February 2, 2012

Michael Fulton, Director  
Water Quality Division  
Arizona Department of Environmental Quality  
1110 W. Washington Street  
Phoenix, Arizona 85007

via Mendolia.Richard@azdquier.gov

Re: Draft Aquifer Protection Permit P-106100

Dear Mr. Fulton:

The Aquifer Protection Permit (APP) is one of the key permits any new mine would require. As documented in previous letters to former Director Benjamin Grumbles and others at the Arizona Department of Environmental Quality (ADEQ), Pima County and the Pima County Regional Flood Control District are concerned about the impacts of the Rosemont mining proposal upon aquifers and surface water features located in Pima County.

Both agencies (hereafter referred to as Pima County) reviewed portions of the Rosemont Project Mine APP Application and supporting documents prepared for Augusta Resources or Rosemont Copper, dated 2009 through 2011, and submitted to ADEQ. In addition, we reviewed the Draft APP No. P-106100 prepared by ADEQ and released for public comment in December 2011. The consolidated, detailed staff comments are attached and are based on the premise that the APP will be issued. However, first and foremost, we object to the issuance of this APP.

Pima County objects to the issuance of this APP. The application is premature, and the issuance of the permit is against Arizona Administrative Rules.

The U.S. Forest Service and U.S. Army Corps of Engineers are the decision agencies for the location of most of the sources of pollutant discharges for the Rosemont APP. In October 2011, the federal agencies issued a Draft Environmental Impact Statement (DEIS)
for this project. The DEIS evaluates a range of alternative locations for the disposal of waste and tailings.

The footprint of the pollutant-generating facilities identified in the APP’s supporting documents differs from the Forest Service’s preferred alternative in the Draft EIS for this project. At this point, the federal agencies are evaluating a more compact configuration for the waste and tailings.

Because the bulk of the pollutant-generating material would be located on land owned by the federal government, it is the Forest Service’s decision as to the location and conditions under which the waste and tailings will be allowed. By law, this decision may not come until after publication of the Final EIS, a public comment period, completion of additional studies, analysis by Forest Service staff, publication of a record of decision in the Federal Register, and completion of any appeals.

Based on the evidence presented in the DEIS, the mine design that is the basis for this APP is unlikely to be chosen because it has greater impacts on Forest resources and waters of the United States than some of the other action alternatives.

Rosemont is evidently willing to engage ADEQ’s staff in review of a mine design that is unlikely to be chosen. The federal decisions will be known only after completion of the final EIS process. Federal decisions affecting how the project will be located, designed, operated and closed will likely not be completed in the next six months due to deficiencies in the DEIS and requirements in the Code of Federal Regulations requiring due process.

Rosemont Copper has placed your agency in the position of having to respond according to state-mandated licensing timeframes.

The resulting Draft APP gives the appearance of progress. Rosemont Copper, knowing full well that any APP would have to be amended again later if the project were approved by the federal agencies, has short-circuited the public review process by applying prematurely.

Granting the APP will not alter the fundamental uncertainty regarding where the pollutant-generating facilities will be located, pending the decision of the various federal agencies having jurisdiction over the private and public lands.

These federal uncertainties impede ADEQ’s Director from meeting the following requirements:
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- R18-9-A201(B)(5). Costs cannot be fully identified because design is incomplete and subject to federal requirements to minimize and mitigate certain impacts.
- R18-9-A202(A)(2). Facility site plan will remain unresolved.
- R18-9-A202(A)(3.) Documentation is insufficient to allow evaluation.
- R18-9-A202(A)(5) particularly from the standpoint that all of the alternatives considered for BADCT are not fully represented to satisfy subsections (a) and (b).
- R18-9-A202(A)(6) particularly inadequate because siting information is needed to be able to identify the Pollution Management Area so Points of Compliance may be identified consistent with ARS 49-244.
- R18-9-A202(A)(8) because discharge locations cannot defined with certainty.
- R18-9-A203(B). Closure and post-closure costs cannot be evaluated if R18-9-A201(B)(5) is not complete because the federal agencies have yet to determine the design, location and measures to minimize and mitigate.

Until the decisions have been made by the federal agencies, only incomplete and tentative information regarding the mine can be provided. Only then will the true nature and location of APP-regulated facilities be known, which would form a sound basis for ADEQ’s decision to approve or deny an APP for the proposed industrial site.

Pima County requests a new Draft APP be issued for public notice and comment. A new Draft APP is needed to correct serious errors and major deficiencies in the APP and in the application materials.

The detailed staff comments provide specific requests and suggestions. The major problems are listed below:

1. The proposed discharge limits do not protect existing uses of surface waters;
2. Neither the applicant nor ADEQ have demonstrated that this APP would protect Outstanding Waters of the State of Arizona downstream of the proposed facility;
3. The proposed discharge limits do not protect existing aquifer uses;
4. The proposed facility description is incomplete; it should include the open pit and perimeter stormwater control design, among others;
5. The proposed facility design, including heap leach and flow-through drains, is based on flawed engineering that unnecessarily places existing uses of water at jeopardy from pollutants;
6. Pollutant discharges are inadequately characterized;
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7. The proposed monitoring well network is unacceptable and incorrectly described in the APP;
8. Lack of closure planning;
9. No requirements for post-closure maintenance or monitoring of the 1,135-acre tailings disposal facility, 1,370-acre waste rock disposal facility, 170-acre buried heap leach, stormwater facilities, or the on-site landfill;
10. Best Available Demonstrated Control Technology for the heap leach, the open pit, the dry stack, the waste storage area, the surface water impoundments, and the flow-through drains is not demonstrated;
11. The financial assurances place the public at risk for remediating the costs of Rosemont’s pollution; and
12. The financial capability of the company is not demonstrated.

The incomplete application materials leave all of us guessing as to how the facilities will be operated and whether the approaches proposed in the application can be successful in meeting rules and statutory requirements. This application should have been declared incomplete and the licensing time frame suspended until the applicant completed their work. The Draft APP seems to reflect the rush to comply with Rosemont’s schedule and resulted in a Draft APP that does not meet minimum requirements, let alone assure the public of its safety. Furthermore, errors and omissions in the Draft APP denied the public, including public agencies such as ours, an opportunity to provide comment on required components of an APP.

If this APP is to be granted without additional public notice and comment, Pima County requests this APP be issued only for the first phase of mining, through closure of the heap leach.

