JSAI

TECHNICAL MEMORANDUM

To: Jeffrey Smith jsmith@themacresourcesgroup.com
New Mexico Copper Corporation

From: Steve Finch, Principal Hydrogeologist-Geochemist
Michael A. Jones, Principal Hydrologist

Date: October 12, 2017

Subject: Hydrologic Effects of proposed Rapid Fill Reclamation of Copper Flat Open Pit

The proposed Copper Flat Project includes a mine pit, supply wells, tailings facility, and waste rock facilities located in the Hillsboro Mining District, Sierra County, New Mexico. The proposed operating scenario reflects a processing rate of 30,000 tons of ore per day for 11.5 years, which is "Alternative 2" in the Copper Flat Draft Environmental Impact Statement (BLM, 2015). Figure 1 shows the configuration of the ultimate open pit and Open Pit Surface Drainage Area (OPSDA).

After mining, rapid-fill of the open-pit reclamation is proposed. Clean water from the supply wells will be used to rapid fill the open pit to the steady state elevation that is projected to occur with natural fill. The primary purpose of rapid fill reclamation is to limit time of exposure of open pit bottom to atmospheric conditions (oxidation of sulfides) and to achieve optimum water quality while maintaining a hydraulic sink. The open pit dewatering and rapid fill effects were evaluated using the numerical model of groundwater flow developed by JSAI (2014) and peer reviewed and adopted by the New Mexico Office of the State Engineer (NMOSE).

At the end of mining, groundwater-level drawdown in the bedrock around the open pit reaches a maximum of about 800 ft at the pit (Fig. 2). A permanent cone of depression will form around the pit, with maximum drawdown of about 600 ft at the edge of the pit. The pit, which currently is an evaporative hydrologic sink, will form an evaporative hydrologic sink again in the future. Current and projected final pit water surface elevations and areas are shown on Figure 2. The existing pit currently has a water surface area of about 5.2 acres. The proposed pit water body will have a steady state surface area of about 22 acres.

Existing Open Pit

The existing Copper Flat open pit water body is a hydraulic sink, as evidenced by more than 20 years of data and analysis (SRK, 1997; INTERA, 2012, SRK, 2013; JSAI, 2014a; BLM, 2015). In addition the U. S. Army Corp of Engineers determined the Copper Flat water body is not a water of the U. S. because it is a hydraulic sink disconnected from natural water courses (Leavitt, 2014).

EXHIBIT
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Open-Pit Dewatering

Projected pit water level, pit-area groundwater level, and dewatering rates are summarized on Figure 3. Long-term total inflow ranges between about 35 and 65 gpm (56 and 105 ac-ft/yr) with an initial minimum of about 20 gpm (32 ac-ft/yr) and a maximum of about 70 gpm (113 ac-ft/yr), as the pit bottom approaches final elevation of 4,650 ft above mean sea level (amsl).

Pit Dewatering Effects

The drawdown effect of model-simulated open pit dewatering is shown on Figures 3 and 4. Open pit dewatering during mining creates a 600 ft cone of depression in the bedrock aquifer. Groundwater drawdown due to pit dewatering remains within the bedrock, and formation of the open pit and associated pit dewatering forms a permanent hydraulic sink (Figs.4 and 5). The area of open pit hydraulic containment (AOPHC) for end of mining is illustrated by the drawdown contours on Figure 4.

Post-Mining Open Pit Water Balance

The post-mining pit water level and water balance were simulated assuming the pit geometry and watershed shown on Figure 1. The area within the pit highwall is about 129 acres, and the total OPSDA watershed area is about 314 acres.

Precipitation on the pit area was estimated for each month based on the record at Hillsboro (JSAI, 2014, Sec. 2.0), with annual average precipitation of 12.5 in. Runoff from the highwall was simulated at 20.7 percent of precipitation, and runoff from the haul road at 30.3 percent. Runoff from the remainder of the watershed was simulated at 7.1 percent of precipitation.

Evaporation from the open pit was assumed at 50 in/yr, less than the 65 in/yr estimated potential evaporation (JSAI, 2014, Sec. 2.4) for the existing open pit. The lower rate reflects the wind and sun sheltering effects of the deeper open pit. Monthly evaporation rates based on the record at Hillsboro were scaled to match the annual rate of 50 in/yr.

