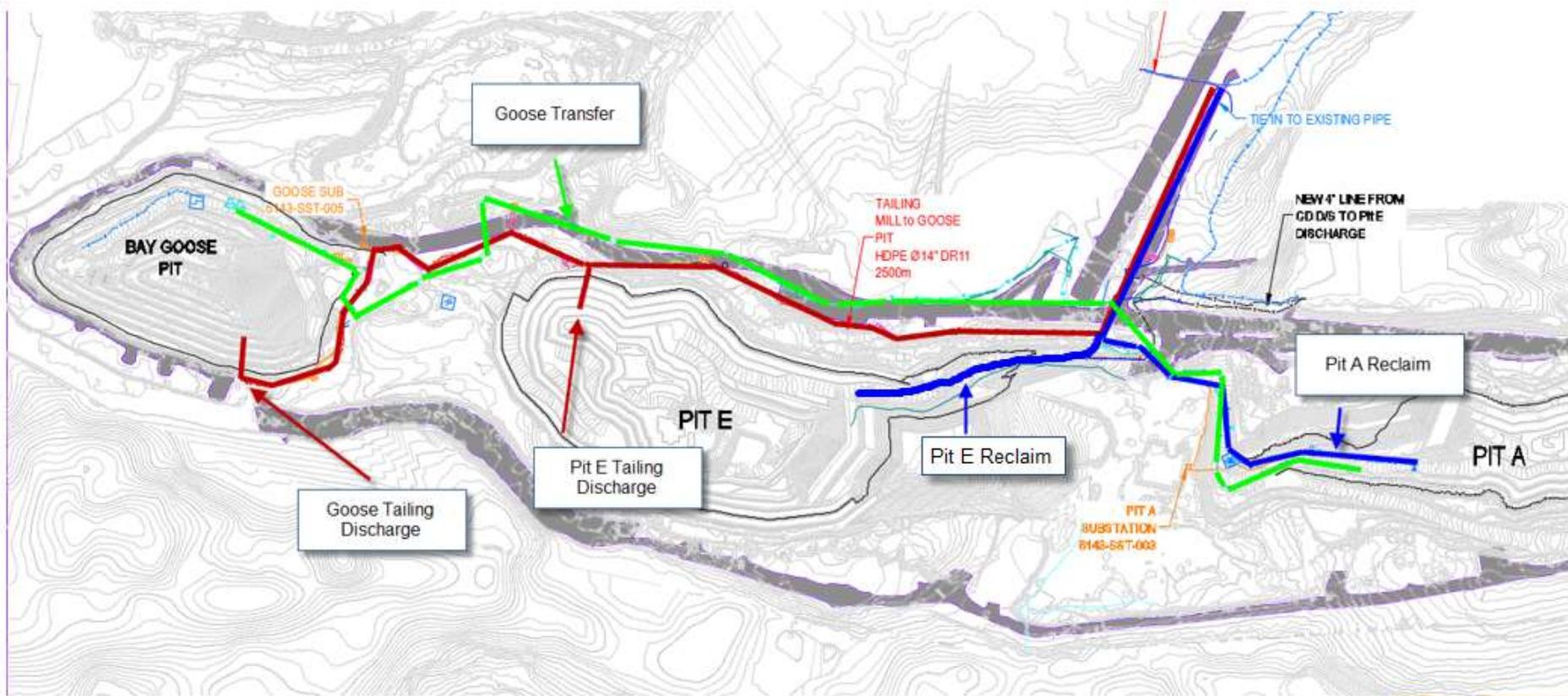
# INTRODUCTION

- **IPD PLAN OBJECTIVES**
  - Provide global construction schedule update
  - Identify deposition needs
  - Identify infrastructure move
  - Identify water transfer requirements
  - Set reclaim requirement
  - Update plan based on current parameters
  - Minimise freshwater consumption
  - Evaluate impact of increase throughput – HPGR addition
  - Establish In Pit Deposition KPIs
- Deposition Plan modeling steps:
  - *Quarterly for 2021-2022*
  - *Yearly until 2027*
- Starting water balance & surfaces: August 2020
- MinePlan : 20210108\_21BUD\_Case2B\_Production Plan



Pit E – October 2020

# IN-PIT DEPOSITION – 2021 INFRASTRUCTURE OVERVIEW



IPD Infrastructure Map- 2021

# 2021 IPD PLAN – PARAMETERS AND ASSUMPTIONS

- **Validation of 2021 parameters and assumption**
  - Based on historical values
  - Based on 2020 bathymetry
  - Based on initial SNC report

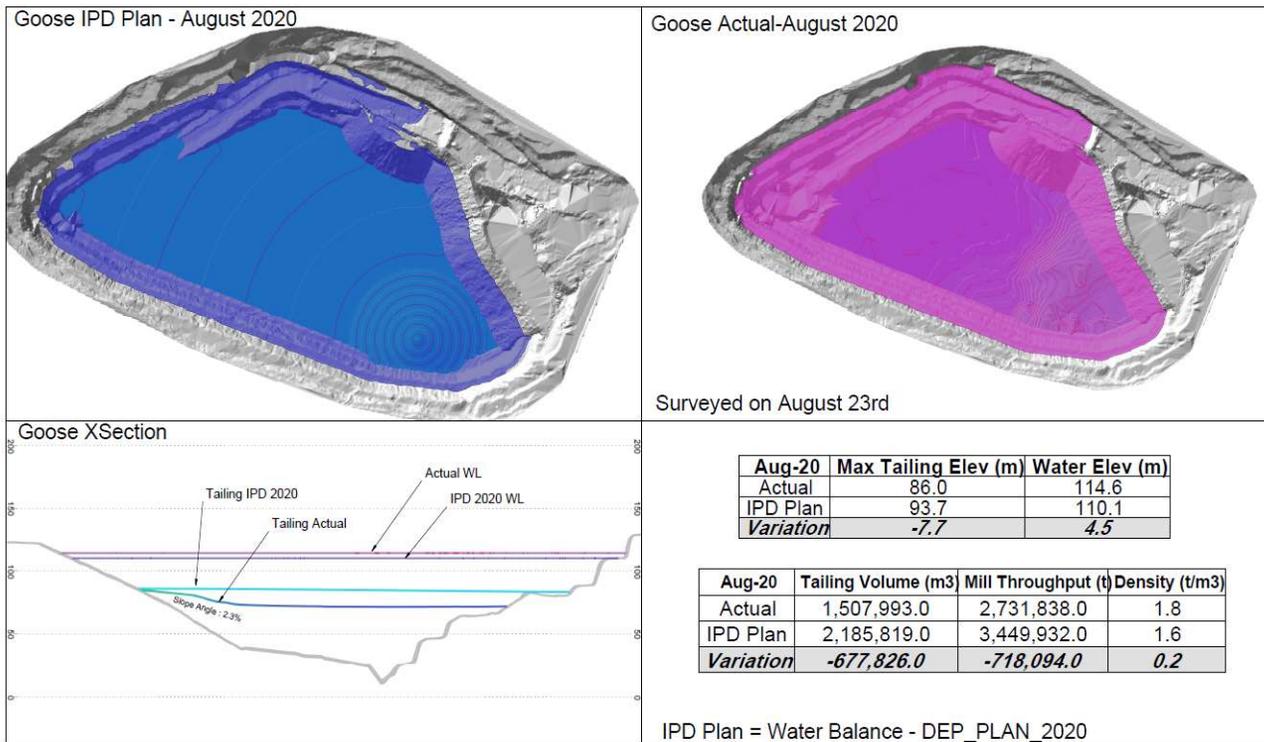
## List of parameters / influencing factors

1. Tailing Slope angles
2. Waste In pit Dump porosity : 0.3
3. Slurry density
4. In Situ density
5. Tailing Water entrapment %
6. Mill consumptions : 1.1 m<sup>3</sup>/t
7. MBK water management inflow
8. Reclaim pump performance



