From:	Robert Casavant
To:	FS-objections-southwestern-regional-office
Subject:	Rosemont Copper-Draft ROD-ASP technical comments/recommendations-author SIGNED version
Date:	Friday, February 14, 2014 5:29:22 PM

You may disregard the unsigned, version that was sent previously. This version contains a few minor grammatical changes and a recommended (not mandatory) signature of authentication as stated in the Dec 13, 2014 CNF memo from the Forest Supervisor, File # 2810/1950.

Cordially.
Bob

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Emailed to: **objections-southwestern-regional-office@fs.fed.us**

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Feb 14, 2014

Rosemont Copper—Draft--Record of Decision

Mr. Jim Upchurch, Forest Supervisor

Coronado National Forest, Nogales Ranger District

Dear Mr Upchurch:

The unprecedented levels and diversity of solicited participation in formulating and reviewing diverse technical and socio-economic input, and addressing alternatives and concerns from Cooperating Agencies and the public in the Rosemont EIS process is to be commended. From a scientific and resource management perspective, various issues revolving around the Coronado National Forest (CNF) ID team and contactor capacity to fully integrated all CA concerns regarding data quality, assumptions used in modeling and hydrogeologic interpretation, and uncertainties regarding linkages (known, inferred and yet unrealized) between surface waters and groundwater impacts and systems continue unabated. Although expected and potential impacts from the proposed alternative that the CNF has chosen were mostly noted in the ROD, they remain worthy of rigorous and sustained monitoring and mitigation strategies, but which seemed vague enough in the draft ROD to remain a point of concern. Ample case studies in hard rock mining and environmental mitigation—pre-, syn- and post-mining—showcase the need to be proactive and establish 3rd party monitoring/mitigation in the support and

sustainability of the public's trust and "resource bank".

Some time ago during a visit with you and your District Rangers at Kartchner Caverns, we explored, discussed and marveled at how new, very subtle, but actually quite informative geologic elements and spatial relationships could be teased out and observed in the overlying rocks and landscape. We concurred that the general current understanding of these linkages was in its infancy and that these findings could help current and future resource managers and scientists better infer, model, risk, and thus, mitigate expected and potential negative impacts to groundwater and related surface water resources and linked environs. When asked what might be a critical issue to pay attention too, it didn't take much time for me to reply "Water". Observed trends in climate and demographic change in light of Arizona's geographic setting and importance to the nation validated that quick answer.

The goal of that day was to advance our appreciation for how much we have to learn about not only observable, but also masked known linkages between upland and lowland hydrogeologic systems and process (e.g. consider the widely available published examples of geo-architectures and structural/stratigraphic settings and linkages made known through reflection seismic survey from the oil industry). We came away with a greater appreciation for the natural and complex heterogeneity and uncertainty that characterizes almost all hard rock mining, especially extraction in solutional (secondary porosity, high-permeability) and highly deformed units.

Some might see the task as being too difficult to tackle, while others see it as a positive task that requires planning around a range of uncertainty that requires them to employ all known and novel adaptive management practices (e.g. water isotope/tracer studies; electrical resistivity surveys across fault zones and carbonate strata where mineralized units transition into less mineralized areas, respectively). Progressive and successful companies design programs that are ready to own up to uncertainty, and can modify their resource extraction programs to mitigate impacts in a proactive, rather than reactive manner. Studies show that mineralized and altered rocks in structurally deformed carbonate strata are most often interleaved with, and/or are transition (gradationally or abruptly) into adjacent, relatively non-mineralized rocks. Rarely has the literature represented a closed system or low-permeability system (within and outside of the proposed area) as some of the modeling has assumed. Numerous published and unpublished reservoir or rock characterizations of similar mineral deposits and settings across Arizona and elsewhere, reveal heterogeneity to be more common, and thus, to be expected, modeled, and risked accordingly.

A topic of concern for the FEIS and draft ROD revolves around specifics associated with independent and robust monitoring and reporting of changes, etc. that may impact resources on public lands. The characterization of flow paths is crucial, but also a difficult task to do consistently or correctly in some industries. To that end surface and borehole mapping should be continued as mining proceeds, given that sufficient fracture aperture analyses, and connectivity may not have been not measured and modeled directly beforehand. Key hydraulic tests (e.g. flow, pressure, isotope, geochemistry, and tracer studies) could be designed and conducted before and during mining by independent monitoring experts like the U.S. Geologic Survey. Individual fractures assessments can also be tested using packers in current and future boreholes. As you may soon find out from past publications and those in prep, various geophysical methods, if designed and executed correctly, can and will advance knowledge of the underground heterogeneities in carbonate

terranes.