Open Pit Reclamation

Post-mining reclamation would include use of the water-supply wells PW-1 through PW-4, and a temporary pipeline to the bottom of the pit, to rapidly fill the pit to the expected long-term post-mining equilibrium water level. The post-mining simulation assumes this “rapid fill” scenario. Rapid filling will result in better water quality in the open pit by filling it with clean water and inhibiting oxidation of sulfide by submerging potential acid-generating sections of the pit wall. The water quality from the PW wells has low total dissolved solids content, buffering capacity from bicarbonate ions, and meets all water quality standards (see attached lab report).

After mining is complete, the pit will be rapid filled to the projected steady-state post-mining water level that maintains the hydraulic sink conditions. The volume placed by rapid fill will still be within the cone of depression cause by open pit dewatering, with hydraulic controls caused by the established AOPHC.

A pumping rate of 2,726 gpm is simulated in the model, sufficient to fill the pit to elevation 4,894 ft amsl in 6 months. Total volume pumped from the supply wells will be 2,200 acre feet. Model simulated open pit water-level elevations due to rapid fill reclamation are presented on Fig. 5). The final open pit water body elevation of about 4,894 ft amsl corresponds to a water-surface area of about 22 acres. Water levels will fluctuate around this mean by a few feet, rising and falling seasonally and with wet and dry climatic conditions, but the hydraulic sink conditions will remain in place.

The simulated (annual) pit water balance is presented on Figure 6, showing a final pit water balance of about 93 ac-ft/yr, with about 57 ac-ft/yr from precipitation and runoff, and 36 ac-ft/yr from groundwater inflow, all discharging as evaporation from the pit water surface to maintain the hydraulic sink.

The rapid filling of the pit will not result in pit water discharging to the groundwater system. In the pit bottom, a dewatered space forms between the groundwater levels at the end of the rapid fill and the pit shell (see Fig. 2). Model simulated flow to this dewatered space during rapid fill amounts to 0.74 acre feet for the six month rapid fill event, and 0.00 acre feet for the following 100 year simulation into the future. Rapid fill water will be confined to the open pit and adjacent dewatered space, and the hydraulic force of groundwater discharge at the pit bottom and sides caused by the 600 ft drawdown cone created during dewatering will prevent discharges to groundwater.

Water levels in the open pit and immediate vicinity of the pit wall will change due to rapid fill and natural fluctuations after rapid fill, but groundwater levels adjacent to the pit will remain as a hydraulic sink, before, during, and after rapid filling. After reclamation, groundwater levels in the bedrock around the open pit will remain below pre-mining levels, due to groundwater flowing to the open pit and discharging as evaporation from the hydrologic sink (Fig. 7). The pit water level will fluctuate naturally (by a few feet) according to climate conditions, tending toward a long-term equilibrium level.

The pit will remain as a hydraulic sink during temporary water level fluctuations, because of the large cone of depression caused by dewatering and maintained by water surface evaporation. In order for it to be possible for water to flow from the pit to groundwater, the hydraulic gradient would have to be higher than surrounding groundwater. No conceivable storm event, wet year or even wet decade could possibly add enough water to the pit to reach the water level (>5,100 ft elevation) required to achieve flow-through. Figure 2 is an east-west cross section through the open pit, showing projected water levels in the pit and downstream (5,100 ft elevation).

Attachments

Figure 1. Ultimate open pit and watershed area

Figure 2. West-to-east hydrogeologic cross section E-E’ showing water-level profile across existing pit and proposed open pit after rapid fill

Figure 3. Projected pit water level, groundwater level, and pit pumping rate

Figure 4. Projected end-of-mining groundwater drawdown (ft) for Mine area

Figure 5. Model-simulated water level elevation contours and direction of groundwater flow around open pit at end of mining

Figure 6. Projected open-pit water level due to rapid fill reclamation

Figure 7. Projected open-pit water balance during first six months of rapid fill and afterwards

Figure 8. Model-simulated open pit water level elevation, groundwater level elevation contours, and direction of groundwater flow after rapid fill reclamation

PW-1 water quality analysis

References

[BLM] U. S. Bureau of Land Management, 2015, Copper Flat Copper Mine Draft Environmental Impact Statement: BLM/NM/ES-16-02-1793, November 2015.

INTERA, 2012, Baseline Data Characterization Report for Copper Flat Mine, Sierra County, New Mexico. Report prepared for New Mexico Copper Corporation, June 2012.

