SRK Consulting (Canada) Inc.
2200–1066 West Hastings Street
Vancouver, BC V6E 3X2

T: +1.604.681.4196
F: +1.604.687.5532

vancouver@srk.com
www.srk.com

Memo

To:	John Roberts, PEng	**Client:**	TMAC Resources Inc.
From:	Gregory Fagerlund, MSc	**Project No:**	1CT022.002
Reviewed By:	Maritz Rykaart, PhD, PEng	**Date:**	December 4, 2015
Subject:	Response to NRCan IR-3 & AANDC IR#13: Estimation of the Time Required for the Underground Mine to Fill		

1 NRCan Information Request 3 (NRCan IR-3)

1.1.1 Subject

Post-mining groundwater flow regime around the underground mine.

1.1.2 Reference

Package 5 (P5-2), Package 6 (P6-3)

1.1.3 Rationale

NRCan requests clarification as to how groundwater flow into the underground mine will change once mining has ceased. NRCan requests clarification on how groundwater inflow rates will change and an approximate time frame for when the groundwater system will reach a post-mining state of equilibrium. This information will assist in confirming that the long-term potential contaminants in the underground mine (resulting from disposal of waste) do not have an effect on local groundwater that surrounds the underground mine. Such contamination could potentially occur if there is a groundwater flow reversal once a mine has filled with surface water and groundwater.

1.1.4 Information Request

a. Please provide clarification on the post-mining groundwater flow regime in the vicinity of the underground mine.

b. Please provide information on the time required for the underground mine to fill and clarification on post-mining groundwater regime (flow directions and rates) and potential impacts to the groundwater quality.

1.2 AANDC IR#13 – Tailings Management Plan

1.2.1 References

2.2 New Tailings Storage Requirements

Package 6, Part 7, Page 4 (PDF page 104)

Geochemical Characterization of Tailings from the Doris Deposits, Hope Bay 5 Summary and Conclusions

Package 6, Part 7, Page 30 (PDF page 91)

1.2.2 Issue/Concern or Information Deficiency

Concern that the strategy proposed by the proponent will accumulate a large volume of potentially acid generating (PAG) material and detoxified tailings underground. The detoxified tailings with acidic pH and elevated concentration of Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn can contaminate underground water.

1.2.3 Rationale

About 6% (i.e. 150,000 tonnes or 116,000 m^3) of the tailings are comprised of detoxified cyanide leach tailings, and this tailings stream will be sent underground where it will be mixed with underground waste rock for use as structural mine backfill.

The proponent states, that 'The detoxified tailings also showed a propensity for leaching of several metals in the humidity cell tests. In addition to arsenic, neutral pH metal leaching of ammonia, cadmium, copper, iron, selenium and silver was reported in the Doris North detoxified tailings, and cadmium and selenium in the Doris Central detoxified tailings. Acidic conditions developed in the Doris Central detoxified tailings after 202 weeks of testing. At acidic pH, increased metal leaching of Cd, Co, Cu, Fe, Mn, Ni, Pb, and Zn was noted.' The potential leaching of contaminates under low pH conditions can be a significant source of underground water contamination.