*Pit E Deposition – September 2020*

# 2021 – TAILING PROPERTIES



Goose Bathymetry Analysis 2020

## Tailing Properties

Parameters validated and updated from Goose Bathymetry:

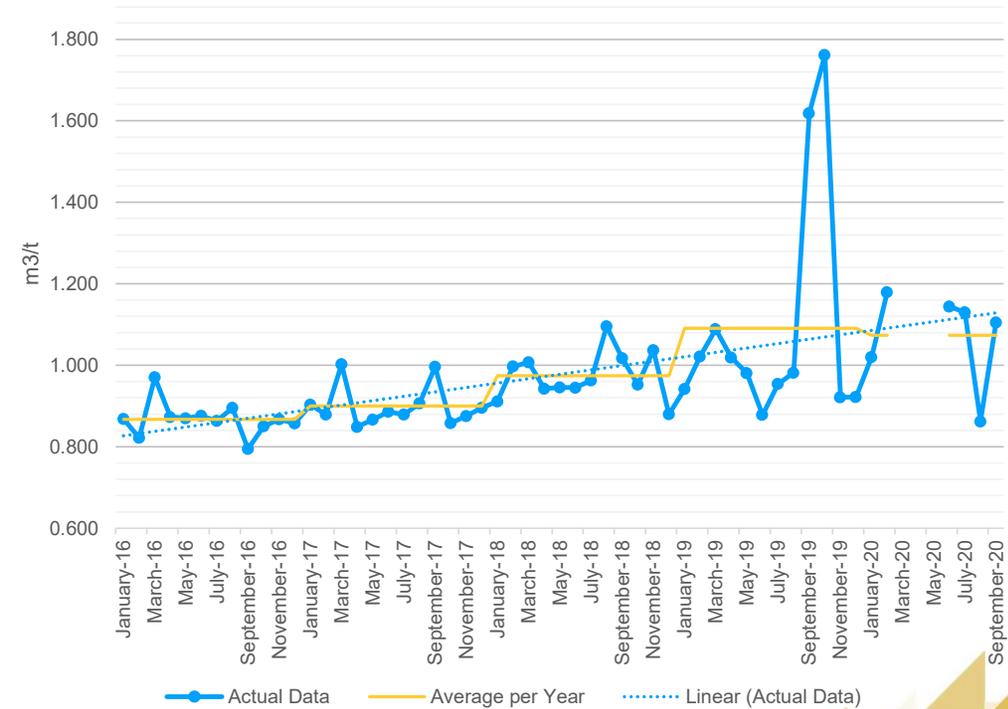
- Tailing Slope Angle: 2.4%
  - Slope for 50m and than flat
- Slurry Density: 1.56 t/m3
- In Situ Density: 1.8 t/m3
- Water entrapment: 13%

# 2021 – MILL WATER VOLUME REQUIREMENT REVIEW



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Total Water per ore tonnes (m<sup>3</sup>/t)



Historical mill total water m3 per mill throughput

## Sum Total Water used (m<sup>3</sup>) / Sum Mill Throughput (t)

- Important ratio used to plan water consumption
- For the past few years, this ratio has increased from 0.85 m<sup>3</sup>/t to 1.1 m<sup>3</sup>/t
  - This is an increase of +/- 30%

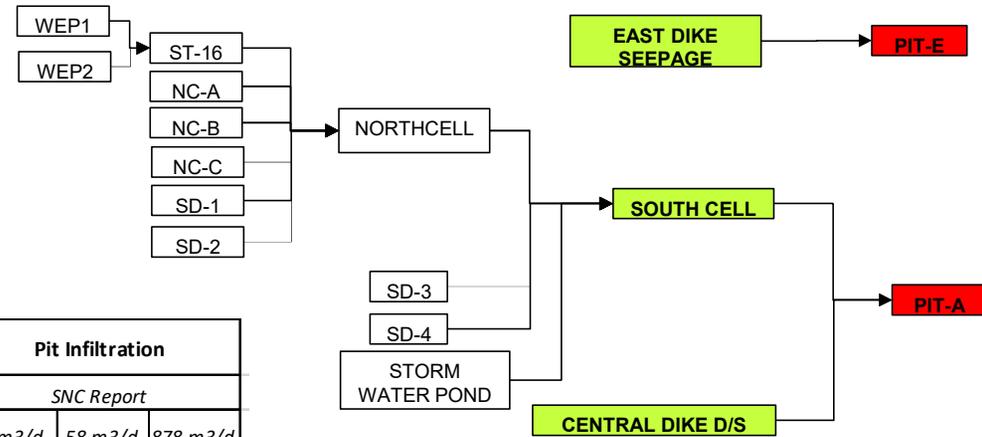
- An average of 1.1 m<sup>3</sup>/t is used as assumptions for 2021 Plan

# 2021 - MBK SITE WATER MANAGEMENT

## Sources of inflow

- Net Runoff
- Historical Internal Water Transfer
  - TSF to Pit A
  - Seepage to Pit A / Pit E
- Natural Pit Infiltration

Flow Diagram –MBK 2021



Monthly Average Volume per Origin and Destination

		Net Runoff			Internal Water Transfer					Pit Infiltration		
Source		SNC Report			Historical Data					SNC Report		
Origin		Runoff			South Cell	Central Dike Seepage		East Dike Seepage		80 m3/d	58 m3/d	878 m3/d
Discharge		Pit A	Pit E	Goose	Pit A	Pit A		Pit E		Pit A	Pit E	Goose
days		m3	m3	m3	m3	m3/h	m3	m3/h	m3	m3	m3	
January	31					70	52,080			2,480	1,798	27,218
February	28					70	47,040			2,240	1,624	24,584
March	31					70	52,080			2,480	1,798	27,218
April	30					90	64,800			2,400	1,740	26,340
May	31				24,717	150	111,600	20	14,880	2,480	1,798	27,218
June	30	50,845	49,787	38,976	96,443	180	129,600	23	16,560	2,400	1,740	26,340
July	31	5,084	4,979	3,898	217,358	180	133,920	23	17,112	2,480	1,798	27,218
August	31	8,240	8,069	6,317	80,000	180	133,920	23	17,112	2,480	1,798	27,218
September	30	25,685	25,151	19,689	36,094	150	108,000	20	14,400	2,400	1,740	26,340
October	31					90	66,960			2,480	1,798	27,218
November	30					70	50,400			2,400	1,740	26,340
December	31					70	52,080			2,480	1,798	27,218

# 2021– RECLAIM PUMP & GOOSE TRANSFER PERFORMANCE



Reclaim flow variable in function of water elevation  
*Pump mechanical availability: 90%*

RECLAIM

Pit A reclaim flow rate m3/h			
Water Elev	Nominal	Max	Avg
40	222	288	<b>229.5</b>
64	250	325	<b>258.8</b>
77	325	365	<b>310.5</b>
91	308	400	<b>318.6</b>
99	308	400	<b>318.6</b>
109	308	400	<b>318.6</b>
117	250	325	<b>258.8</b>
126	270	350	<b>279.0</b>

Pit E reclaim flow rate m3/h			
Water Elev	Nominal	Max	Avg
60	250	325	<b>258.8</b>
80	285	370	<b>294.8</b>
110	308	308	<b>277.2</b>
125	270	350	<b>279.0</b>

Average reclaim flow including mechanical down: **283 m<sup>3</sup>/h**  
 +/- 13% increase compared to 2020 average

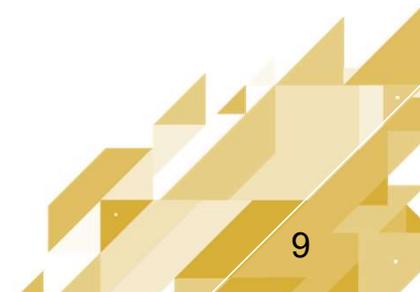
- An additional 50 m<sup>3</sup>/h added in the reclaim capacity during February 2021: **333 m<sup>3</sup>/h**