[JSAI] John Shomaker & Associates, Inc., 2014, Model of Groundwater Flow in the Animas Uplift and Palomas Basin, Copper Flat Project, Sierra County, New Mexico: Consultant report prepared for NM Copper Corporation.

[JSAI] John Shomaker & Associates, Inc., 2014a, Results from first year of Stage 1 Abatement investigation at the Copper Flat Mine Site, Sierra County, New Mexico: Consultant report prepared for NM Copper Corporation.

[JSAI] John Shomaker & Associates, Inc., 2017, Results from first year of Stage 1 Abatement investigation at the Copper Flat Mine Site, Sierra County, New Mexico: Consultant report prepared for NM Copper Corporation.

Leavitt, M., 2015, Letter regarding Approved Jurisdictional Determination – Action No. SPA-2014-00364-LCO, Open Pit Water Body Inclusive of the Associated 230 Acre Watershed at Copper Flat Mine in Sierra County, New Mexico to Katie Emmer, New Mexico Copper Corporation, October 6, 2014

SRK, 1997, Copper Flat Mine Compilation of Pit Lake Studies: Consultant's report prepared by Steffen Robertson and Kirsten, Inc. prepared for Alta Gold Co., December 1997

SRK, 2013, Predictive Geochemical Modeling of Pit Lake Water QWaulity at the Copper Flat Project, New Mexico: Consultant's report prepared by SRK Consulting prepared for TheMAC Resources Group, LTD, September 2013

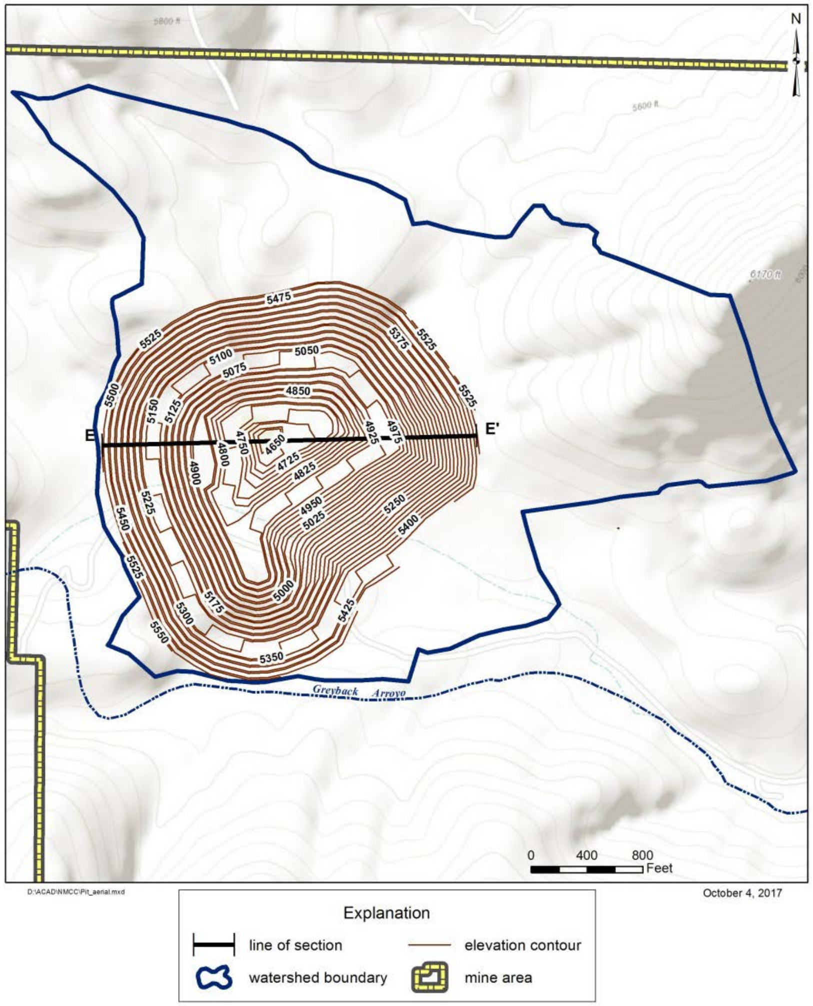

Figure 1. Ultimate open pit and watershed area.

