USDA Forest Service
Tonto National Forest
Arizona

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Process Memorandum to File

Review of Queen Valley Hydrologic Connection to Queen Creek

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Purpose of Process Memorandum

The Draft EIS (DEIS) for the Resolution Copper project was released in August 2019 and included an analysis of the potential impacts from tailings seepage to groundwater quality in aquifers downgradient from the tailings storage facility. The analysis also extended to any potential surface water quality impacts where perennial waters downstream from the tailings storage facilities are fed by groundwater.

The water quality analysis was conducted as far downstream as the nearest downstream perennial water. To estimate impacts, the predicted concentrations of contaminants in these perennial waters were compared to Arizona numeric surface water quality standards; since the surface water quality standards vary by use, the most strict standards (i.e., lowest allowable concentrations) were used for comparison (see DEIS, Appendix N, Table N-5).

The specific perennial waters analyzed in the DEIS were:

- Queen Creek at Whitlow Ranch Dam, pertinent to Alternatives 2, 3, and 4
- Gila River below Donnelly Wash, pertinent to Alternative 5
- Gila River below Dripping Springs Wash, pertinent to Alternative 6

The rationale for selecting these locations for analysis was described in Section 3.7.2 of the DEIS:

> *The downstream limit of the analysis area is the location of the first perennial water, specifically Queen Creek at Whitlow Ranch Dam and the Gila River either at Donnelly Wash or Dripping Spring Wash. The goal of this section is to identify potential risks to water quality, including surface water. These perennial surface water locations are the point at which seepage would enter the surface water system and represent the location at which surface water quality is most at risk and any impacts on surface water or aquatic habitat would be greatest.* (DEIS, p. 346)

Comments received on the DEIS, including those from the U.S. Environmental Protection Agency, questioned the appropriateness of stopping the analysis at these locations and not assessing impacts further downstream, particularly to community water supplies. In response, Section 3.7.2 of the FEIS has been modified to discuss further downstream impacts.

With respect to the Gila River, these impacts are relatively straightforward to assess since a continuous physical connection to downstream water supplies via surface water exists downstream from Donnelly Wash (Alternative 5) and Dripping Springs Wash (Alternative 6). This allows the project impacts to be reasonably extrapolated downstream.

Potential receptors downstream on Queen Creek represents a more difficult problem, requiring an assessment of the hydrologic connection between the perennial water at and outflow from Whitlow Ranch Dam, and the near downstream community of Queen Valley. The purpose of this memo is to review the information and evidence available to describe this hydrologic connection, and identify the ramifications this information has on the FEIS analysis.

Key Process Steps

In order to assist the Tonto National Forest with reviewing public comments, formulating responses to those comments, and revising analysis where appropriate, a Water Resources Workgroup was reconvened in January 2020. This workgroup represented the combination of several workgroups that existed prior to the publication of the DEIS, which were useful to the Tonto National Forest for evaluating groundwater modeling and water quality impacts. The reconvened workgroup included a wide variety of participants including Forest Service specialists, specialists from the NEPA third-party contractors, Resolution Copper and their contractors, cooperating agency specialists including USEPA, the U.S. Army Corps of Engineers (USACE), Arizona Department of Water Resources (ADWR), Arizona Department of Environmental Quality, Arizona Game and Fish Department, and a specialist attending on behalf of the San Carlos Apache Tribe.

Comments on the scope of analysis for downstream water quality impacts were brought forward at the first meeting of the Water Resources Workgroup on January 23, 2020 (Project Record #0003714). An action item (WR-12) was developed at this meeting to compile applicable data related to the Queen Valley hydrologic connection with Queen Creek.

The results of the investigation were provided to the Tonto National Forest and circulated to the workgroup in April 2020: Montgomery & Associates, "Response to Groundwater Work Group Action Item WR-12: Assessment of Potential Sources of Impact in the Queen Valley Area", April 22, 2020.

Information Reviewed

The location of Queen Valley is such that it lies outside of the alluvial basin aquifer in the East Salt River Valley, which has been thoroughly investigated and modeled over the years by the ADWR, and also beyond the domain of the groundwater model constructed for the Resolution Copper mine site, which only encompasses the Queen Creek basin above Whitlow Ranch Dam. Neither modeling effort speaks directly to Queen Valley hydrologic conditions. To remedy this, Montgomery & Associates (2020) compiled and reviewed available hydrologic information to determine the hydraulic connection between Queen Valley and the upstream watershed:

- Several aquifer tests were reviewed that reflect Quaternary alluvium and Tertiary basin fill deposits that form the primary aquifers for Queen Valley.