## Summer 2020 obtained flow

GOOSE TRANSFER

Goose Transfer flow rate m3/h		
Month	Flow m3/h	AVG
June	475	
July	463	
Aug	590	494.4
Sept	506	
Oct	438	

Average Goose transfer = **494 m<sup>3</sup>/h**



# IPD 2021 PLAN – AUGUST 2020 START POINT



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## Current Water Elevations:

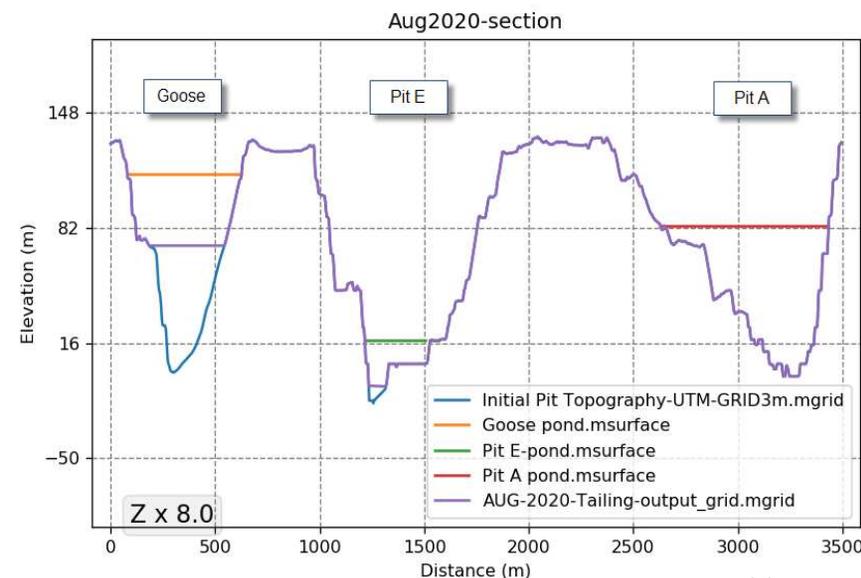
	Pit A	Pit E	Goose
Actual – Oct2020	82.5	31.1	112.6

## Current Tailings Elevations:

	Pit A	Pit E	Goose
Actual – Aug2020	0	0	80.1



		Goose Pit	Pit A	Pit E
<b>Water Elevation</b>	m	112.6	82.5	31.1
<b>Total Free Water Volume</b>	m <sup>3</sup>	3,96 M	4,20 M	1,2 M
<b>Total Volume of tailings</b>	m <sup>3</sup>	1,51 M	0	0,24 M
<b>Max Storage Capacity</b>	m <sup>3</sup>	<b>7.9 M</b>	<b>4.3 M</b>	<b>37.4 M</b>
	<i>Max Elev</i> m	131	86.5	134

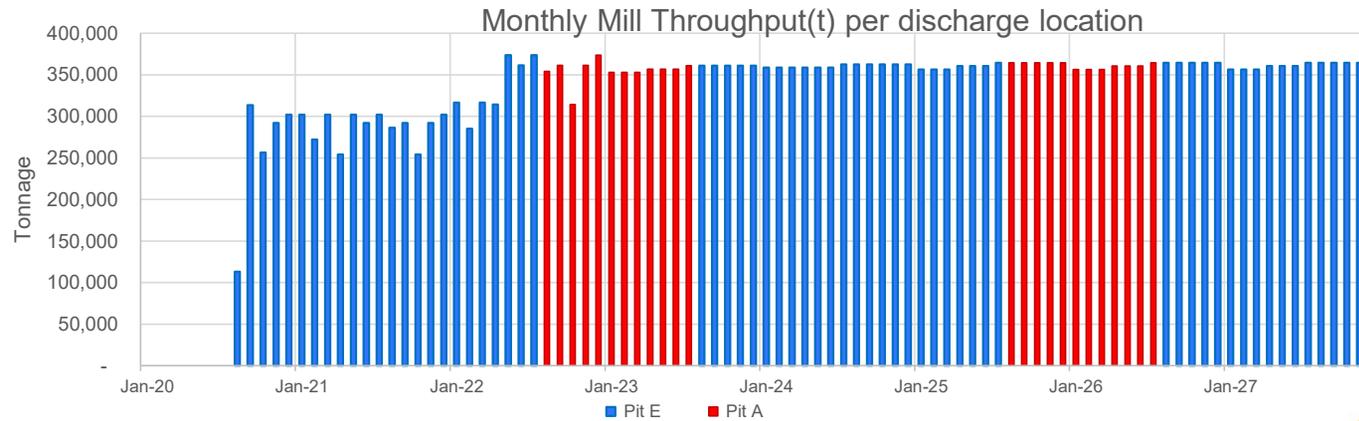
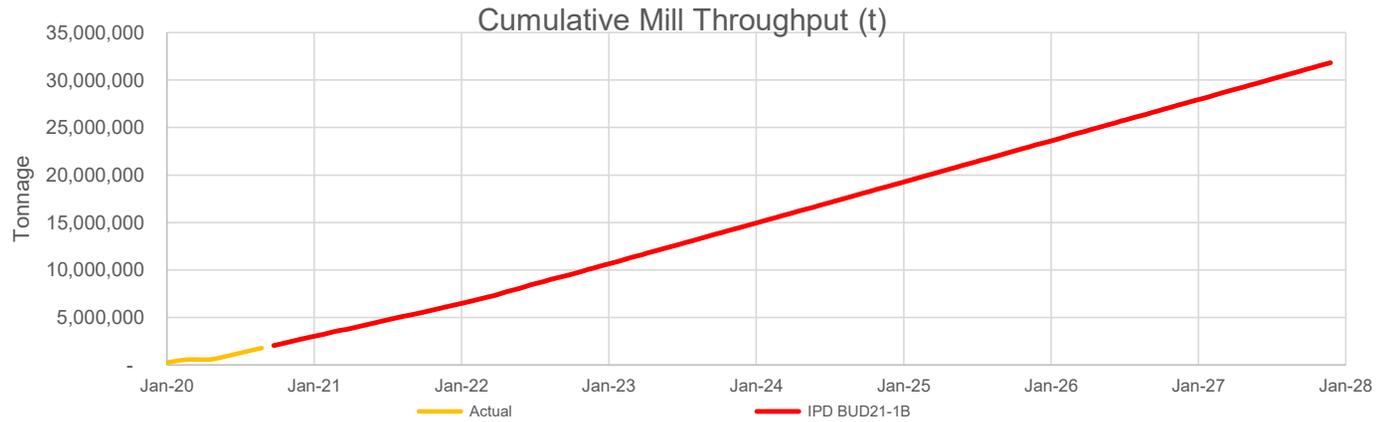




# IPD 2021 PLAN – MILL THROUGHPUT FORECAST



## BUD2021-SC1B HPGR addition early 2022



# IPD 2021 PLAN – Q4 YEAR 2020

## Actual In-pit results for Q4 2020

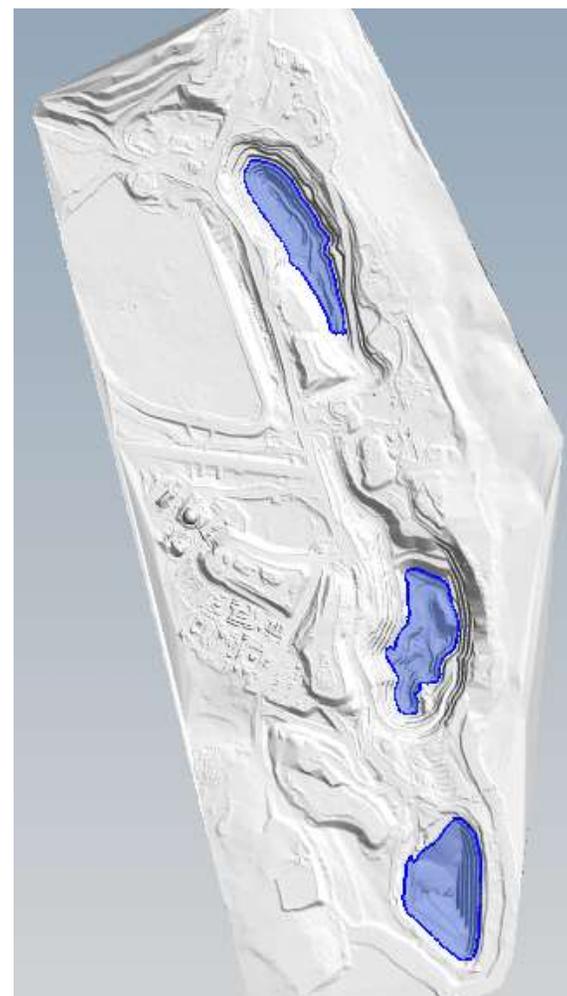
Location	Tailings Discharge (t)	Tailings Elev (m)	Water Elev (m)
Goose	0	80.06	112.47
Pit E	804,470	17.83	42.99
Pit A	0	0.00	78.90