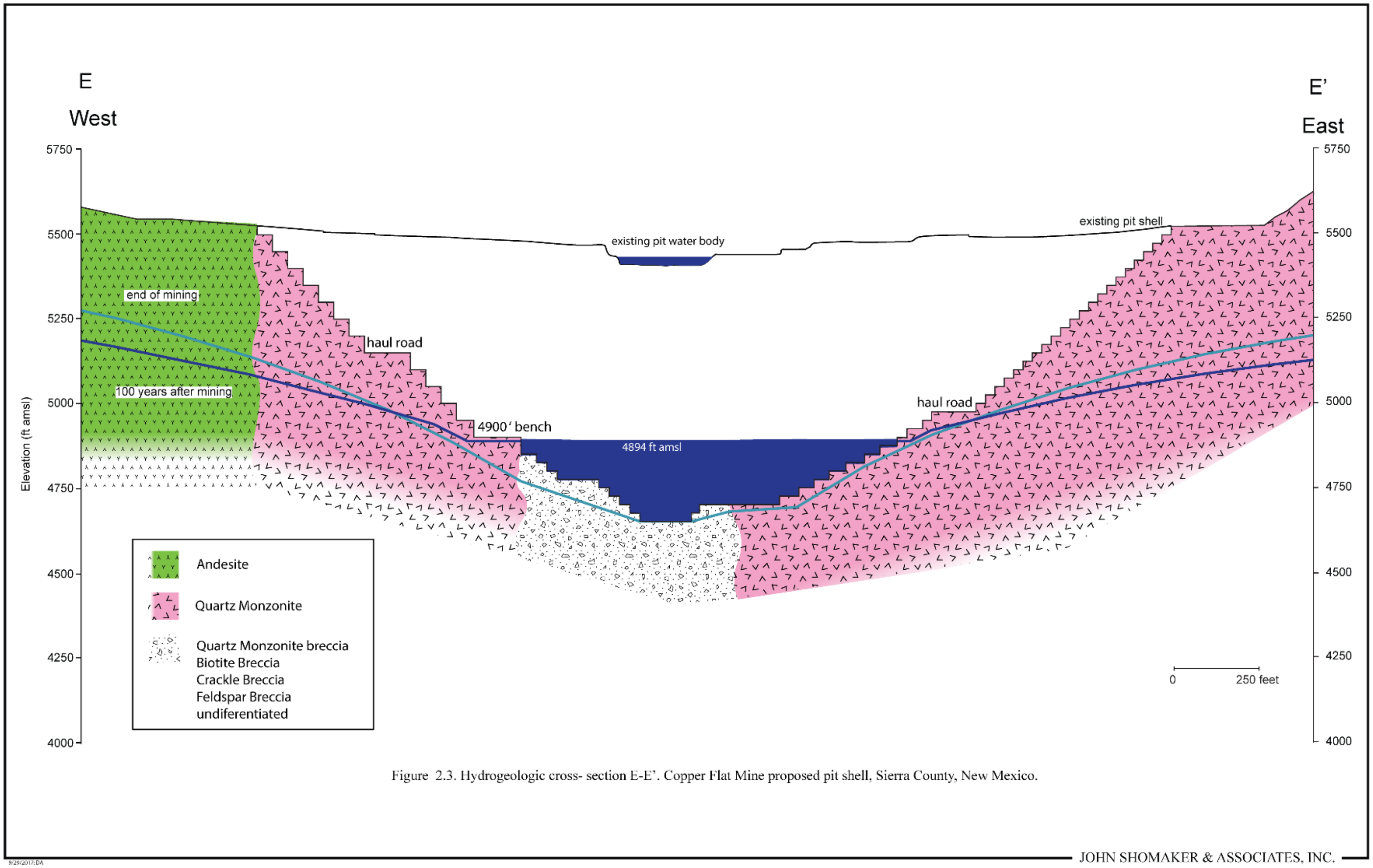

Figure 2.3. Hydrogeologic cross- section E-E’. Copper Flat Mine proposed pit shell, Sierra County, New Mexico.

Figure 2. West-to-east hydrogeologic cross section E-E’ showing water-level profile across existing pit and proposed open pit after rapid fill.