The impacts associated with the next phase, sulfide operation, should be contingent on the applicant maintaining compliance with all local, state and federal rules. Such a phased approach would give ADEQ the opportunity to evaluate the closure plan for the heap and to assess whether clean closure has been achieved before Rosemont Copper buries that facility in tailing material, an untested practice that itself warrants further scrutiny.

In addition, Pima County requests to be notified of temporary cessation of the facility.

Summary

Pima County objects to the issuance of this APP. The application is premature because the mine design that is the basis for this APP is unlikely to be selected by the federal decision makers. Rosemont Copper has short-circuited the public review process by applying
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prematurely. The uncertainties with the federal decision-making process prevent ADEQ from complying with state requirements under administrative rules.

Pima County requests a new draft APP to correct significant errors and deficiencies, along with additional public notice and comment. However, if this APP is to be granted, we request it be limited to the first phase of mining through the heap leach closure so compliance can be evaluated before the applicant proceeds with the secondary phase of mining.

Sincerely,

C.H. Huckelberry  
County Administrator

CHH/mjk

Attachment

c The Honorable Chairman and Members, Pima County Board of Supervisors  
Suzanne Shields, Director, Pima County Regional Flood Control District  
James Dubois, Principal Hydrologist, Pima County Regional Wastewater Reclamation  
Julia Fonseca, Environmental Planning Manager, Pima County Conservation and  
Sustainability Office  
Nicole Fyffa, Executive Assistant to the County Administrator
FACILITY / SITE DESCRIPTION

This Open Pit Should be a Regulated Facility; the APP Should Be Revised to be Consistent With Pit Functions

Per Rosemont Copper’s *Response to June 30, 2011 ADEQ Letter* (August 31, 2011, p. 3), under the bullet “Removal of the Open Pit as an APP-Regulated facility, Rosemont states:

- *The rationale for requesting that the Open Pit be removed from the list of area-wide APP-Regulated facilities is four-fold. (1) There are no plans to utilize the Open Pit to store, hold, settle, treat or dispose of liquid pollutants. Therefore, the Open Pit does not meet the definition of a “surface impoundment”.*

This is a specious argument that the pit is not a surface impoundment and therefore is not a categorically discharging facility under A.R.S. §49-241.B. By mining, Rosemont will have created the pit. As described, the pit will act as a holding pond because it will hold seepage from the pit walls as well as rainwater that has contacted mineralized material exposed by the excavation. Also, if left without backfill, the pit will be a disposal pit because it will be actively disposing large quantities of water through evaporation. Rosemont has described this process of using the pit for water disposal by evaporation in its application and has included it as a significant component of their groundwater model. ADEQ should recognize the open pit as a surface impoundment and include it as a categorical facility under A.R.S.§49-241.B.

If ADEQ does not accept that the open pit qualifies as a surface impoundment and must be included as a categorical facility under A.R.S.§49-241.B, ADEQ still has an obligation to evaluate whether or not the pit is a discharging facility under A.R.S.§49-241.A. Because it will be a collection point for pollutants and those pollutants will become concentrated through evaporation, the pit is likely to serve as a conduit for pollutants into the aquifer. In the pit lake configuration, the physical gradient of groundwater will flow toward the pit. However, because of chemical concentration of metals, TDS, sulfate, and other pollutants, the pit lake will provide a chemical gradient that will drive pollutants to disperse into the aquifer. **There is a reasonable probability that pollutants in the pit lake will reach an aquifer.**

Another reason to include the open pit among the discharging facilities that are part of the areawide permit is that this facility is similar in function and regulatory status to the Compliance Point Dam. Rosemont Copper requested inclusion of the *Compliance Point Dam* (CPD), a general permit facility, within the pollutant management area (PMA) in their *Response to the June 30, 2011 ADEQ Letter* (p. 4). Rosemont acknowledges “ADEQ’s verbal acceptance of General Permit facilities within the PMA”.

- ADEQ responded by a subsequent extension of the PMA to include the *Compliance Point Dam* as a Statutory General Permit Stormwater Catchment Feature.

Using the same rationale, the Open Pit should also be included within the PMA for the mining complex as a Statutory General Permit Stormwater Catchment Feature:
• Without diligent post-closure maintenance, the flow-through drain system will fail due to various factors, including lack of operational maintenance and clogging of the drain entrances from the buildup of fine sediments.

• The Contingency Plan for the Flow-Through Drain System simply acknowledges this ultimate failure, and discusses how stormwater building at the plugged inlets along the western side of the Tailings and Waste Rock Disposal Facilities will “report” to the Open Pit (Tetra Tech Technical Memorandum, Rosemont Flow-Through Drain Contingencies, March 8, 2011).

• Therefore, similar to the Compliance Point Dam, the Open Pit will receive surface water which will contain sediments affixed with various pollutants from the general plant site and from the side slopes of the Tailings and Waste Rock Disposal Facilities.

Failing the inclusion of the open pit as a categorical discharging facility, ADEQ should at least regard the open pit as an APP regulated facility covered by the general permit following A.R.S. §49-245.01.

Request:

✔ Per the discussion above, ADEQ should identify and regulate the Open Pit as an APP facility.

✔ Per the discussion above, ADEQ should extend the PMA to include the entire Open Pit.

Perimeter Stormwater Control Design for the Tailings Disposal Facility is Inadequate

Along the north and east sides of the Tailings Disposal Facility, the perimeter stormwater channel is aligned through bedrock areas with significant topographic elevation differences. For instance, along the Permanent Diversion Channel No. 2 along the north side of the Tailings Disposal Facility, the channel alignment routinely rises and drops vertical distances of 25 to 50 feet within the Mount Fagan rhyolite bedrock. In addition, this channel connects Detention Basins 2A, 2B, and 3 along its alignment.

Similarly, the perimeter diversion channel depicted along the eastern perimeter of the Tailings Disposal Facility also rises and falls significant distances along its bedrock alignment. However, Rosemont has not even attempted to show the alignment of this channel, other than with a few arrows (Figure 1, Proposed PMA and POC Locations, Tetra Tech, 10/11).
For an enormous industrial complex which is proposed to permanently impact thousands of acres of Forest Service land, the lack of design plans to adequately review development, closure, post-closure, mitigation, and cumulative impacts is unacceptable.

**Request**

For the purposes of finalization of an Aquifer Protection Permit for a massive mining facility, the lack of design and detail for primary stormwater control features within the facility Pollutant Management Area is woefully inadequate. Without such design information, it is not possible to evaluate whether the facility meets Best Available Demonstrated Control Technology (BADCT) for surface water control as outlined in the guidance document, for example in sections 3.2.4.2, 3.5.4.2, and 3.6.4.2.

