

**EXECUTIVE SUMMARY**  
**PROBABLE HYDROLOGIC CONSEQUENCES & PREDICTIVE GEOCHEMICAL MODELING OF PIT**  
**LAKE WATER QUALITY REPORTS**  
**COPPER FLAT MINE**  
**THEMAC Resources Group Ltd.**  
**May 2018**

## FINDINGS

Based on the model results presented in *Probable Hydrologic Consequences of the Copper Flat Project Sierra County New Mexico* by JSAI, Inc., December 2017, NMCC's planned operations at Copper Flat will minimize change to the hydrologic balance in the permit area and potentially affected areas. These two reports together provide an analysis of how NMCC's reclamation plan will meet the performance and reclamation standard contained in 19.10.6.603.C.(4), Hydrologic Balance.

As detailed in JSAI's report, groundwater systems at Copper Flat include:

- The regional Santa Fe Group (SFG) aquifer,
- Quaternary-age alluvial aquifers along Animas and Percha Creek,
- The crystalline bedrock of the Animas uplift.

Surface water includes:

- Perennial flow in the Rio Grande and Caballo Reservoir that is supplied in part by discharge from the SFG aquifer.
- An area of perennial flow and riparian vegetation along Animas Creek where the Quaternary-age alluvial aquifer discharges to the surface and an area of perennial flow and riparian vegetation along Percha Creek, atop the crystalline bedrock.
- Springs
- Storm water flows in Grayback Arroyo.

JSAI's report details how the groundwater and surface water in the permit area and potentially affected areas are impacted by the operation of Copper Flat, and shows how mitigation measures and physical properties of the area result in minimal change and meet the standard of similar after mining ceases. Table 1 below presents JSAI's findings of probable effects for groundwater and surface water systems and how the post-mining condition will be similar to pre-mining conditions. Based on the model results presented in *Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico* by SRK Consulting,

<b>Table 1</b>		
<b>System Evaluated</b>	<b>Probable Effect</b>	<b>Post-Mining Condition</b>
Santa Fe Group Aquifer	Water-level drawdown in the SFG aquifer projected to reach a max. of 70' at the well field at the end of mining. (Section 3.1.1 JSAI 2017)	Water levels will recover over a period of about 20-30 years.
Quaternary-age alluvial aquifers along Animas and Percha Creeks	Effects are projected to be minimal, less than 2' of groundwater-level change on Percha, less than 1' of groundwater-level change on Animas. (Section 3.1.7 JSAI 2017)	Water levels will remain similar throughout mine operation and minimal changes to water levels will recover after mining ceases.
Crystalline bedrock of Animas uplift	At the end of mining, drawdown will approach a maximum of about 750' at the bottom of the dewatered pit and drawdown of 1' extends for an approximately 2-mile radius around the pit. (Section 3.2.1 JSAI 2017)	The crystalline bedrock will be similar to pre-mining conditions in that it has not historically been a strong source of groundwater and it will remain thus into the future.
Perennial flow in the Rio Grande and Caballo supplied by SFG	Depletion to the Rio Grande is projected to peak around 2,080 ac-ft/yr at the end of mining. These depletions will be offset by additional water purchased by NMCC and added to the river to result in no net effect to the Rio Grande. (Section 3.1.1 JSAI 2017)	Offsets will be supplied to the Rio Grande to match depletions to flow even as depletions decrease in the years post mining. JSAI projects that depletions will be about 28-ac-ft/yr 100 years after mining. At some point, NMCC may elect to permanently retire water rights to offset depletions to the Rio Grande. (Section 3.1.4 JSAI 2017)
Area of perennial flow along Animas Creek where Quaternary-age alluvial aquifer discharges to the surface and an area of perennial flow and riparian vegetation along Percha Creek, atop the crystalline bedrock.	Peak groundwater drawdown along Animas Creek and most of Percha Creek will be less than 1 ft. A small area of Percha Creek is projected to see drawdown of less 1-2 ft. (Section 3.1.7 JSAI 2017)	Projected effects on evapotranspiration and surface discharge from the shallow aquifers are small and will recover post mining.
Effects on Springs	Springs discharging on the Animas uplift are fed by local perched groundwater systems or precipitation and would not be affected by flow of groundwater toward the open pit. Springs of the Animas Graben are fed by Las Animas and Percha Creek watersheds west of the Animas Uplift and are separate from and will not be directly affected by movement of groundwater toward the open pit. Springs on the east edge of the Animas Uplift could be indirectly affected by the project. (Section 3.2.4 JSAI 2017)	No direct effects to identified springs are predicted to occur as a result of the project because (1) the springs of the Animas Uplift are ephemeral, precipitation-event-fed springs unrelated to the bedrock groundwater system, (2) the springs of the Animas Graben are fed by groundwater from the west and depth, unrelated to groundwater of the Uplift. Small indirect effects may occur, however the end result to the hydrologic balance is expected to be similar.
Storm water flows in Grayback Arroyo.	The Grayback Arroyo diversion would be maintained. (Section 1.1 JSAI 2017)	No change to the Grayback Arroyo will result in similar conditions post mining.