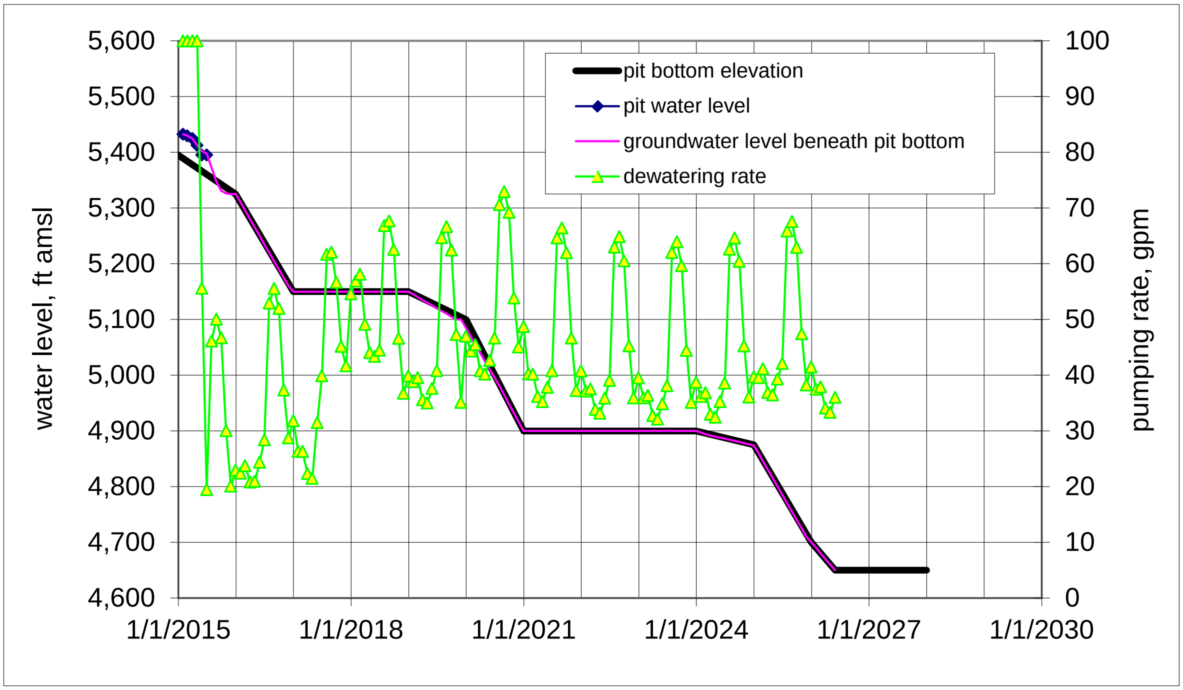

Figure 3. Projected pit water level, groundwater level, and pit pumping rate.

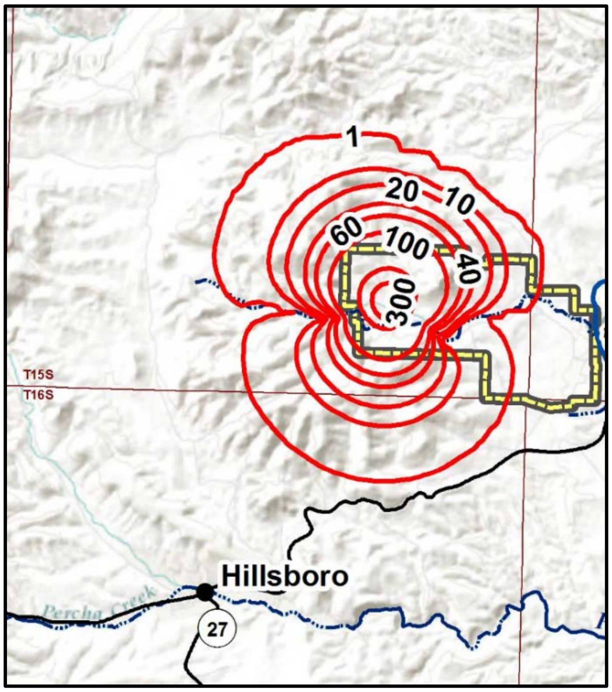

Figure 4. Projected end-of-mining groundwater drawdown (ft) for Mine area.