✓ Provide a STORMWATER MANAGEMENT PLAN which clearly contains, within a single document, the design calculations and design plans for perimeter drainage channels, perimeter containment areas, retention / detention basins and pools on the Tailings and Waste Rock Disposal Facilities final cover system and disposal mound side slopes, and all planned Perimeter Containment Areas where surface water will be trapped against the base slope of the tailings and waste rock disposal mounds.

✓ For both the northern and eastern perimeter stormwater control systems on either side of the Tailings Disposal Facility, Rosemont Copper must perform adequate hydrologic analyses and prepare design plans to let ADEQ and the public know how these systems will operate immediately adjacent to a permanent tailings disposal mound.

✓ Include requisite hydrologic routing for Perimeter Diversion Channel 2 and Basins 1, 2A, 2B, and 3.

✓ Include within the hydrologic calculations stormwater runoff from the side slopes and decanted from the upper surface of the Tailings Disposal Facility.

✓ Show the location, alignment, and design for Perimeter Containment Areas and Perimeter Diversion Channels along the East side of the Tailings Disposal Facility.

✓ For Perimeter Containment Areas along both the north and east sides of the Tailings Disposal Mound, clearly identify the height of the ponded water against the tailings mass before any draindown along the perimeter channel.

_The sediment control facilities were designed using a method inappropriate for estimating sediment production from mining sites._

The PSIAC method (Pacific Inter Agency Committee - PSIAC, 1968) used for this analysis (p.6) is inappropriate because it is a scoring method that does not explicitly recognize site conditions and changes in site conditions resulting from disturbance (like mining) in the...
analysis. Because it does not recognize the effect of site disturbance, it cannot be used to evaluate alternatives that specifically involve evaluating the impact of site disturbance. Additionally, the impacts of the projects on sediment yield were estimated simply based on changes in the contributing watershed areas. It is highly unlikely that sediment yield would decrease proportionally to a decrease in the contributing watershed area. Instead, it is expected that loss of vegetation cover and dredging or filling resulting from the proposed mining activities will increase erosion rate or sediment yield from the project site.

Additional specific concerns about the PSIAC method and the need to use a method like the Revised Universal Soil Loss Equation (RUSLE) for mining (Toy and Foster, 1998) are summarized in the Appendices of our comments.

The flow-through drains are inappropriate for this use are not adequately sized and cannot remain in perpetuity without maintenance.

Flow-through drains will be used to transport stormwater across the site. The drains were designed by using hydrologic methods (Rosemont Flow-Through Drain Sedimentation Analysis, Tetra Tech, 2010) that the District has determined to be inappropriate, as described in Appendices A and B. As cited in the Tetra Tech Memo, the drain systems are supposed to be designed to convey the local and general Probable Maximum Precipitation (PMP) events. The PMPs used to size the flow-through drain are inconsistent with the results of Technical Memorandum “Rosemont Hydrology Method Justification” (Tetra Tech, 2010). In this memorandum, Tetra Tech selected 72-hr storm event for General PMP and 6-hour storm event for local PMP. Runoff volume produced by the 72-hr or 6-hr PMP is larger than the 100-yr, 24-hr storm runoff volume. However, the flow-through drains were designed by using a 100-yr 24-hr storm event, as explained in the 404 application, which indicates that they are under-sized.

Failure of these engineered systems will adversely impact the Davidson Canyon Outstanding Waters downstream and result in discharges of pollutants to the open pit, as proposed.

Requests:

- Consider alternative designs to the flow-through drains as part of the BADCT evaluation.

- Provide for public comment a Monitoring, Maintenance, and Contingency Plan for the Flow-Through Drain System so that Rosemont Copper, ADEQ, and the public are fully aware of the measures to be taken regarding the operation of this sub-drain system below massive, permanent Tailings and Waste Rock Disposal Mounds. Include a long-term monitoring and maintenance plan to ensure the proper function of the flow-through drains in perpetuity.

- The above Plan must identify who will be responsible for the monitoring, maintenance, and repair of the flow-through drain system when Rosemont Copper completes their post-mining reclamation work and leaves the project site. The Plan
must identify and evaluate the likely effectiveness of any proposed responses.

✓ When the flow-through drains fail to function and pass water, as they will at some time in the future, identify a contingency action to be taken as part of the above plan to provide for the proper operation of the flow-through drain system.

✓ Provide for remedial actions to be taken if drains fail and proper operation cannot be addressed through contingency actions.

✓ Provide specific examples where flow-through drain systems, in the size and tributary configuration of the proposed system beneath the Tailings and Waste Rock Disposal Mound, have been successfully implemented at mining sites for periods of 10-20 years, 20-40 years, and 40+ years.

✓ Provide plans and sections showing the specific entrance design, geometries, and materials for all flow-through drain system components which have inlets on the west or north sides of the Tailings and Waste Rock Disposal Facilities.

✓ Provide transverse and longitudinal sections which clearly show the methodology and sequencing for construction of the proposed flow-through drain systems.

✓ Provide a Construction Quality Assurance Plan which provides sufficient detail and documentation for successful construction of the drainage system utilizing earthen and geosynthetic materials.
FINANCIAL CAPABILITY AND ASSURANCE

Estimated Closure and Post-Closure Costs Do Not Account for All APP Closure and Post-Closure Activities; Revise Value of Surety Bond

The following paragraph constitutes all the information provided within the draft APP for Financial Capability (draft APP Section 2.1):

“The permittee has demonstrated financial capability under ARS 49-243(N) and AAC R18-9-A203. The permittee shall maintain financial capability throughout the life of the facility. The estimated closure and post-closure costs for the facilities listed in this area-wide APP are $2,744,100 and $1,549,035. The Dry Stack Tailings Facility shall undergo concurrent reclamation as practicable, which is covered as part of the annual operational costs. Financial assurance was demonstrated through A.A.C.R18-9-A203 through a Surety Bond from Arch Insurance Company.”

Per AAC R18-9-A203(C)2, under the Performance Surety Bond category of financial assurance mechanisms, “the bond provides for performance of all the covered items listed in R18-9-A201(B)5 by the surety”.