## Mill Water Consumption

Source	Origin	Volume (m <sup>3</sup> )	Average flow m <sup>3</sup> /h
Mill Process Water Volume		1,004,640	465
Reclaim Water	Pit A	655,991	297
Fresh Water	Third Port Lake	339,434	157

### Notes:

- Deposition occurs in Pit E
- Reclaim from Pit A



MBK - Water Level



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# IPD 2021 PLAN – END Q1 YEAR 2021

## Forecast In-pit results

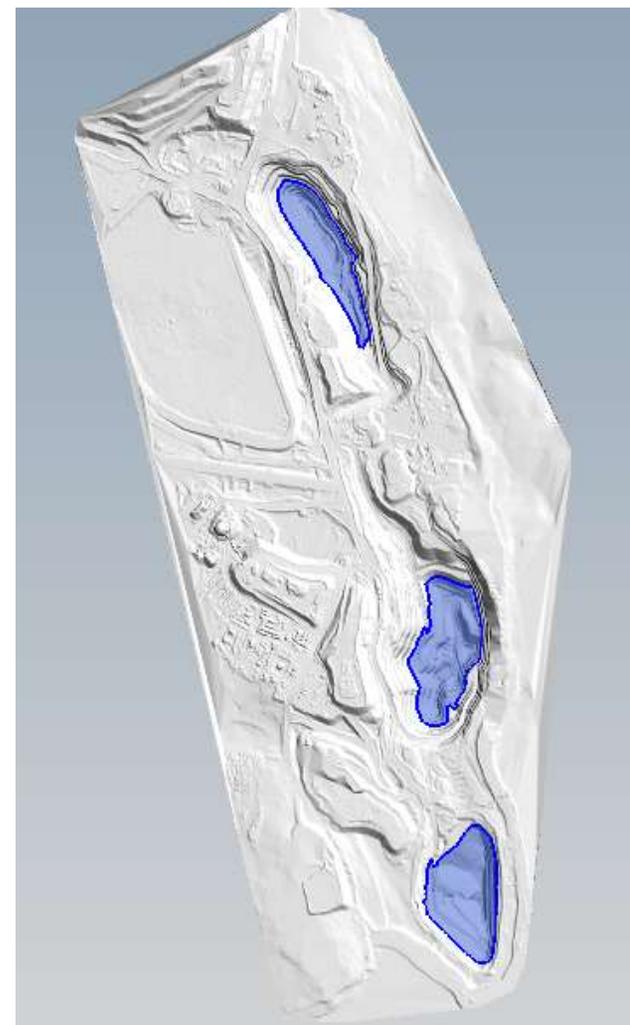
Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	113.12
Pit E	876,480	27.18	55.05
Pit A	0	0.00	73.77

## Mill Water Consumption

Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		968,718	442
Reclaim Water	Pit A	681,671	315
Fresh Water	Third Port Lake	283,200	131

### Notes:

- Deposition occurs in Pit E
- Reclaim from in Pit A
- Anticipated reclaim increase of 50 m<sup>3</sup>/h reclaim planned during February 2021



MBK - Water Level

# IPD 2021 PLAN – END Q2 YEAR 2021

## Forecast In-pit results

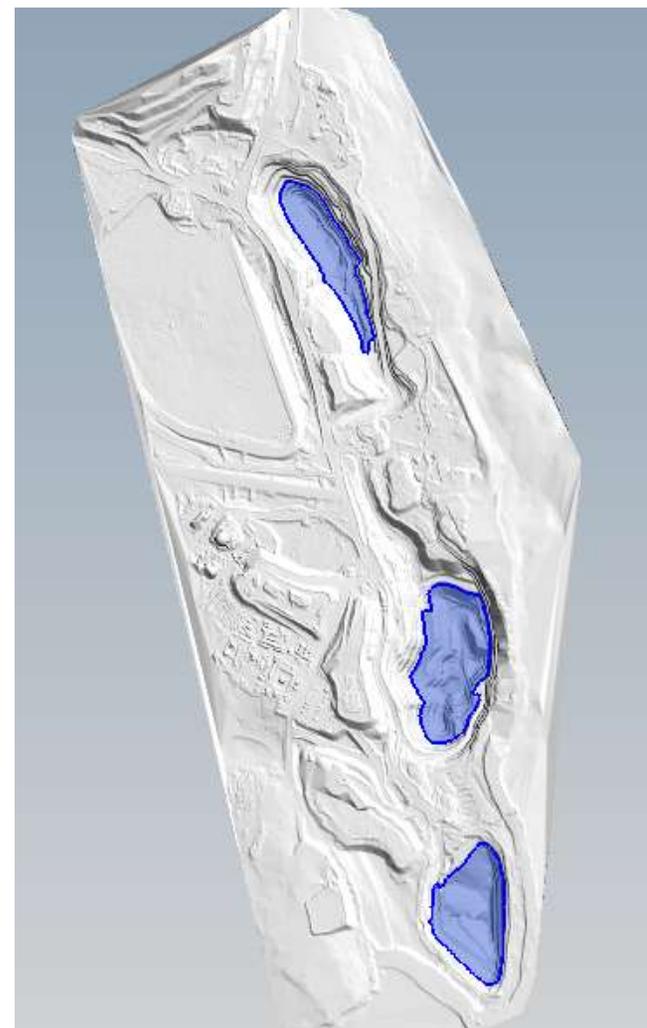
Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	111.14
Pit E	815,260	37.03	64.60
Pit A	0	0.00	74.71

## Mill Water Consumption

Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		908,252	407
Reclaim Water	Pit A	747,548	343
Fresh Water	Third Port Lake	150,086	68

### Notes:

- Deposition occurs in Pit E
- Reclaim from Pit A



MBK - Water Level



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# IPD 2021 PLAN – END Q3 YEAR 2021