Inc., December 2017, the changes to the hydrologic balance of the future pit water body that will form post- mining will be nil or minimal. Section 4.3.4 of the July 2017 Revised MORP presents further information about how the planned and designed operations of Copper Flat minimize change to the hydrologic balance in the permit area and potentially affected areas. Subsection 19.10.6.603.C.(4) NMAC (Hydrologic Balance) specifically addresses requirements on how hydrologic balance to surface water quality will be achieved. The SRK and JSAI PHC reports address potential water quality and quantity impacts to groundwater from the mine pit, waste rock stockpiles and the tailings storage facility, and potential water quantity impacts to the groundwater and surface water system at the site and potentially affected areas. Subsection 19.10.6.602.D.(13).(g).(v) NMAC requires that the baseline data provided include a determination of the probable hydrologic consequences of the operation and reclamation, on the permit and affected areas with respect to the hydrologic regime, quantity and quality of surface and groundwater systems that may be affected by the proposed operation, including dissolved and suspended solids under seasonal flow. As such, Section 4.3.4 of the July 2017 Revised MORP addresses the surface water component of this requirement.

With respect to groundwater quantity and quality of the hydrologic regime, Subsection 19.10.6.603.C.(4) NMAC requires that operations be planned and conducted to minimize change to the hydrologic balance in both the permit and potentially affected areas and that reclamation result in a hydrologic balance similar to pre-mining conditions unless non-mining impacts have substantially changed the hydrologic balance. Operations at the Copper Flat project are planned and will be conducted such that change to the hydrologic balance in the groundwater regime of the permit at affected areas will be similar to pre-mining conditions. The mine pit has been determined to be a hydrologic sink such that during operations there will be no impact to groundwater as groundwater around the pit will flow to the pit. The waste rock stockpiles will be located on the andesite bedrock, demonstrated to provide a natural impermeable liner, thus preventing net-percolation from the WRSP to groundwater. A liner will be installed at the TSF to prevent percolation of tailings fluids to groundwater during operations. Therefore, during operations there will be no impacts to groundwater quality.

With respect to minimizing impacts to groundwater quantity during operations, the JSAI PHC report demonstrates that water quantity impacts during the 12 years of operations will be localized and minimal. The groundwater flow model projections indicate that existing water rights uses will not be impaired by the Copper Flat operations, as required pursuant to the New Mexico State Engineer requirements for water rights protection.

The mine site will be reclaimed in accordance with the Reclamation Plan presented in Appendix E of the MORP. As described therein, reclamation of the site will ensure that a hydrologic balance similar to pre-mining conditions will prevail. With respect to surface water, quality and quantity, the diversion structures that diverted water around the site will remain after reclamation. On-site reclamation is designed such that the site will be regraded and re-contoured and a 36-inch soil cover will be placed over the TSF, WRSP's and other areas identified in the Reclamation Plan. Other areas of the site, such as haul roads, process areas will receive a 6-inch soil cover, as appropriate. The soil cover areas will be re-vegetated as described in the Reclamation Plan. Mine pit areas identified to receive soil cover, such as the haul roads

and perimeter of the mine pit will be re-contoured and reclaimed per the Plan. Upon completion of reclamation all direct precipitation onto the site will be shed off the site through runoff collection channels and swales, routing surface water to Grayback Arroyo. The mine pit will be rapid-filled with fresh water from the Production Wells as described in the Reclamation Plan and the PHC. Surface water in the Open Pit Surface Drainage area will continue to report to the open pit after reclamation. As discussed in detail in the MORP, DP and referenced herein in the SRK and JSAI PHC reports, the mine pit will remain a hydrologic sink after mining and the resulting future pit lake will not significantly change. The resulting surface water hydrologic balance will be similar to that which exists pre-mining.