R18-9-A201(B)(5) - Cost estimates for facility construction, operation, maintenance, closure, and post-closure - contains the following information:

a. The applicant shall ensure that the cost estimates are derived by an engineer, controller, or accountant using competitive bids, construction plan take-offs, specifications, operating history for similar facilities, or other appropriate sources, as applicable

b. The following cost estimates that are representative of regional fair market costs:
   i. The cost of closure estimate under R18-9-A209(B)(2), consistent with the closure plan or strategy submitted under R18-9-A202(A)(10);
   ii. The estimated cost of post-closure monitoring and maintenance under R18-9-A209(C), consistent with the post-closure plan or strategy submitted under R18-9-A202(A)(10);

Information provided by Rosemont in a document entitled Rosemont APP Closure Costs and Post-Closure Period (internal Rosemont Memorandum, August 30, 2011), provided to ADEQ as part of an August 31, 2011 Response package, represents a starting point for discussion of closure activities, and post-closure monitoring and maintenance activities.

But as discussed in our Closure and Post-Closure comments, the public, and apparently ADEQ as well, does not presently understand the true extent of Rosemont Copper’s closure responsibilities for the mine APP facilities because Rosemont Copper and ADEQ have not adequately evaluated the full nature and extent of Closure Activities, and Post-Closure Monitoring and Maintenance Activities.
Therefore, there is no way to know if the following statement within Financial Capability (draft APP Section 2.1) is accurate: “The permittee has demonstrated financial capability under ARS 49-243(N) and AAC R18-9-A203. “

Request:

✔ Prepare an UPDATED ESTIMATED CLOSURE COST based upon information to be prepared in a professional PRELIMINARY CLOSURE PLAN, as detailed in an accompanying APP comment. For all APP facilities, clearly distinguish for both ADEQ and the affected public which closure activities are regulated by ADEQ and which reclamation activities are regulated by the Forest Service. Include the rationale for these decisions.

✔ Prepare an UPDATED ESTIMATED POST-CLOSURE COST based upon information to be prepared in a professional PRELIMINARY POST-CLOSURE OPERATIONS AND MAINTENANCE PLAN, as detailed in an accompanying APP comment. For all APP facilities, clearly distinguish for both ADEQ and the affected public which post-closure activities are regulated by ADEQ and which post-reclamation activities are regulated by the Forest Service. Include the rationale for these decisions.

✔ Revise the VALUE OF THE SURETY BOND to account for updated closure costs, and updated post-closure costs.

✔ Rosemont Copper must demonstrate Financial Assurance based upon the REVISED VALUE OF THE SURETY BOND.

Even Revised Financial Assurances Leave the Public With Long-Term Costs; A Contingent Environmental Fund is Needed

Per the requirements of an ADEQ Aquifer Protection Permit, Rosemont Copper is responsible for compliance with aquifer water quality standards at the downgradient edge of the mine’s pollutant management area. Per permit conditions, this must be demonstrated by systematic groundwater sampling from the mine compliance monitoring well system. Should it be found that Rosemont Copper is contaminating the bedrock or alluvial groundwater systems, they would be responsible for remediation or mitigation of the groundwater through corrective action.

At first glance, from a project permitting perspective, it appears there will be abundant time for the systematic collection and analysis of groundwater monitor well data in order to determine if ground-water contamination has occurred and to respond with appropriate mitigation strategies.

However, it is entirely possible that any groundwater contamination in bedrock might not be observed for many tens or even hundreds of years, long after releases of assurances have
been made or monitoring has ceased. Rosemont Copper would be completely out of the picture, as their APP groundwater monitoring program in bedrock would be terminated by ADEQ based upon a number of successive sampling results indicating no groundwater contamination.

If and when bedrock groundwater contamination became apparent either within site monitoring wells or in regional public or private wells, the responsibility for cleanup would lie squarely with the landowners, the federal government, and U.S. taxpayers.

Request:

- ADEQ should include within Rosemont Copper’s bonding requirements a separate $20,000,000 environmental protection fund, to be used solely for the purpose of mitigating unforeseen environmental impacts from the mine site after mine reclamation and closure and release of other assurances. This fund amount is equivalent to the purchase cost of one (1) of the three (3) electric mining shovels Rosemont intends to use at the industrial complex.

- Should surface water contamination be detected either within the Rosemont Copper PMA or within the area of potential effect identified in the FEIS, the fund would be utilized to implement environmental remediation technologies and resources towards remediation of the affected environment and communities.
BEST AVAILABLE DEMONSTRATED CONTROL TECHNOLOGY (BADCT)

Pit Backfilling with Waste Rock/Tailings should be evaluated as BADCT. The open pit would lower the regional aquifer by about 2,000 feet within the pit. The maximum groundwater drawdown at the pit occurs at the end of mining, when a pit lake begins to form. After closure, the mining company would stop dewatering and the pit would begin to fill with water (see Figure 1, below). Continued evaporation from the pit-lake surface removes water directly from the aquifer. The effect on the surrounding groundwater is the same as having a large diameter well.

![Aquifer levels in relationship with the proposed mine pit. Figure provided by the U. S. Forest Service.](image)

Unless filled with rock or other geologic materials, the pit will become the center of a permanent drawdown cone with the lake forming in the unbackfilled pit. Evaporation would prevent the pit lake from filling up to the original water table, therefore groundwater would flow forever into the pit lake from all directions. In addition, the water quality of the pit lake will likely exceed water quality standards (DEIS, Chapter 3, Table 68 at 293). Alternately, complete or partial backfilling the pit with waste rock/tailings materials would eliminate the long-term loss of water to evaporation and eliminate the threats posed to water quality and wildlife by the pit lake.

Neither the APP application submitted by Rosemont or the Draft Permit written by ADEQ relies upon a hydrologic sink as passive containment (A.R.S. §49-243.G.) in the design of the mine. Therefore, a pit-lake configuration and resultant cone of depression is not a necessary component for the facility. However, even if it were, Myers (2010) found that the cone of depression created by the open pit could be maintained for a prolonged period of time, even when the pit is backfilled so that a pit-lake does not form. As demonstrated on Figure A-4 (Myers, April 2010), the 50-foot and 10-foot groundwater drawdown contours within the uppermost groundwater model layer – which contrast conditions simulating both pit lake
creation and open pit backfilling - are remarkably similar in location relative to the mining pit even 1,000 years after the end of mining.

Backfilling the pit would itself be a water-quality protection measure, reducing the long-term contamination that would come from oxidation and seepage along the face of the pit walls.

The limited modeling of waste rock in Rosemont’s APP application indicates that seepage through the waste rock would not exceed Aquifer Water Quality Standards (AWQS). With pit backfilling, the relatively small amount of potentially acid generating (PAG) rock could be segregated and placed above the water level; alternatively, PAG rock could be submerged very deeply to minimize oxidation. If seepage through the backfilled waste rock could be a problem in the pit, then it can also be a problem dumped on the ground surface.