1.2.4 Information Request

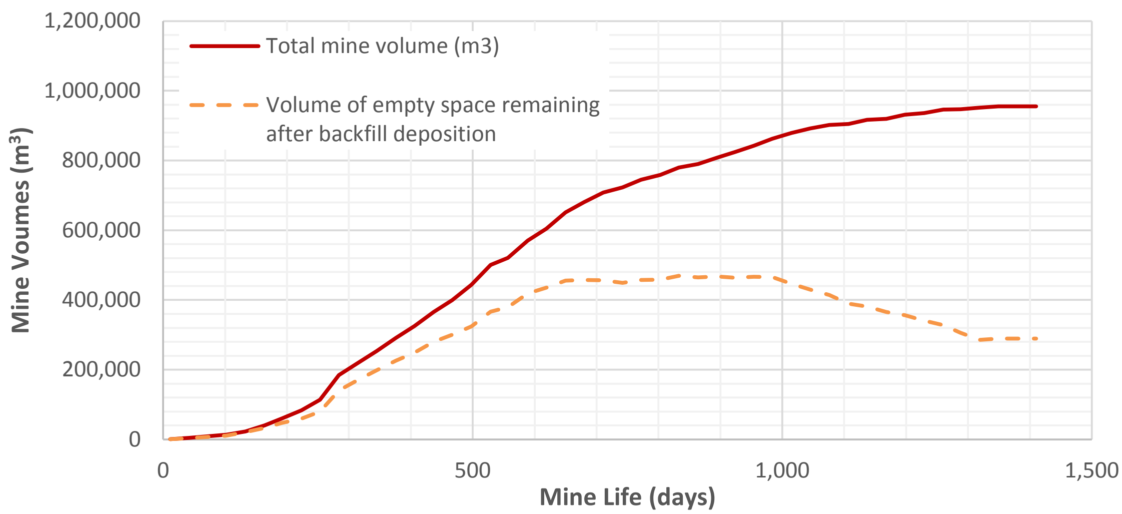
Please provide an analysis of the combined impact of detoxified tailings and backfilled PAG waste rock on groundwater.

2 TMAC Response

This response relates directly to item b. in NRCanIR-3 and follows on the response to AANDC-IR#13 which both required an estimate of the time for reflooding the Doris underground mine.

Once mining at Doris ceases, and the mine workings have been prepared for closure, mine dewatering pumps will be switched off and the mine will reflood. Figure 1 shows a plot of the mine volumes over time for the portions of Doris Central and Connector zones which are below the elevation of Doris Lake, including both talik and non talik zones, which is the maximum level to which the mine would flood. Two curves are represented: one curve corresponds to the total mine volume and the other, the volume of empty space remaining after backfill is deposited. Figure 2 shows a plot of the predicted inflow versus mine level elevation (in mine grid elevations).

The reflood time was estimated using a simplified step-wise approach that uses the groundwater inflow numerical predictions and the planned volume of mine workings. The time to reflood each mine level was calculated based on inflow rate predictions presented in Document P6-3, Groundwater Inflow and Quality Model at the respective mine levels and the planned mine volumes.



Note: A 30% porosity is assumed for tailings and waste rock backfill.

Figure 1: Estimated volume of the mine over time for the Doris Central and Connector Zones

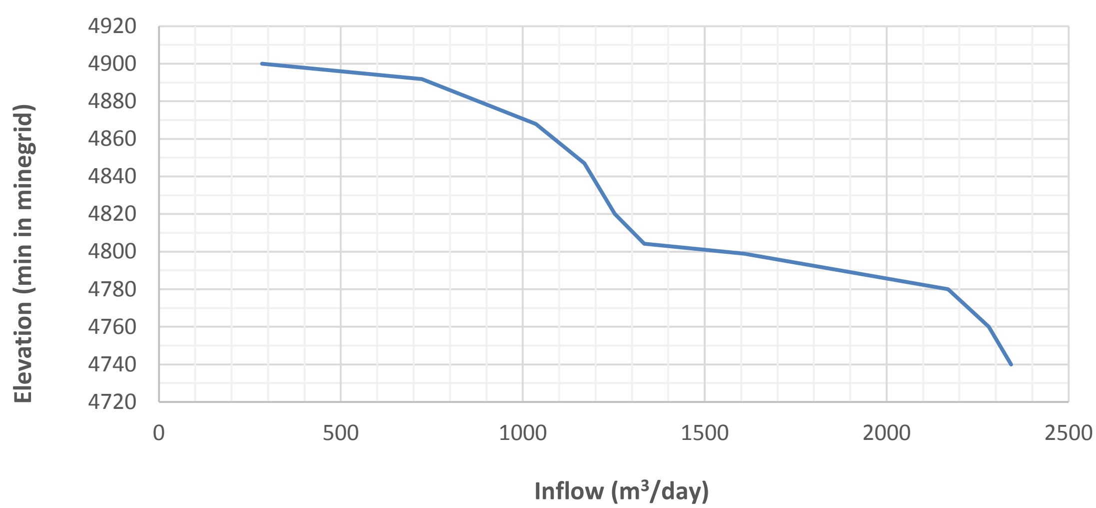


Figure 2: Predicted mine inflow in the Doris Central and Connector Zones versus elevation

