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Technical Memorandum

To:	Dale Ortman, P.E.	**Date:**	August 3, 2010
cc:	Tom Furgason, SWCA File, SRK	**From:**	Vladimir Ugorets, PhD, SRK Michael Sieber, P.E., SRK Larry Cope, SRK
Subject:	Technical Review of *Davidson Canyon Hydrogeologic Conceptual Model and Assessment of Spring Impacts, Rosemont Copper Project* (Tetra Tech, 2010a)	**Project #:**	183101/1800(3)

A technical review was undertaken and this Technical Memorandum was prepared at the request of SWCA and the Coronado National Forest, in accordance with a statement of work from Mr. D. Ortman dated July 18, 2010. Provided here are comments related to the review of the following report:

(a) *Davidson Canyon Hydrogeologic Conceptual Model and Assessment of Spring Impacts, Rosemont Copper Project* (Tetra Tech, 2010a)

These comments were prepared by Michael Sieber and Vladimir Ugorets of SRK Consulting, Inc. (SRK). Review was performed by Larry Cope, also of SRK.

The first draft of Davidson *Canyon Hydrogeologic Conceptual Model and Assessment of Spring Impacts, Rosemont Copper Project*, April 2010 (Tetra Tech, 2010b) was reviewed by SRK (2010a) on May 11, 2010.

1 Davidson Canyon Hydrogeological Conceptual Model and Assessment of Spring Impacts

The report is relatively comprehensive, well presented, and well written. The report describes the most likely hydrologic dynamics and key physical processes that are governing groundwater-surface water interactions in Davidson Canyon. It includes a discussion of creeks and springs and their interface with the groundwater system (Tetra Tech, 2010b).

This document is a good compilation of available groundwater, surface water, local geology, and water chemistry data indicating that:

(a) The Rosemont Project will have some effect on Davidson Canyon due to the changes in the surface and groundwater flow patterns at the Project site.

(b) The estimated area affected by the Rosemont Project comprises about 16 percent of the Davidson Canyon watershed. Stormwater flow diversions will likely result in reduced flows to downstream receptors.

(c) In average annual conditions, Tetra Tech (2010a) estimated that most of the stormwater entering the flow-through drains will result in infiltration and likely will reduce flows to downstream receptors.

(d) The areas with the greatest potential for groundwater-surface water interactions are along the narrow riparian zones of Reaches 2 and 4, and potentially Reach 3.

(e) Changes to baseline conditions in Davidson Canyon and Cienega Creek as a result of open pit dewatering operations will not occur unless the cone of depression extends to an aquifer that is hydraulically connected to surface water, Reach 4.

(f) Three springs (Questa, Rosemont, and Helvetia) are potentially hydraulically connected with the regional bedrock groundwater system and might be impacted by in-pit dewatering, if drawdown propagates to their location. Other local (or perched-water) springs would be less likely to be affected by mine activities, unless they are proximate to the pit where the pit may alter the local flow system that is yielding water to the springs.

(g) The long term impacts to the water resources in Davidson Canyon and the larger Cienega Creek basin will not exceed the predicted rate of pit inflow (300 to 400 gallons per minute (gpm) during mining, and will continuously decrease to 120 gpm after 100 years of pit lake infilling (M&A, 2009). This model is currently being revised and the impact on Davidson Canyon should be re-examined when the revisions are complete.

(h) Tetra Tech is currently developing a regional groundwater model to simulate mining and post-mining conditions. The impacts on Davidson Canyon should be re-examined when this model is complete.

Mine Impacts

Open pit dewatering (M&A, 2009) and infiltration, seepage, and transport from the Waste Rock Storage area (waste rock), Heap Leach facility (heap), and the Dry Stack Tailings Storage Facility (TSF) (Tetra Tech, 2010c), and seepage from the TSF (AMEC, 2009, Tetra Tech, 2010c) are the mining operations that could potentially impact the Davidson Canyon and Cienega Creek watersheds. A large amount of work is currently being conducted by M&A and Tetra Tech. The M&A numerical groundwater flow model is being revised and Tetra Tech is currently developing a groundwater model. Once those works are complete and the final versions reviewed by SRK, the following will need to occur:

- Re-evaluation of the impacts to Davidson Canyon from pit dewatering once the M&A and Tetra Tech models are reviewed and complete.
- The Infiltration, Seepage, and Fate and Transport Modeling report (Tetra Tech, 2010c) was reviewed by SRK (2010c) and should be revised in light of the review comments.
- Re-evaluation of the impacts of seepage from the TSF, waste rock, and heap on Davidson Canyon.

SRK found Tetra Tech's conceptual model of Davidson Canyon and their conclusions regarding possible impacts from the mining operations to be defensible and supported by the data provided. The isotopic interpretations that were presented are also defensible and supported by the information provided in the report. However, we feel that it should be considered preliminary due to limited available data and uncertainties in the groundwater modeling predictions and infiltration and seepage modeling predictions (discussed in SRK (2010c)). Specifically, we consider a number of descriptors used in the report are relative and not quantified. Waters are described as "different," "very similar," and "dissimilar." Inclusion of charts showing the data or a more complete presentation of the data and summary statistics would illustrate the differences.

Potential impacts to Davidson Canyon should be re-evaluated on the basis of the predictive simulations and sensitivity analyses of the 3-D numerical groundwater model currently being revised by M&A and the completion of the Tetra Tech numerical groundwater flow model.

2 REFERENCES

AMEC, 2009, Rosemont *Copper Company, Dry stack tailings storage facility, Final design report*: unpublished report prepared for Rosemont Copper Company, AMEC Project 842-1191, 54 p, 7 appendices.

Montgomery & Associates, 2009, *Groundwater-flow modeling conducted for simulation of proposed Rosemont pit dewatering and post-closure*: unpublished report prepared for Rosemont Copper by Errol L. Montgomery & Associates, Inc., October 28, 2009, 73 p.

SRK, 2010a, *Technical review of Tetra Tech (2010) Davidson Canyon hydrogeologic conceptual model and assessment of spring impacts*: Technical Memorandum prepared for SWCA, May 11 2010, 4 p.

_____ 2010b, *Technical review of Tetra Tech (2010) Infiltration, seepage, fate and transport modeling report*: Technical Memorandum prepared for SWCA, April 30, 2010, 9 p.

_____ 2010c, *Technical review of M & A (2009) groundwater flow model report prepared Rosemont Copper*: Technical Memorandum prepared for SWCA, February 9, 2010, 6 p

Tetra Tech, 2010a, *Davidson Canyon hydrogeologic conceptual model and assessment of spring impacts*: unpublished report prepared for Rosemont Copper, Tetra Tech Project No. 114-320869, April 2010, 72 p, 1 appendix.

_____ 2010b, *Infiltration, seepage, fate and transport modeling report*: unpublished report prepared for Rosemont Copper, Tetra Tech Project No. 114-320794, February 2010, 68 p., 6 appendices.

3 QUALIFICATIONS OF KEY TECHNICAL REVIEWER

The Senior Reviewer for Hydrogeology, Vladimir Ugorets, Ph.D., is a Principal Hydrogeologist with SRK Consulting in Denver, Colorado. Dr. Ugorets has more than 31 years of professional experience in hydrogeology, developing and implementing groundwater flow and solute-transport models related to mine dewatering, groundwater contamination, and water resource development. Dr. Ugorets's areas of expertise are in design and optimization of extraction-injection well fields, development of conceptual and numerical groundwater flow and solute-transport models, and dewatering optimization for open-pit, underground and in-situ recovery mines. Dr. Ugorets's resume was submitted to SWCA previously.