The statutory requirement for BADCT in A.R.S.§49-243.B(1) states that “In determining best available demonstrated control technology, processes, operating methods, or other alternatives, the director shall take into account…the opportunity for water conservation or augmentation….” The APP fails to analyze the pollutant management and aquifer conservation advantages of backfilling the pit. The adverse impacts are clearly understood: dewatering of the Rosemont Watershed, permanent regional groundwater drawdown extending to the Davidson-Cienega watershed system, creation of a large permanent pit lake, increased oxidation and mobility of metal and sulfate contaminants along the pit walls, restriction of surface water downgradient movement, and the creation of massive, permanent waste rock and tailings disposal mounds which will cover thousands of acres of Forest Service land. The size of the resultant pit lake itself will exceed 150 surface acres and a volume of over 90,000 acre-feet of water.

Furthermore, Open Pit Backfilling is Practicable: Open-pit mining is commonly used in the copper industry to exploit low-grade ore deposits. Such methods create very large excavations and in the process the volume of the material recovered from the pit increases by 25 to 35%. Less than 1% of the volume generated by the Rosemont project would be marketable metallic substances. Thus, the open pit proposed will generate large volumes of waste.

Over thirty years ago, Congress required surface coal mines be backfilled as an element of reclamation. Backfilling is also used, voluntarily, in some underground mines. In 2003, California’s state Mining and Geology Board evaluated reclamation of open pits from metallic mines. They found that none of the open pits that had been created since 1976 had been reclaimed, despite having a reclamation standard to return land to usable condition and protect public health and safety. The Board found that many of the pit lakes, where present, were found to have elevated levels of metals of concern to human and other life.

Because open pits were not being reclaimed, the State of California adopted a new requirement to backfill new metallic mines to a level “not less than the original surface elevation” unless there remains insufficient volume of materials (Public Resource Code Section 3704.1 Performance Standards). Financial assurances are collected to assure backfilling and grading required. This standard remains in effect today.
In the state of Nevada regulations require the following with respect to pit lakes:

3. **Bodies of water which are a result of mine pits penetrating the water table must not create an impoundment which:**
   (a) **Has the potential to degrade the groundwaters of the State; or**
   (b) **Has the potential to affect adversely the health of human, terrestrial or avian life.**
   
   *(NAC 445A.429)*

If these criteria cannot be met, mine closure must incorporate an alternative approach, such as partial or complete backfill of the pit.

Pit backfill was been completed in Ladysmith, Wisconsin following open-pit copper-gold mining. The mine’s open pit was backfilled and the site returned to its original contours. Notice of closure was filed with Wisconsin DNR in 2001. As a result of backfilling, over 10 acres of wetlands were created and clusters of trees and prairie grasses were planted to provide habitat for wildlife. At the request of local governments, 32 acres of the site were set aside for industrial use and leased for subsequent industrial development purposes.

In Arizona, backfilling of open pit mines is practiced voluntarily, and has been previously evaluated in NEPA deliberations. For instance, partial backfilling was considered as an alternative in EISs for both the Carlota and Dos Pobres mines. In the case of the Carlota mine (in the Tonto National Forest) partial backfilling was advantageous enough to the company that it was incorporated into the preferred alternative voluntarily. Partial backfilling is used in certain areas of the mine at Morenci. At Pinto Valley there is precedent for the open pit being backfilled with re-processed tailings.

Based on representations made by Rosemont Copper, it is anticipated that several billions of dollars of profit might result from operation of the proposed mine. If so, partial or complete backfilling would likely be financially and technically feasible, particularly in consideration of the waste rock and non-acid generating material characterizations provided by Rosemont.

An argument that some future technology might make the processed Rosemont tailings material economically viable is a very weak argument, at best. Energy costs for processing increase dramatically as concentration declines. Even should new technology dramatically decrease energy costs, the metal content of waste rock and tailings materials from the proposed Rosemont project would still be substantially less than the nearby Peach-Elgin, Broadtop Butte and Copper World mineral deposits owned by Rosemont.

Request:

- ✔ ADEQ should analyze and disclose the advantages and disadvantages of pit backfill and should include the opportunity for water conservation in their BADCT analysis.
To protect wildlife, the contingency plan for the APP should disclose the steps that the mining company would be required to take if the pit lake did become contaminated.

Revise the BADCT for Heap Leach Pad to Include a Leak Collection and Removal System

Within Table 4.1.1, Permitted Facilities and BADCT (draft APP p. 25), the BADCT system at the base of the Heap Leach Pad is presented as, from top to bottom:

- Minimum 3 ft layer of Overliner Drain material (crushed rock)
- 60-mil LLDPE geomembrane liner
- Geosynthetic clay liner (GCL)
- 6-inch layer of bedding soil

Based on information presented by Rosemont as part of the APP application, this lining system is inadequate for groundwater protection below the facility.

Total Potential Liner Leakage: Daily, Annually, and Site Life

Section 3.0 BADCT Analysis for the Heap Leach Pad of the Rosemont Heap Leach Facilities Final Design Liner System (Attachment 3, dated September 28, 2011; within the Summary of APP Regulated Facilities, Rosemont Technical Memorandum, October 7, 2011), includes an analysis of the Total Potential Leakage (TPL) of acidified solutions with metals through the base BADCT system outlined above, and into the underlying soils.

The calculation used a defect rate of one hole, less than a half-inch in size, per acre (43,560 square feet), which is an industry standard which represents failure of the geomembrane due to accidental punctures during construction.

The TPL was identified as 45 gallons per day (gpd). Leakage of sulfuric acid solution with metals through the heap leach base lining system into the environment below the process facility would then become 16,425 gallons annually (45 gpd x 365 days).

Thus, over the planned 10-year operational life and draindown period for the heap leach pad, the corresponding leakage of sulfuric acid solution through the heap leach base lining system into the natural environment is 164,250 gallons.

The leakage of sulfuric acid solution with metals into the natural environment at even a fraction of these quantities is unacceptable.

Natural Environment below the Heap Leach Pad
Leaked sulfuric acid solution will migrate downward into the basin-fill deposits (Gila Conglomerate) underlying the heap leach pad and, based upon existing and prepared foundation topography, downgradient towards the area of the Pregnant Leach Solution (Leach) Pond.