## Forecast In-pit results

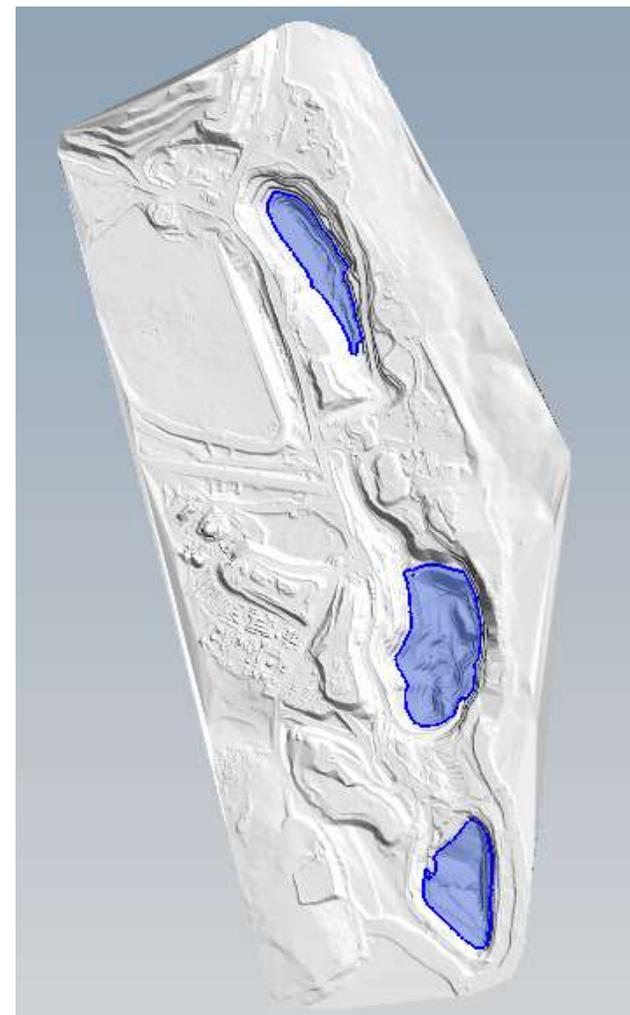
Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	105.34
Pit E	880,630	39.51	73.26
Pit A	0	0.00	81.67

## Mill Water Consumption

Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		975,997	435
Reclaim Water	Pit A	771,073	350
Fresh Water	Third Port Lake	197,814	90

### Notes:

- Deposition occurs in Pit E
- Reclaim from in Pit A
- Resume Goose Transfer in June 2021 to increase reclaim volume capacity
  - 3 months of transfer



MBK - Water Level



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# IPD 2021 PLAN – END Q4 YEAR 2021

## Forecast In-pit results

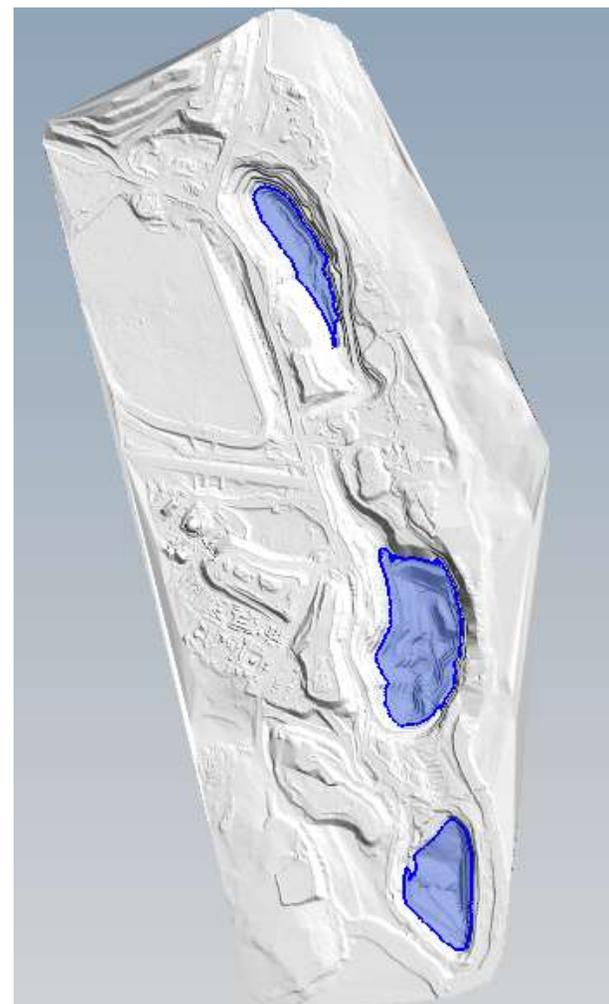
Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	106.13
Pit E	808,260	44.37	79.74
Pit A	0	0.00	76.29

## Mill Water Consumption

Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		894,693	399
Reclaim Water	Pit A	736,813	334
Fresh Water	Third Port Lake	153,190	70

### Notes:

- Deposition occurs in Pit E
- Reclaim from Pit A
- Goose Transfer stopped in October



MBK - Water Level



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# IPD 2021 PLAN – END Q1 YEAR 2022

## Forecast In-pit results

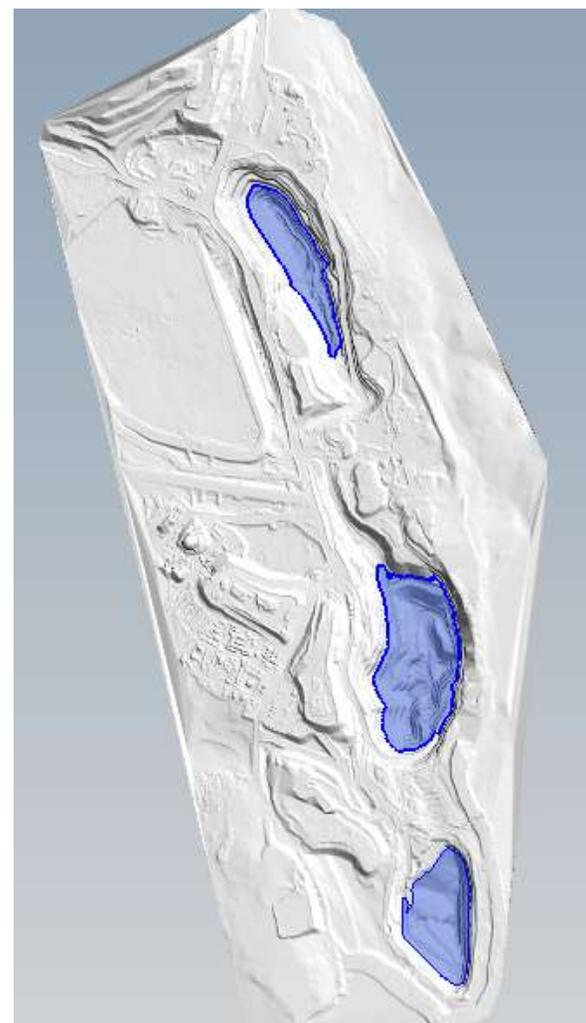
Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	106.90
Pit E	918,720	49.28	86.43
Pit A	0	0.00	70.39

## Mill Water Consumption

Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		1,015,403	464
Reclaim Water	Pit A	745,012	341
Fresh Water	Third Port Lake	265,392	125

### Notes:

- Deposition occurs in Pit E
- Reclaim from Pit A
- Pit E Water Level Portage Pits connection at 86.5
  - Water will overflow to Pit A through Central Dump
  - Overflow will provide water volume for Pit A reclaim



MBK - Water Level

# IPD 2021 PLAN – END Q2 YEAR 2022

## Forecast In-pit results

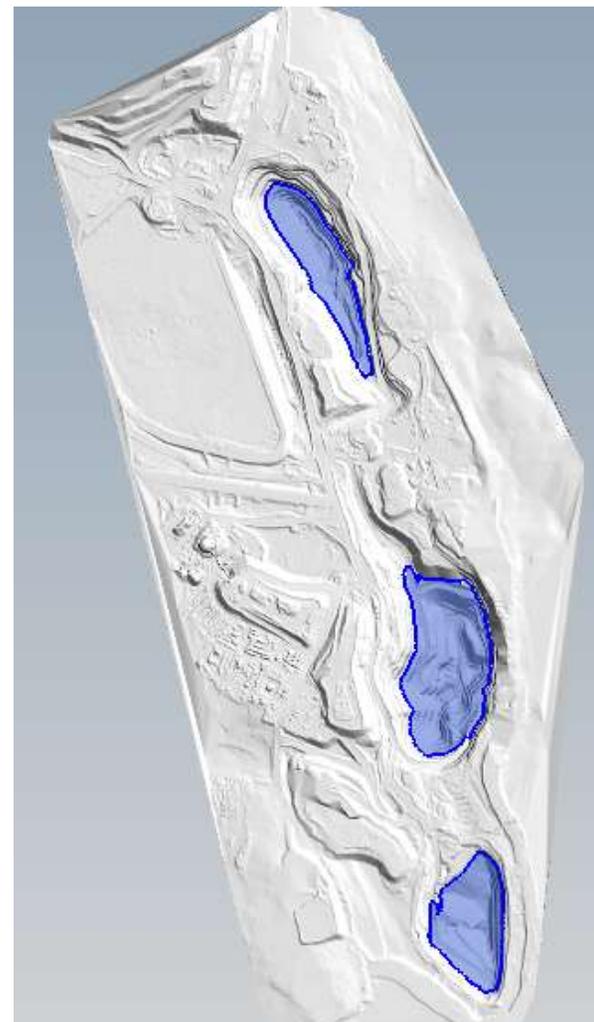
Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	108.04
Pit E	1,016,594	54.04	86.50
Pit A	0	0.00	84.06