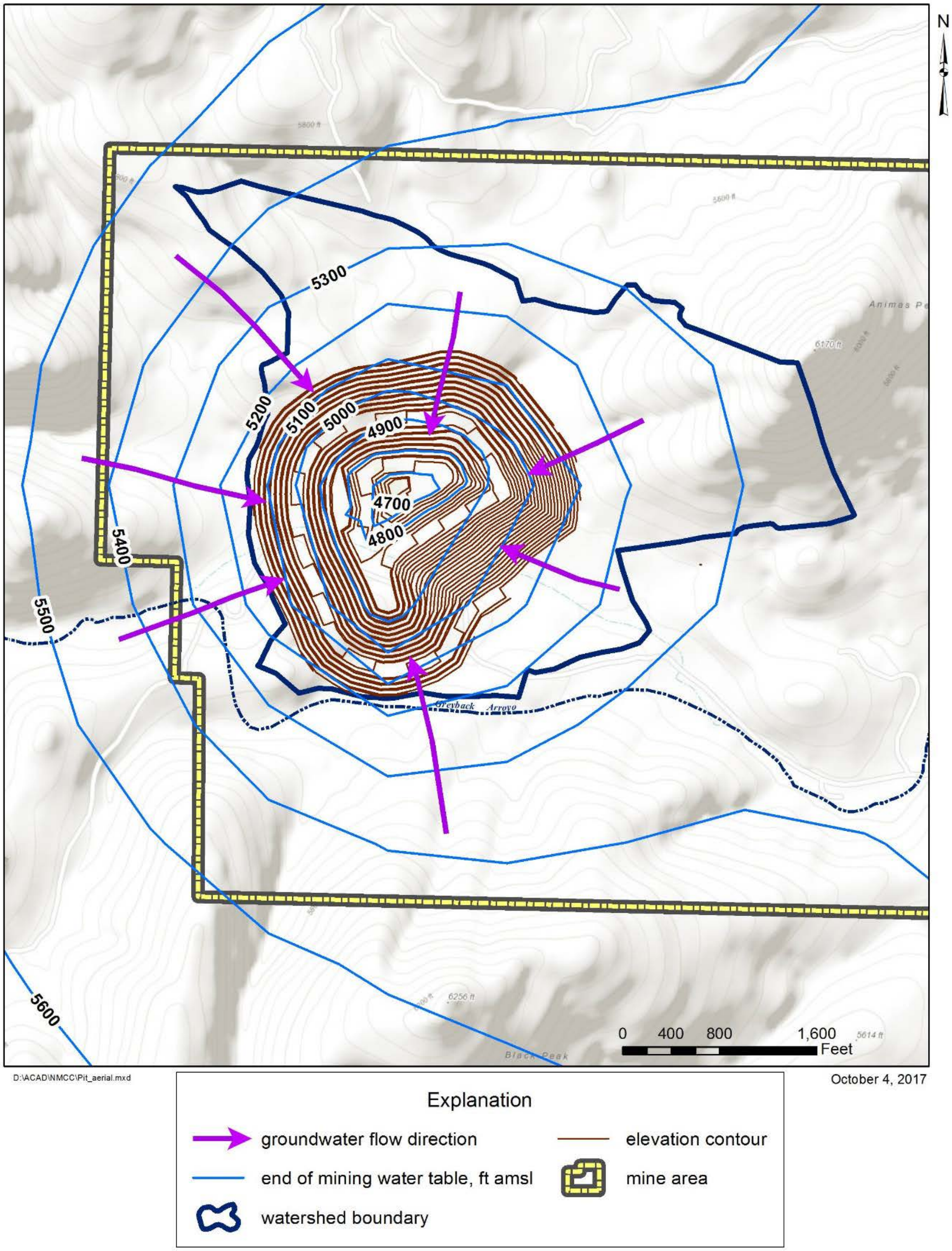

Figure 5. Model-simulated water level elevation contours and direction of groundwater flow around open pit at end of mining