- The downgradient end of the Phase 1 Heap Leach Pad is underlain by Younger Alluvium which is in direct hydraulic connection to the alluvial deposits located in the bottom of nearby Barrel Canyon. Sandy alluvium above bedrock in the vicinity of the Pregnant Leach Solution (PLS) Pond is some 40 feet thick (boring VABH-06-04). Sandy alluvium in nearby Barrel Canyon is at least 50 feet thick (boring VABH-06-06).

- Groundwater level measurements in the nearby Gayler and Gayler 2 wells in Barrel Canyon indicate the occurrence of groundwater typically 40 to 60 feet below the land surface over the last few years (Phase 2 Hydrogeologic Investigation and Monitoring Program, Montgomery and Associates, 2009).

- Rosemont confirms this depth to water in Table 3, Estimated Depth to Water, located within a August 23, 2010 Tetra Tech Technical Memorandum (Rosemont APP-Regulated Depth to Groundwater). The estimated depth to water below the PLS Pond is identified as 45 ft.

- During the operational life of the proposed heap leach pad(s), surface water collected in a local constructed watershed approximately 2/3 square mile in size will drain to a “Storage and Recovery Sump Area” immediately downstream of the Leach Pond (Figures 4 – 8, Reclamation and Closure Plan, Tetra Tech, 2007 with 2008 revisions). As a result, the subsurface alluvial environment in this area will likely be at or near saturation conditions throughout the operational life of the heap leach pad. Under these conditions, subsurface contamination will more readily spread with groundwater as recharge into the regional groundwater system and as downgradient sub-flow through wash alluvium and the proposed flow-through drain (Dwg. 080-CI-901, Volume 1, 2009 Heap Leach Report).

- The highly variable topography at the base of the Heap Leach Pad, which results from minimizing the base grade cut and fill for proposed heap leach pad construction, is not particularly conducive to the deployment of rolled geosynthetic materials, namely the GCL and LLDPE geomembrane fabrics. Slope steepness and length constitute additional integrity issues associated with construction of the heap leach pad base lining system, and with the placement of the overliner rock drainage material and the initial overlying ore material lifts.

**Geotextile Material Needed Over Geomembrane Liner**

The design for the Heap Leach Pad differs from liner specifications in BADCT guidance document in section 2.4.2.3. The pad liner should use minus 3/4” crushed rock rather than minus 1½” crushed rock in the drainage layer. The smaller diameter is better able to keep
fine material from plugging the drainage layer and is less likely to damage the liner. A preferable approach is to use a geotextile between the liner and drainage layer. Use of 1.5” – 2” minus rock without a protection layer directly on top of a geomembrane liner is problematic: Per Chapter 3, Section 3.1.2 of the GSE Geomembrane Protection Design Manual (Volume 2 - 2009 Heap Leach Report, Appendix G, Attachment C), “Soil particles coarser than 1 cm (3/8 inch) should never be placed directly on a geomembrane without first placing a suitable nonwoven needlepunched geotextile as a protection layer.”

For 1.5" minus stone, Table 3.2 recommends the minimum use of 16 oz/sq. yard nonwoven geotextile. For 2.0" minus stone, Table 3.2 recommends the minimum use of 32 oz/sq. yard nonwoven geotextile. Based upon photographic documentation included in Appendix I3 as part of slake durability testing, with the same sample used for puncture testing (QMP 30 Jan 2009), Rosemont Copper intends to use primarily angular/blocky rock pieces in the 1¼” - 2” size range for overliner drainage material.

Also, the design does not use perforated pipe in the drainage layer, so there is little control over the hydraulic head on the liner. The BADCT document prescribes that head should be kept below 2 feet on average. Without the pipe, this type of control is unlikely.

Requests

The above factors, when considered individually and collectively, demonstrate the proposed design of the Heap Leach Pad base lining system is inadequate for protection of the subsurface environment.

- ADEQ should disallow the burial of this facility under tailings as a closure design. This is not a technology that is demonstrated, and it is certainly not practiced on an industry-wide basis.
- The BADCT design for the Heap Leach Pad should include design aspects related to the closure configuration in order to cover the mine “life-cycle” approach of the BADCT guidance.
- Due to the high risk of groundwater contamination due to the proposed Heap Leach Pad base lining system, revise the base lining system to achieve a true BADCT below this industrial facility.
- Specifications for drain-down, cap design, and the biologic treatment process to deal with long-term drainage from the heap after closure should be included in the APP.
- Design and construct a leak collection and removal system below a primary HDPE geomembrane liner in order to collect and manage acid and metal fluids which flow through even small holes.
The BADCT base lining system for the Heap Leach Pad would then be similar to the BADCT base lining system for the connected PLS Pond, with primary and secondary geomembrane liners separated by a collection system and with the secondary (bottom) liner underlain by a GCL.

Although Rosemont’s puncture results to date have not indicated a full puncture of the geomembrane, in a number of instances the geomembrane experienced moderate to severe indentations. A leak collection and removal system below a primary HDPE geomembrane liner would not only help control discharges due to construction accidents and seaming problems, but also from punctures due to heap leach pad vertical loading of over 400 feet of stacked ore.

Per manufacturer’s specifications, Rosemont should install a 32 oz/sq. yard nonwoven geotextile over the upper geomembrane liner to help protect the primary BADCT liner from puncture during construction and operation.

The resultant base-lining system for the entire operational heap leach pad area (between the overliner crushed rock drainage layer and the underlying accepted liner bedding fill) might therefore consist of the following components:

1) 32oz geotextile
2) 60 mil LLDPE geomembrane liner
3) 6" sand layer* (base slopes) / geonet drainage material (side slopes)
4) 60 mil HDPE geomembrane liner
5) Geosynthetic clay liner (GCL)

A sand layer is warranted on all base and shallow slopes of the heap leach pad to collect sulfuric acid solution which passes through punctures of the upper 60 mil LLDPE geomembrane. With a lining system only composed of manufactured geosynthetic materials on the base and shallow slopes, rock punctures may breach the entire lining system and pass the sulfuric acid solution and leached metals into the natural subsurface environment.

**Prepare a Professional Heap Leach Pad Base Grading Plan**

The proposed Heap Leach Pad construction location is characterized by ridge and valley topography, as depicted on the figure below, from a Technical Memorandum prepared on April 6, 2010 (*Rosemont Heap Leach Facility Stormwater Management Analysis*, Tetra Tech). A similar figure is presented in other documents in support of the APP application.