The groundwater hydrologic regime will also be similar post-mining. As noted above, the existing mine pit is a hydrologic sink and will remain so in the future after reclamation. A 36-inch thick soil cover will be placed over the re-graded and re-contoured WRSP's per the Copper Rule regulatory requirements to eliminate net-percolation through the stockpile, and of course, the andesite formation will provide an additional protective shield to groundwater. Similarly, the TSF will be covered with 36-inches of soil cover in accordance with regulatory requirements. The site will be revegetated as described in detail in the Reclamation Plan. Therefore, the groundwater hydrologic regime will be similar post-mining in compliance with 19.10.6.603.C.(4) NMAC. Monitoring will be conducted after reclamation to provide verification as discussed below.

## **MONITORING**

The Monitoring Plan presented as Appendix E to the Copper Flat Mine Discharge Permit by JSAI Revised, 2016, presents a monitoring well network within the permit area that will be able to verify the effectiveness of mitigation and reclamation efforts. A monitoring network has also been developed to verify the similarity of the hydrologic balance in the potentially affected areas as well and is presented below.

NMCC believes that the groundwater model is conservative and that monitoring will reveal that impacts to groundwater in the potentially affected areas will be less than those projected. NMCC nevertheless commits to providing a groundwater monitoring network to evaluate future impacts to the three groundwater units identified near Copper Flat and its Production Wells. The information obtained through this monitoring network can be used to verify the similarity of the hydrologic balance for MMD, and will be useful to other agencies, such as the Office of the State Engineer (OSE), the Bureau of Land Management (BLM) and United States Fish & Wildlife (USFW).

With assistance from JSAI, NMCC has evaluated the number of wells necessary to monitor the groundwater projections. NMCC has identified 23 monitoring wells at the mine and in the surrounding affected area that will be sufficient to assess and verify projected effects on the Santa Fe Group aquifer (eight wells), the Quaternary-age alluvial aquifers along Animas (four wells) and Percha Creek (three wells) as well as the crystalline bedrock of the Animas uplift (eight wells). Plate 1 presents the locations of these 23 monitoring wells in relation to the mine area and the Production Wells. Some of these wells are part of the Monitoring Plan in Appendix

E of the Discharge Permit, and others are in addition to it. Where necessary, NMCC has obtained permission from private land owners for access to monitor these wells through mine operation and reclamation. Many of these wells have been in place for years and NMCC has background data on water levels and water quality, some are newly identified monitoring locations, and 3 wells will be drilled to replace wells that will be taken out by the planned pit expansion.

These wells are in the three groundwater systems shown in the Copper Flat groundwater model:

### **Santa Fe Group**

Eight Santa Fe Group aquifer wells (all of these have been used historically): MW-5 near the Production Wells, MW-9 and MW-10 north of the Production Wells along Animas Creek, MW-6 west of the wellfield, MW-8, MW-4 and MW-2 near the mine area to the west and southwest of the wellfield, and GWQ11-27 east of the wellfield in the flowing well area along Animas Creek. NMCC has right of way access from BLM (via NMNM 125870) to monitor MW-2, MW-5, MW-6 and MW-8. NMCC owns the land where MW-4 is located. NMCC has permission from the rangeland allotment holders, to monitor MW-6. NMCC owns MW-9 and MW-10 and has permission from the private landowners to access these wells.