## Mill Water Consumption

Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		1,132,541	507
Reclaim Water	Pit A	754,761	346
Fresh Water	Third Port Lake	365,000	166

### Notes:

- Deposition occurs in Pit E
- Reclaim from Pit A
- Anticipated HPGR addition to the ore process to increase Mill Throughput (t)



MBK - Water Level

# IPD 2021 PLAN – END Q3 YEAR 2022

## Forecast In-pit results

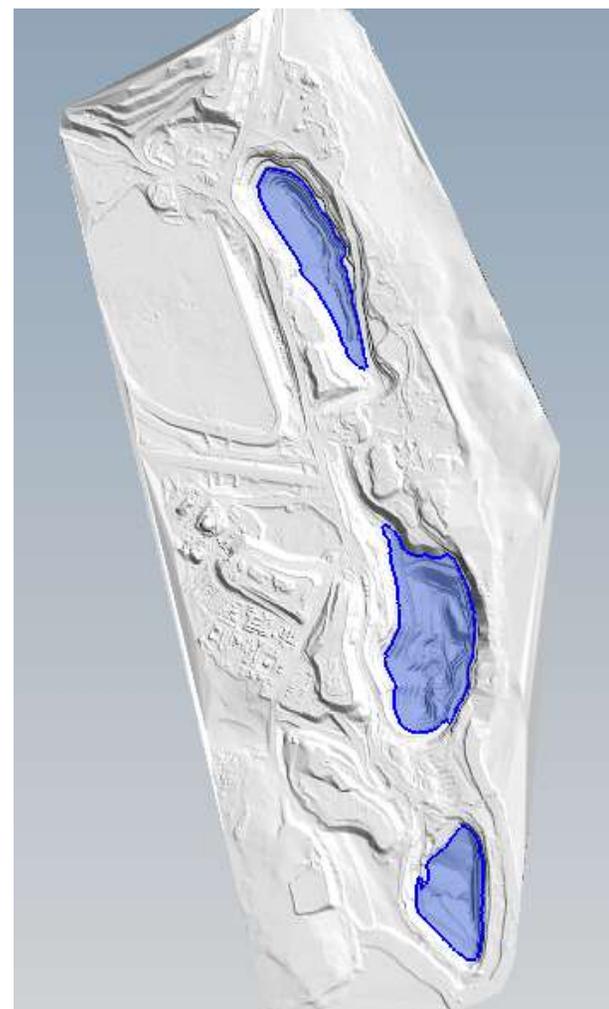
Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	105.55
Pit E	373,828	57.77	91.52
Pit A	715,819	31.87	91.52

## Mill Water Consumption

Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		1,207,647	553
Reclaim Water	Pit A	263,420	355
Reclaim Water	Pit E	531,777	363
Fresh Water	Third Port Lake	402,409	182

### Notes:

- Deposition switch from Pit E to Pit A planned August 2022
- Reclaim moved to Pit E
- Goose Transfer starts in July 2022



MBK - Water Level

# IPD 2021 PLAN – END Q4 YEAR 2022

## Forecast In-pit results

Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	106.34
Pit E	0	57.77	93.82
Pit A	1,009,594	46.93	93.82

## Mill Water Consumption

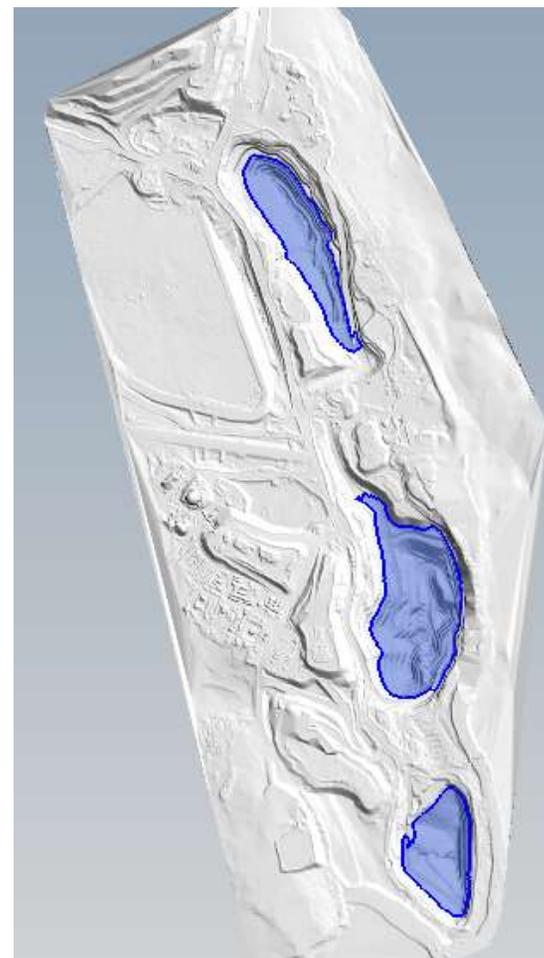
Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		1,117,559	499
Reclaim Water	Pit E	804,918	365
Fresh Water	Third Port Lake	304,527	138

### Notes:

- Deposition occurs in Pit A
- Reclaim from Pit E



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MBK - Water Level

# IPD 2021 PLAN – EOY 2023

## Forecast In-pit results

Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	106.55
Pit E	1,764,286	62.77	106.66
Pit A	2,457,699	66.93	106.66

## Mill Water Consumption

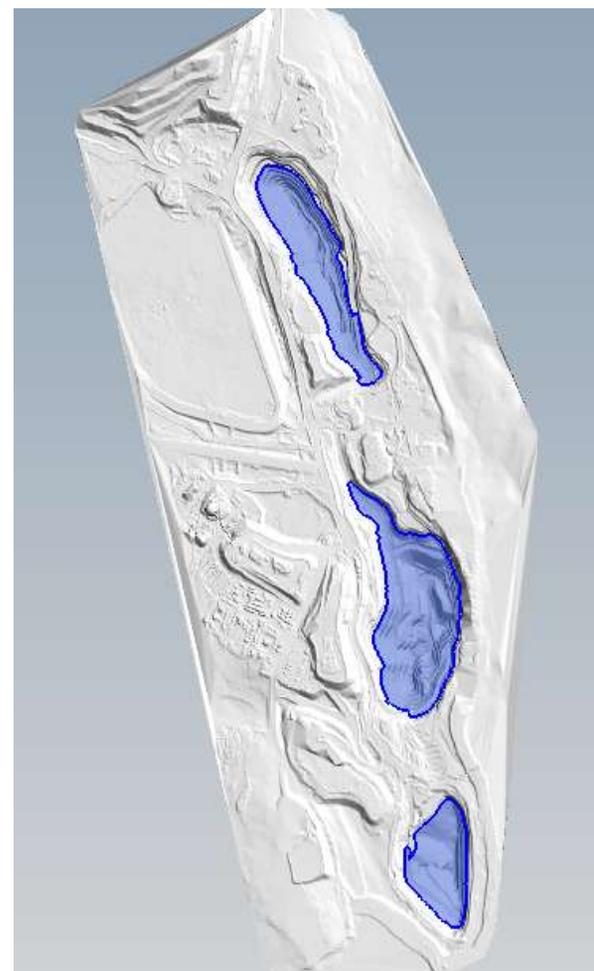
Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		4,680,376	526
Reclaim Water	Pit A	1,293,926	352
Reclaim Water	Pit E	1,860,389	366
Fresh Water	Third Port Lake	1,483,037	170