A review of the grading plan indicates Rosemont Copper intends to minimize the amount of cut and fill needed to set base grades for the heap leach pad facility. A highly variable base topography for the Heap Leach Pad results from minimizing base grade cut and fill. The base grading plan as shown is not conducive to the uniform, stable deployment of rolled geosynthetic materials, namely the GCL and LLDPE geomembrane fabrics. In turn,
construction-related defects and lining accidents will rise above normal liner installation settings.

In fact, the professional installation of GCL and LLDPE geomembrane liners is not possible using the chaotic base grades depicted on the Tetra Tech figure below.

The above grading plan from Tetra Tech 2010 shows proposed topography under proposed heap leach geomembrane is highly irregular.

**Request**

As an integral part of the BADCT demonstration for both ADEQ and the public, the proper installation of the base lining system below the Heap Leach Pad constitutes a critical discharge control element of the mining industrial complex.

- Rosemont Copper must provide a *Heap Leach Pad Base Grading Plan* which is appropriate for the installation of the base lining and overdrain systems and is suitable for uniform deployment.

- The *Heap Leach Pad Base Grading Plan* should minimize the potential for construction punctures of the liners, poor seaming of the geomembrane liners, and inadequate anchoring of liner materials.

**Prepare a Professional Construction Quality Assurance Plan for the Heap Leach Pad Base Lining System**
As part of BADCT Pre-Operational Requirements (draft APP, Section 2.2.3, p. 5), there is no mention of a Construction Quality Assurance Plan which must be prepared for the proper installation of the Heap Leach Pad Base Lining System.

Within Section 2.2.3.2, Liner Installation and Testing, it states an Arizona-registered Engineer is responsible for Quality Assurance work related to liner installation and testing, including “reporting and certifying that the liner installation and testing was performed according to approved specifications in the application documents.”

A significant problem exists, however. The CQA specifications found within the application documents are deficient in many respects. (Volume 2, Appendix D, 2009 Heap Leach Report).

Descriptions of some deficiencies found within the “approved specifications in the application documents” are listed below in Items (1) through (7).

Request

✓ Rosemont Copper is requested to prepare a professional Construction Quality Assurance Plan for construction of the Heap Leach Pad Base Lining System. The CQA Plan shall provide the basis for construction monitoring, testing, and recordkeeping.

✓ Within the Construction Quality Assurance Plan, address the comments provided below within Items (1) through (7), including the following:

  ➢ GCL Panel Deployment Plan
  ➢ Geomembrane Panel Deployment Plan
  ➢ Overliner Drainage Material Construction Plan
  ➢ Full Documentation, including Photographic Record
  ➢ Complete Construction Quality Assurance Report

(1) Geosynthetic Clay Liner and LLDPE Geomembrane Panel Deployment Plans

Slope steepness and length constitute additional integrity issues associated with the construction of the heap leach pad base lining system. Per the 2009 Heap Leach Report, in Phase 1 the present design includes deployment of the rolled geosynthetic materials for distances exceeding 850 feet on 5:1 (horizontal:vertical) slopes (southwest quadrant) and approximately 175 feet on a slope steeper than 3:1 (east end). In Phase 2, the present design includes deployment of the rolled GCL and LLDPE geosynthetic materials for distances exceeding 750 feet on 3.75:1 slopes (west end).

✓ How will the GCL material be anchored to the subgrade and deployed over these slope lengths to assure construction integrity prior to deployment of the LLDPE geomembrane material?
✓ How will the LLDPE geomembrane material be deployed and anchored over these slope lengths to assure construction integrity prior to placement of 36 inches of crushed rock material?

✓ How will the 36 inches of crushed rock material be placed and maintained on these slopes both during construction, and during the period from construction to loading of ore rock?

✓ Provide both a GCL Panel Deployment Plan and a LLDPE Geomembrane Panel Deployment Plan, which clearly demonstrate the proper deployment and anchoring of these geosynthetic materials on the highly variable base grade slopes, using the revised base grades provided in the requested Heap Leach Base Grading Plan above. The Deployment Plans must accurately depict all proposed top-of-slope and intermediate slope anchor trenches for the GCL and LLDPE geomembrane, as determined by appropriate engineering calculations.

(2) Overliner Drainage Material Construction Plan

Three feet of crushed Quartz Monzonite Porphry rock (1.5" minus) is proposed for use as the fluid drainage layer above the base lining system. Within this drain layer, the sulfuric acid and metal leach solution will flow downgradient by gravity below the overlying heap leach ore pile for collection into the Pregnant Leach Solution (PLS) Pond.

The crushed rock overliner drainage material must be carefully placed so as not to damage the proposed 1/3" thick base lining system. The results of puncture testing indicate moderate to significant deformation of the primary geomembrane liner.

Regarding the installation of overliner drain fill material, information provided in this section states the following: “fill material should be placed at the coolest time of the day, the material should not be dumped directly onto the geomembrane, the material should not be deployed over wrinkles that may fold over, and overliner drain material placed on slopes should be placed from the bottom of the slope upwards”.

✓ What is considered the “coolest time of the day”? Above what ambient air temperature will placement of the overliner drain material be stopped?

✓ Because the overliner drain material must not be dumped directly onto the geomembrane, the material must be pushed off 42-in thick haul roads or fill pads. What is the maximum distance the material will be pushed from a placement haul road by a dozer, or conversely, what is the minimum distance between adjacent 42-in thick haul roads?

✓ Because the overliner drain material must be placed from the bottom of the slope upwards, specifically define the construction techniques for the overliner drain material which will be utilized in the proposed Phase 1 and 2 heap leach pads on
planned 5:1 (horizontal:vertical) slopes over 850 feet in length? On planned 2.75:1 slopes over 175 feet in length?

✓ Rosemont Copper is requested to provide an Overliner Drainage Material Construction Plan which clearly illustrates all locations of the 42-inch thick crushed rock haul road system which will be utilized to transmit crushed rock overliner material for 36-inch thick distribution on the base lining system.

✓ Provide diagrams of the overliner distribution methodology and equipment use required to successfully construct the 36-inch crushed rock overliner system on the highly variable and often steep heap leach pad foundation grades.

✓ Provide dynamic load, effective stress, and puncture calculations for construction of a 36-inch crushed rock layer on 2.5:1 (horizontal:vertical) side slopes.

(3) Liner Bedding Fill Specifications

The approximate 100-acre Phase 1 Heap Leach Pad base lining system will be constructed above prepared foundation soils. The uppermost soil subgrade layer, the liner bedding fill, provides the critical support for the proposed 1/3-inch geosynthetic base lining system. Section 3.6.1 of the Technical Specifications, Material Requirements (Attachment A) states the following: “Liner bedding fill shall generally include inorganic soils with less than 30 percent particles larger than 0.75 inches and a maximum 1.5 inch particle size.”