### **Alluvium**

Four shallow alluvial wells along Animas Creek (MW-11 has been monitored historically, the remaining wells are new additions): MW-11 north of the wellfield, NMCC owns this well and has permission from the private landowners for access. Also three existing wells owned by private landowners along Animas Creek, one west of MW-11 and another east of MW-11, and a third east of GWQ11-27 near I-25. The private wells will be monitored via transducers that will not interfere with the use of the wells. NMCC has permission from the private landowners to access the wells.

Three existing wells installed by the Bureau of Reclamation (BOR) in the shallow alluvium of Percha Creek are proposed additional monitoring points. BOR has granted NMCC ownership of these wells and NMCC has permission from private landowners for access.

### **Crystalline Bedrock**

There are eight wells proposed for monitoring the crystalline bedrock. Seven wells in the bedrock around the open pit have provided historic data: GWQ-5R, GWQ-6N, GWQ96-22, GWQ96-23, GWQ11-24, GWQ11-25, and GWQ11-26. Of these, two will be destroyed by the expansion of the pit (GWQ11-23 and GWQ11-25). Access to these wells is provided either through NMCC ownership of the well site and well or through an approved access permit with BLM. Three new wells proposed in the New Mexico Copper Discharge Permit application, PGWQ-1, PGWQ-2, and PGWQ-3, will replace two existing wells (GWQ11-23 and GWQ11-25) north and east of the pit that will be taken out during the expansion of the pit through mining operations. These new wells will be installed prior to operation of Copper Flat.

If the Office of the State Engineer (OSE) requires additional monitoring points as conditions of NMCC's water pumping permit, NMCC will incorporate them into the monitoring network. NMCC will comply with all of OSE's directives and conditions regarding groundwater monitoring per its (anticipated) pumping permit. Monitoring and reporting data from the monitoring network will be performed by qualified NMCC personnel staff assigned to the Copper Flat Mine as part of standard procedure during project construction, operation, and reclamation. If NMCC's pumping is found by the OSE to impair private water rights, NMCC will take all appropriate measures, as required.

Similarly, if the groundwater monitoring described herein demonstrates that the impacts of pumping are greater than the model predicted, USFW and BLM have the authority under Section 7 consultation to require additional evaluation and negotiation of monitoring and mitigation measures necessary to protect threatened or endangered species.

JSAI review of the monitoring network and well locations described here has determined that the proposed network is more than adequate to evaluate performance of the NMCC groundwater model and effectively identify changes that may occur in each of the three groundwater systems of interest. Further, monitoring of the shallow alluvial wells will give hydrologists insight into whether surface waters in Las Animas and Percha Creeks might be measurably affected. At this time, the model indicates that impacts to surface waters will be so minor as to not be measurable, but this monitoring network will provide data regarding greater unanticipated effects if they do occur.

### **Pit Water Quality and Quantity**

A property plat for the pit area was completed by a registered land surveyor and provided to NMED in previous correspondence. The survey and plat confirm that the current pit body is entirely on private lands, as shown on the plat. Further, NMCC has proposed a design that will confine the surface of the pit water body in the future pit entirely on private lands. As such, the pit water body is not considered "waters of the state" subject to the New Mexico surface water quality regulations.

Based on the model results presented in *Predictive Geochemical Modeling of Pit Lake Water Quality at the Copper Flat Project, New Mexico* by SRK Consulting, Inc., December 2017, the changes to the hydrologic balance of the future pit water body that will form post-mining will be nil or minimal. The water quality will be very similar to that of the existing pit lake. The existing pit lake at Copper Flat and the future pit water body at Copper Flat are and will be artificial water bodies created as a result of mineral extraction. The post-mining water body will be similar to the existing pit lake and is not expected to be conducive to providing aquatic habitat or supporting fish life. The mine pit reclamation proposed for Copper Flat meets the water quality similarity requirements of 19.10.6.603 NMAC.

Based on the model results presented in *Probable Hydrologic Consequences of the Copper Flat Project Sierra County New Mexico* by JSAI, Inc., December 2017, the pit, which currently is a evaporative hydrologic sink, will remain an evaporative hydrologic sink post-mining.

The projected similarity of water quantity and quality in the pit as well as the continuity of the pit as an evaporative hydrologic sink will be confirmed by post-mining monitoring of the pit as described in the monitoring plan discussed above and in NMCC's Discharge Permit Application.