### Notes:

- Deposition occurs in Pit A and Pit E
  - Pit A from January to August
  - Pit E from August to December
- Reclaim from Pit E and Pit A based on deposition schedule



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MBK - Water Level

# IPD 2021 PLAN – EOY 2024

## Forecast In-pit results

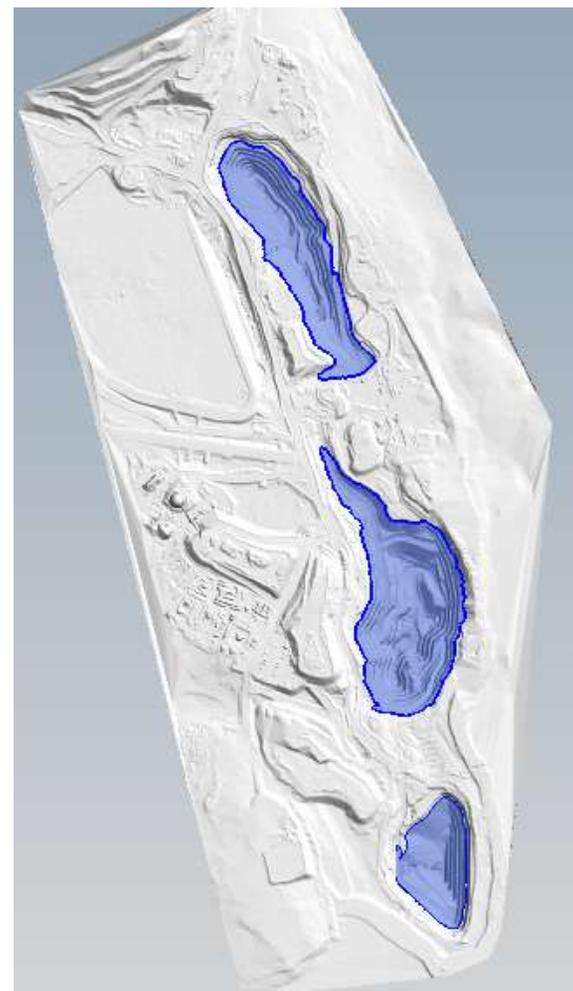
Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	106.76
Pit E	4,254,613	78.27	117.56
Pit A	0	66.93	117.56

## Mill Water Consumption

Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		4,716,508	528
Reclaim Water	Pit A	3,036,768	315
Reclaim Water	Pit E	0	0
Fresh Water	Third Port Lake	1,635,530	187

### Notes:

- Deposition occurs in Pit E
- Reclaim from Pit A



MBK - Water Level



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# IPD 2021 PLAN – EOY 2025

## Forecast In-pit results

Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	106.96
Pit E	2,515,311	83.69	126.81
Pit A	1,822,115	77.15	126.81

## Mill Water Consumption

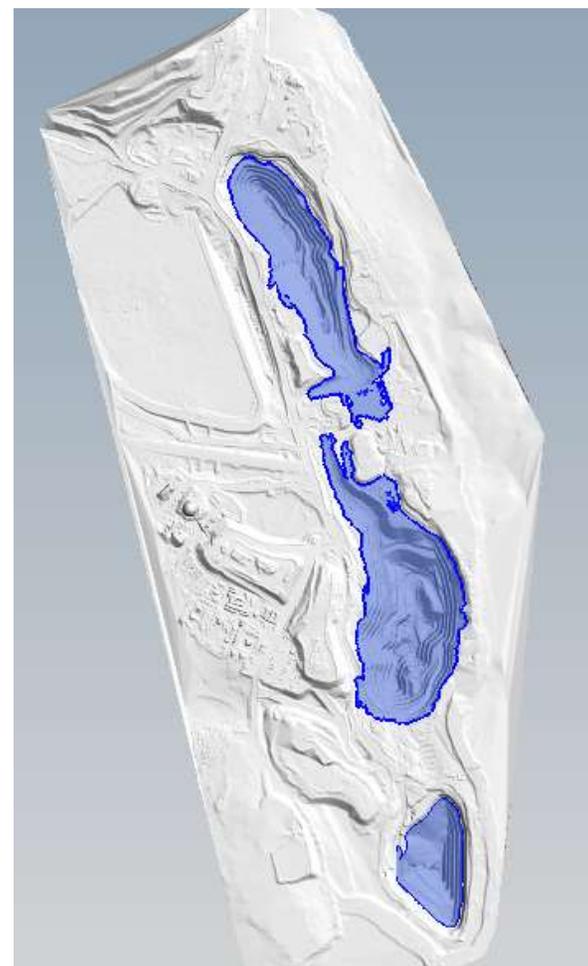
Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		4,264,426	487
Reclaim Water	Pit A	1,705,644	335
Reclaim Water	Pit E	1,225,156	333
Fresh Water	Third Port Lake	1,749,746	200

### Notes:

- Deposition occurs in Pit A and Pit E
  - Pit E from January to August
  - Pit A from August to December
- Reclaim from Pit E and Pit A based on deposition schedule
- Elevation 120 triggered in 2025
  - West Road to be raised



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MBK - Water Level

# IPD 2021 PLAN – EOY 2026

## Forecast In-pit results

Location	Tailing Discharge (t)	Tailing Elev (m)	Water Elev (m)
Goose	0	80.06	120.25
Pit E	0	83.69	130.49
Pit A	1,620,000	85.59	130.49

## Mill Water Consumption

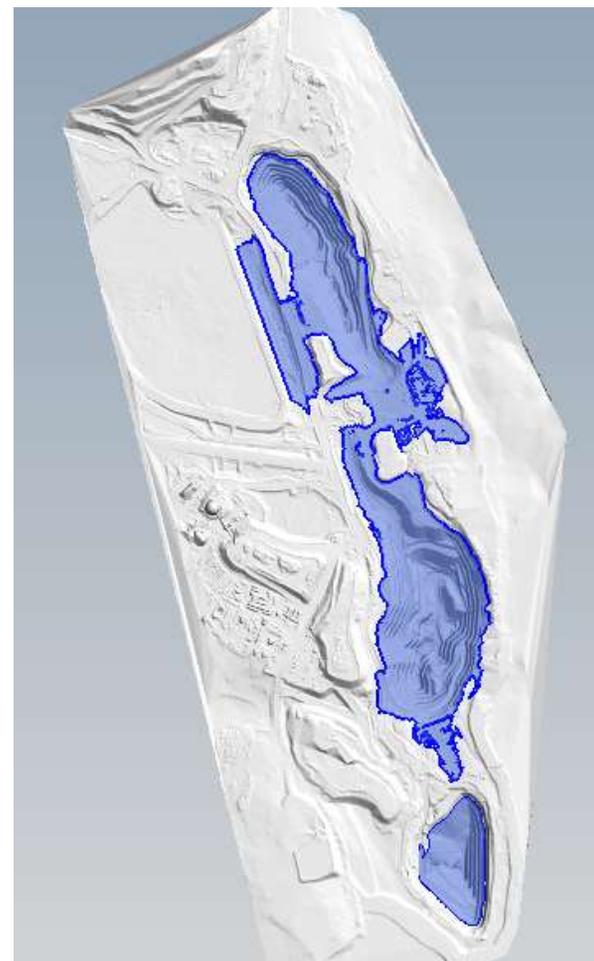
Source	Origin	Volume (m3)	Average flow m3/h
Mill Process Water Volume		1,797,645	540
Reclaim Water	Pit A	0	0
Reclaim Water	Pit E	1,422,364	329
Fresh Water	Third Port Lake	378,295	43