As the Draft ROD recognized that surface flow and groundwater interactions (e.g. springs) remain poorly defined. Indeed, although groundwater gradients have been inferred (mapped) from water level measurements, this does not necessarily imply probably flow paths and gradient. Fractures and faults (identified, misidentified or not known) can result in unexpected flow paths and rapid travel times. To this end, there remain a number of sources of uncertainty in the hydrologic and reservoir characterization of the Rosemont mine proposal. According to textbooks and talks on the topic, large uncertainties can also be realized due to seasonal variability in hydrologic and geochemical conditions.

It is acknowledged that the totality of the underground environment can not fully understood, and so, must be inferred from the limited number of sampling points (well and core data of varying depths and in varying and highly heterogeneous geologic units). Point measurements (field and lab) may not, and often do not, represent larger scale processes and hydrologic complexities, especially where fractures and/or faulting are masked by depth or surficial deposits, or are determined by spacing and depths of drilling, well, and core info or geophysical survey locations. Furthermore, changing climatic conditions (e.g. increasing severity of drought, brief but intense runoff events, etc.) can complicate hydrogeologic modeling and planning. Thus, independent and qualified pre-, syn- and post-mining monitoring should be more rigorously presented and funded.

In materials provided to your ID team related to the DEIS, ASP provided an adjusted, more data intensive interpretation of the groundwater gradient using available spring and water well level measurements in the public record that were compiled and provided another by a fellow Cooperating Agency representative. The data were more comprehensive that what other previous contractors had used for their mapping and given to the CNF. The reinterpretation resulted in notable difference gradient in some areas, and suggested stronger structural influence on slopes and direction than other maps that your ID or industry contract teams may have used in modeling. The adjusted groundwater map, actually agreed better with known geologic structures mapped by the AZGS, and other reps. This water data in combination with robust lineament and drainage network analyses, both derived from high-resolution air photo stereo interpretations, was provided to the CFS for integration and comparative investigation. The fact that none of this data was stated or referenced in the FEIS and ROD, implies that these objective data sets and valid interpretations, provided in good faith, were either inadvertently omitted or biased against in the CFS ID team or contractors reviews. Thus, the ability to assess variations, risk and model impacts, or determine a range of monitoring or mitigation steps in relations to a surface water-groundwater characterization may have been hindered. Thus, potential interactions and subsequent monitoring protocols and needs remain potentially handicapped, when the full range of interpretation and potential outcomes and linkage are not considered—both within the mineralized region of interest and outside of it. Effects on drawdown rates, direction and impacts to riparian and spring resource may not be fully ascertained before impacts are noted and become irreversible.

Additionally, the observation and fact that travertine deposition is associated with one the springs in the area of interest attests to the presence of not only subsurface dissolution, but also ongoing organic and inorganic chemical and material transport. This recorded observation and site are representative of the challenges and

uncertainties that are usually inherent to modeling impacts from hard rock mining based primarily on industry or related contract “expert opinions”. I failed to note this information in the FEIS assessment and uncertainty in the draft ROD, despite the objective and good-faith support of numerous Cooperating Agencies data and recommendations provided during both the drafting of the DEIS and later FEIS.

The technical physical and natural science expertise and experience provided by federal agencies like the USGS and an independent monitoring plan co-developed by the BLM/USFS/USGS should have been put in place to ensure rigorous science-based monitoring of surface and groundwater behavior and change due to natural impacts (e.g. drought, precipitation) and artificial impacts (e.g. mining, water withdrawals, etc.)

Mining-induced alterations to the pre-mine or baseline characterization of the natural hydrologic system in the area of interest should be anticipated. This is especially true for highly fractured and altered carbonate rock units that are both mineralized and relatively non-mineralized.

Respectfully yours,

Bob

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"The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased and not impaired in value." (Theodore Roosevelt, 1910)

Arizona State Parks