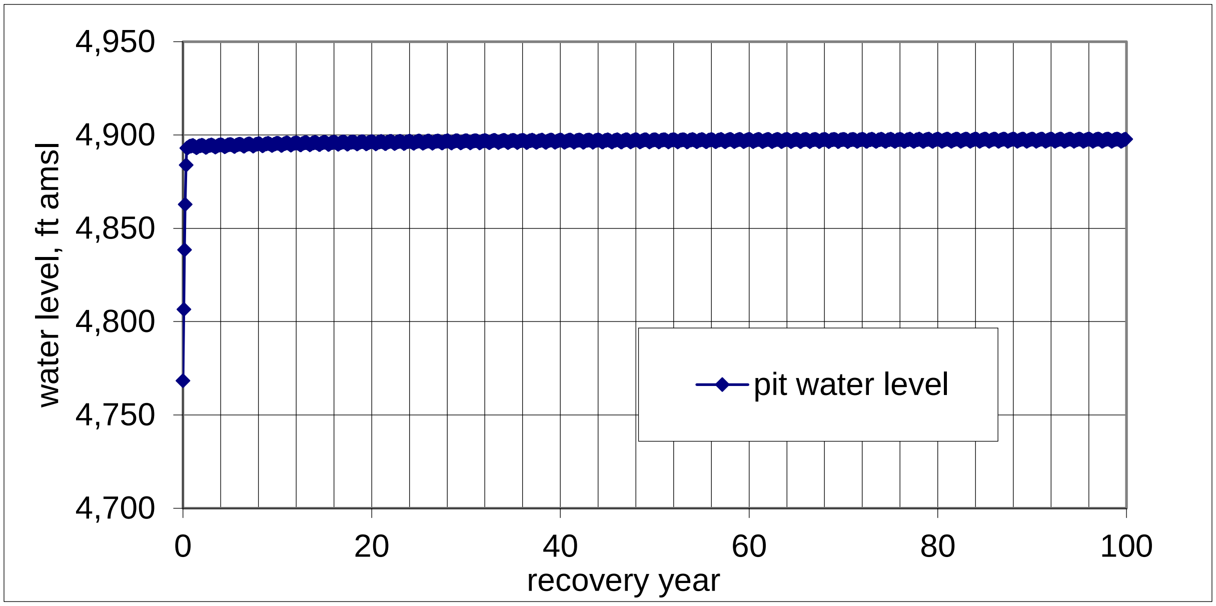

Figure 6. Projected open-pit water level due to rapid fill reclamation

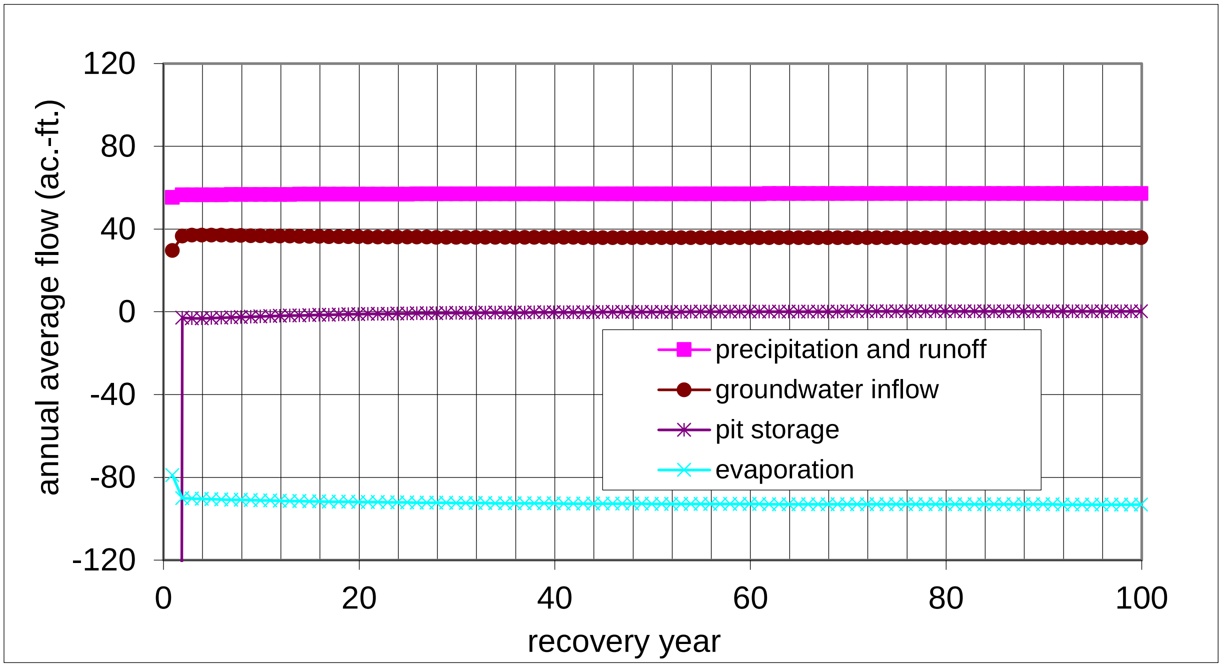

Figure 7. Projected open-pit water balance during first six months of rapid fill and afterwards.