### Notes:

- Deposition occurs in Pit A until July 2026 (end of deposition)
- Reclaim from Pit E
- Re-flooding Goose Pit Jan-Nov 2026



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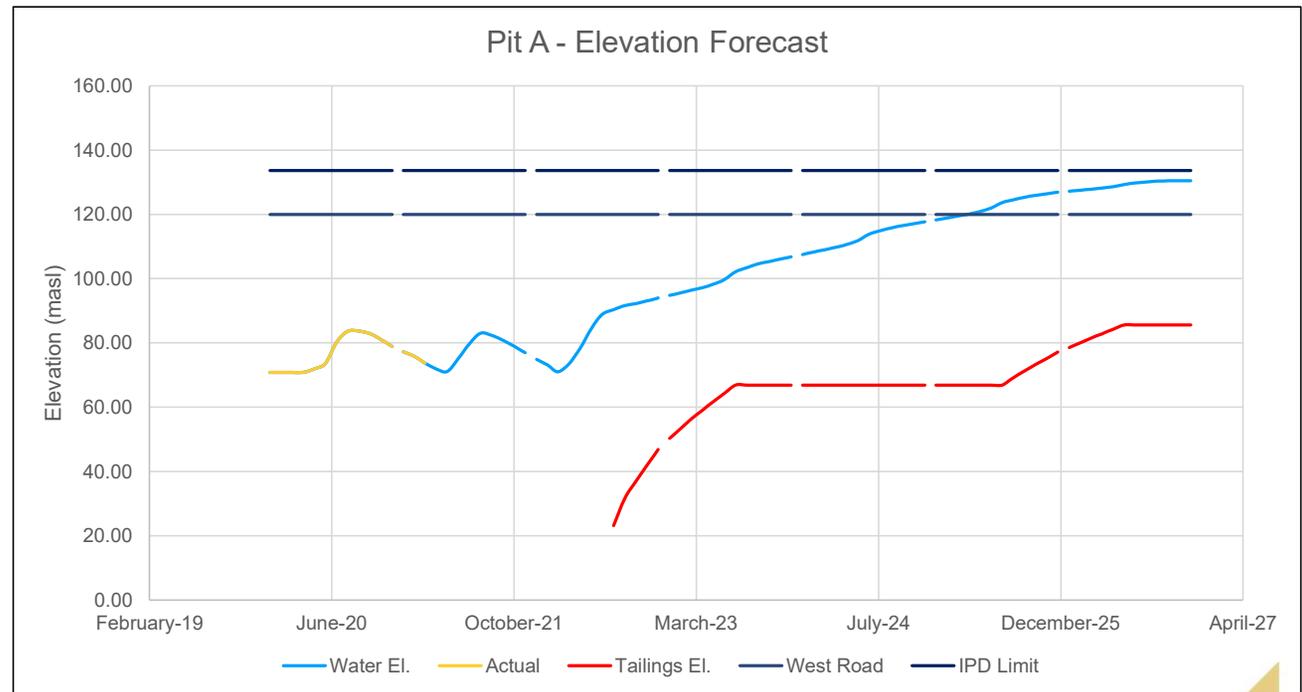


MBK - Water Level

# IPD 2021 PLAN– PIT A ELEVATION FORECAST



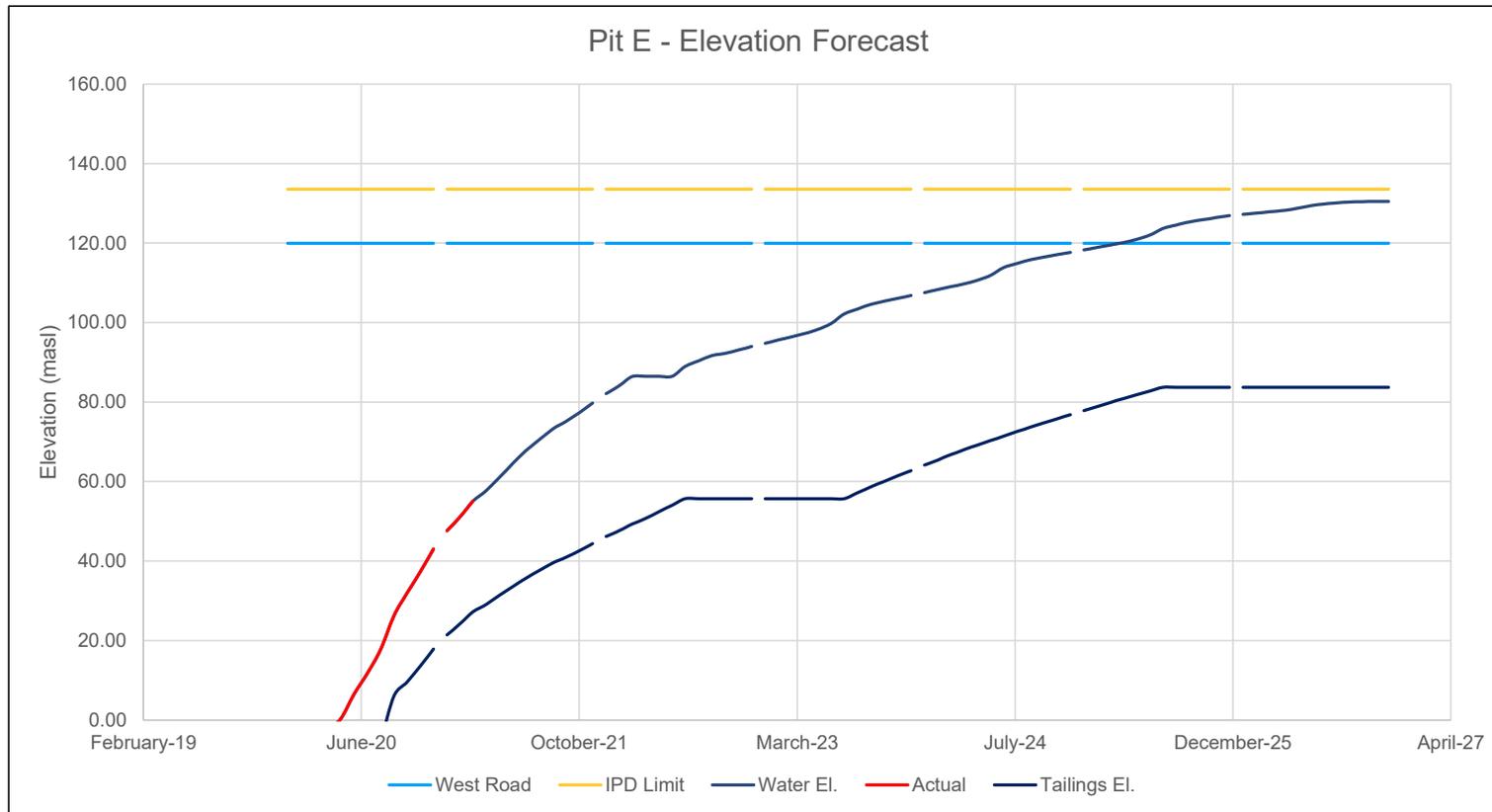
- Pit A connected to Pit E via Pit B dump at elevation 86.5 masl
  - This model assumes Pit A and Pit E are hydraulically connected via the dump
- Elevation 120 masl triggered in Mar 2025
- Tailing Deposition in Pit A starts August 2023
- 8m water cover over tailings always respected



# IPD 2021 PLAN- PIT E ELEVATION FORECAST



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## IPD 2021 PLAN – UNCERTAINTIES & ASSUMPTIONS



- Hydraulic connection between Pit A & Pit E above elevation 86.5 via the Portage waste dump
- Waste dump porosity of 0.3 (Volume available for water only – no tailings)
- Tailing Water Entrapment (13%)
  - Impact on amount of free water released
- Average precipitation values based on previous year