- Well records available from ADWR were reviewed, including well registry files and associated drillers' logs, and Groundwater Site Inventory (GWSI) water level records.

- Estimates of depth to consolidated rock were determined from these well records. Consolidated units below the Quaternary alluvium and Tertiary basin fill include the Tertiary Apache Leap Tuff and the Precambrian Pinal Schist.

- Volumes stored behind Whitlow Ranch Dam (peak ponding volume) were obtained from the Maricopa County Flood Control District for the period from roughly 2000 to 2020.

- Discharge measurements from the USACE and U.S. Geological Survey for the outlet culvert at Whitlow Ranch Dam were obtained for the period from roughly 1984 to 2020; these were further processed by Montgomery & Associates to separate baseflow from storm runoff.

- Hydrographs of groundwater levels for five wells in Queen Valley were reviewed for the period from roughly 1985 to 2020.

- Volumes of groundwater pumped from Queen Valley were obtained for the period from roughly 1985 to 2020.

Conceptual Hydrology of Queen Valley

As described by Montgomery & Associates (2020), groundwater in Queen Valley occurs in a wedge of Tertiary basin-fill deposits and Apache Leap Tuff that is overlain by floodplain alluvium deposits to locally form an aquifer. The floodplain alluvium, reportedly up to 42 feet thick at Whitlow Ranch Dam, serves to capture and store surface water runoff, which in turn recharges the underlying deposits. The alluvium generally doesn't contribute to supply wells in Queen Valley.

As described by Montgomery & Associates, water flows into the Queen Valley community from a narrow bedrock gap at Whitlow Ranch Dam. This represents the discharge point for all surface water runoff from Upper Queen Creek and the Superior Basin. The dam itself, completed in 1960, has an impervious core and footing through the entire thickness of the floodplain alluvium, which forces groundwater to the surface and is the reason for the presence of perennial water behind the dam. Impounded surface water and groundwater are discharged through the dam by a 5.5-foot diameter culvert.

Montgomery & Associates report that flow downstream of the dam rarely travels more than a few miles as it is either diverted to an irrigation canal used by the Queen Valley Country Club or percolates into the alluvium and underlying rock units. The canal delivers water to a series of ponds and lakes, and for irrigation of the golf course; likely seepage from canals and ponds continually recharges the aquifer to some extent.

Overall, it appears the Queen Valley aquifer acts similarly to many ephemeral systems in Arizona. During dry periods, both decreased runoff and increased pumping tend to cause sustained declines in the groundwater levels and aquifer storage below Queen Valley. During wet periods, less groundwater is pumped, and surface water readily recharges the aquifer, recovering groundwater levels and aquifer storage.

Ramifications on EIS Analysis

The conceptual hydrology described above, supported by the data compiled and analyzed by Montgomery & Associates, has ramifications on the analysis of impacts contained in the EIS. The following aspects are being incorporated into the FEIS:

- Surface water and groundwater both form part of the flows that exit from Whitlow Ranch Dam and flow into Queen Valley. These flows are not only used directly for irrigation and amenities, but recharge the aquifer in a fairly direct manner. Changes in water quality in the perennial water behind Whitlow Ranch Dam would reasonably extend downstream to Queen Valley, and the ramifications of this connection should be added to the analysis. For assessment of impacts, comparisons should focus on both surface water quality standards for the uses in Queen Valley (for direct use of surface water) and on aquifer water quality standards (for recharge of groundwater).

- The reductions in surface runoff at Whitlow Ranch Dam (an estimated 3.5% caused by the subsidence crater) would have an effect on availability of surface water used in Queen Valley, and the ramifications of this should be added to the analysis, particularly potential impacts to surface water rights. Mitigation proposed on Queen Creek should be incorporated into this analysis.

- While the aquifer supplying Queen Valley relies on surface water for recharge, the effects of the reduced runoff in Queen Creek are likely not substantial or measurable with respect to changes in the groundwater supply. While a percent reduction in surface flow would theoretically affect the amount of aquifer recharge to a small extent, overall it appears that periodic large storm and runoff events are likely the primary recharge mechanism for the Queen Valley aquifer. Water availability for recharge during these events would not be substantially impacted, even with anticipated peak flow reductions.

References

Montgomery & Associates. 2020. "Response to Groundwater Work Group Action Item WR-12: Assessment of Potential Sources of Impact in the Queen Valley Area", April 22.