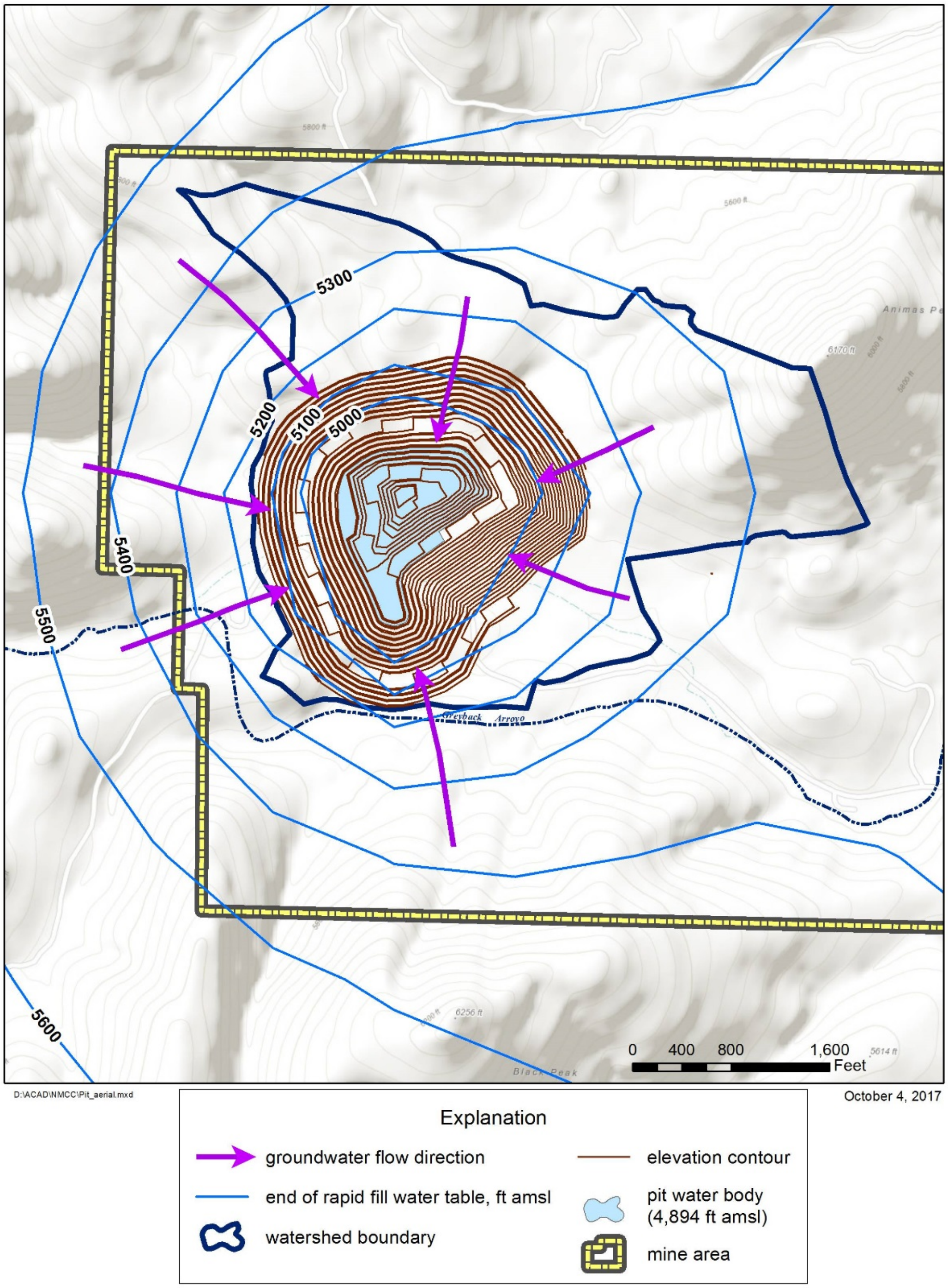

Figure 8. Model-simulated open pit water level elevation, groundwater level elevation contours, and direction of groundwater flow after rapid fill reclamation