The estimated groundwater reflood time at different times throughout the mine life is shown in Figure 3. Three reflood time curves are presented as follows:

- The base case reflood time estimation based on the inflow rates presented in Document P6-3. This corresponds to a mine inflow rate of about 1,450 m^3/day when mining ceases;
- A hypothetical case with a constant reflood inflow rate of 500 m^3/day for all mine levels. This rate corresponds to the lower end of the predicted inflow rates, when the mine begins to receive groundwater inflow; and
- A hypothetical case with a constant reflood inflow rate of 2,650 m^3/day for all mine levels. This rate corresponds to the maximum inflow rate predicted by the numerical model.

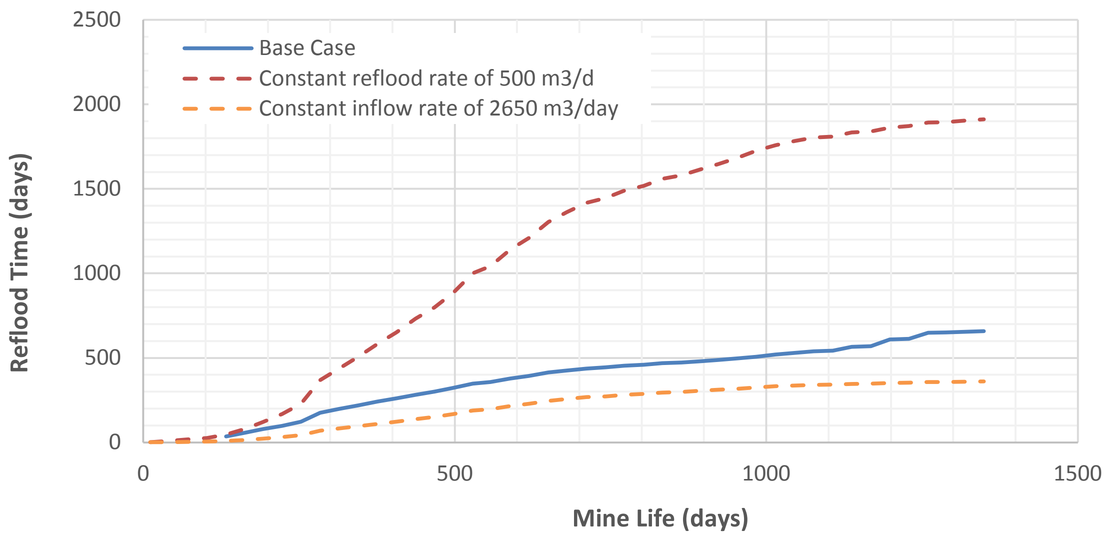


Figure 3: Reflood time estimates at different times throughout the mine life of Doris Central and Connector Zones

When the mine has been fully developed, the total reflood time is estimated to be about 2 years (660 days) for the base case. For the two hypothetical reflood scenarios presented in Figure 3, minimum and maximum reflood times of 1 and 5 years respectively can be observed.

It should be noted that these reflood estimates do not account for backfill being placed as mining progress. Over the life of mine approximately 810,000 m^3 of backfill is placed. This backfill consists of mine waste rock and filtered tailings. This material will reduce the volume of the mine and as a result the reflood values as presented are conservative, i.e. reflooding would occur much faster. If the two hypothetical scenarios account for backfill deposition, the minimum and maximum reflood times are reduced to 4 months and 1.7 years respectively.