Yet further information provided in the same paragraph contradicts this statement: “The maximum particle size in the fill shall be no larger than two-thirds the fill compacted lift thickness, unless otherwise approved by the Engineer.” The maximum particle size could therefore vary from 1.5 inches to say 8 inches (2/3 of a compacted 12 inch lift), or apparently could be even larger if approved by the Engineer.

Rosemont Copper is requested to answer the following questions:

✓ What is the actual soil gradation requirement for the liner bedding fill?
✓ What is the maximum percentage of soil material allowed which is greater than 1.5 inches in size?
✓ Will the final soil surface beneath the heap leach base lining system be smooth-rolled by a smooth-drum compactor prior to deployment of the GCL roll sheets?

(4) Soils In Contact With Geosynthetics (Section 7)

Regarding motorized vehicle use on geosynthetic materials, information provided in this section indicates All Terrain Vehicles (ATVs) with low tire pressure are considered acceptable on the exposed base lining system.

✓ ATVs should never be allowed directly on top of GCL material.
ATVs should never be allowed on any steep side slopes (ie. >15:1 horizontal to vertical) of the constructed and exposed LLDPE geomembrane / GCL system base lining system of the heap leach pad area

Rosemont Copper is requested to revise Section 7 accordingly.

(5) Geosynthetic Clay Liner (Section 9)

As a primary section in the current Heap Leach Facility Construction Quality Assurance manual, surprisingly there are no actual construction quality assurance methods provided in Section 9 for GCL deployment.

Some incomplete information on construction methods is provided in Section 4.3.2 of the Technical Specifications (Attachment A).

Rosemont Copper is requested to respond to the following questions and comments, and revise Section 9 accordingly:

- Who is responsible for acceptance of soil subsurface conditions prior to deployment of the GCL material?
- How will the GCL material be stored on site so as not to be ruined by rain events and associated surface water conditions?
- Provide a similar section in the GCL technical specifications to the information provided for the Linear Low Density Polyethylene (LLDPE) geomembrane material in Section 4.1.4 (ie, Delivery, Storage and Handling of the GCL).
- In order to verify professional experience and qualifications, provide a section in the GCL technical specifications similar to the information provided for the LLDPE geomembrane material in Section 4.1.7.2 (Personnel). The GCL Installer and crew should have considerable demonstrated experience in the installation of GCL for sensitive environmental applications.
- How will the GCL material, of typical roll length of 150 feet, be deployed and anchored over slope lengths of greater than 800 feet, and on steep slopes (2.75:1 or steeper) of greater than 150 ft length? What is the associated sequencing of deployment?
- Due to construction deployment on diverse topographic slope angles and lengths associated with foundation conditions at the heap leach pad, a GCL seam overlap of 6 inches for adjacent panels is considered insufficient. Due to the critical environmental control needs for the heap leach pad base lining system, Rosemont is requested to provide a minimum lateral seam overlap of 12 inches.
✓ Provide a section in the GCL technical specifications similar to the information provided for the LLDPE geomembrane material in Section 4.1.10 (*Quality Assurance and Acceptance*). Similar to the geomembrane specifications, the GCL Installer “shall furnish reproducible as-built drawings showing the location of the GCL panels, seams, repairs, patches, etc.”

In addition, the technical specifications contain the following statement: “If exposed GCL cannot be permanently covered before the end of the work day, it shall be temporarily covered with plastic or other waterproof material to prevent hydration as recommended by the Geomembrane and/or GCL Manufacturer.”
Rosemont Copper is requested to provide answers to these related questions:

✓ Specifically, what plastic or other waterproof materials will be used to cover exposed GCL liner component?
✓ How will the temporarily waterproof cover material be deployed?
✓ How will the temporarily waterproof cover material be collected/retrieved after deployment?
✓ How will the upper surface and seams of the temporary cover material be sealed to prevent surface water from running underneath the cover and onto the deployed GCL?
✓ How will the temporary cover material be anchored on the GCL to prevent ripping, shredding and displacement during strong wind conditions associated with significant storm events?

(6) Documentation (Section 11)

In Section 11.2 (*Observation Logs and Testing Data Sheets*), a list of items is included under the heading “A comprehensive set of CQA Logs would be as follows:”

*However, the “comprehensive” list provided pertains only to geomembrane liner material deployment and therefore is significantly incomplete.*

✓ Rosemont Copper is requested to expand this list (*comprehensive set of CQA Logs*) to include all critical elements of construction, including earthwork, geosynthetics, pipework and concrete. At a minimum, this should include the following:

1) Foundation preparation
2) Liner bedding fill construction
3) Geomembrane, GCL, geonet and any other geosynthetic material
4) Anchor trench construction and fill
5) Piping and pipe bedding
6) Cast-in-place concrete
7) Overliner drainage fill
8) Photographic documentation logs
A “photographic record of construction” must be compiled as part of CQA Plan implementation, as noted in Section 12.1 (CQA Final Report Contents). However, there is no mention of the creation of a photographic record in Section 11.

- Rosemont Copper is requested to create a new subsection (11.3) which formally describes the requirements for the photographic record of construction for the heap leach pad foundation, base lining system, and overliner drainage layer construction.

- At a minimum, the photographic record of construction must include systematic aerial photographic coverage of all construction items covered in the expanded comprehensive set of CQA Logs (see comment above regarding CQA logs).

(7) CQA Final Report (Section 12)

Similar to Section 11.2, Section 12.1 (CQA Final Report Contents) appears to reference primarily geomembrane material deployment and is therefore significantly incomplete.

- Rosemont Copper is requested to revise the listing of the CQA Final Report Contents to include specific reference to all critical elements of construction, including earthwork, all geosynthetic materials, pipework, and concrete.

The Record Drawing list presented in Section 12.2 appears to reference primarily geomembrane material deployment and is therefore significantly incomplete.

- Rosemont Copper is requested to revise the record drawings list to include specific reference to all critical elements of construction:

  1) Surveyed as-built location of heap leach pad(s) or expansions
  2) Surveyed as-built location of PLS, stormwater and Raffinate ponds
  3) Soil testing locations for foundation preparation and liner bedding fill
  4) As-built GCL liner panel, repair, and anchor trench locations
  5) As-built geomembrane panel, repair, seaming, and anchor trench locations
  6) As-built internal and perimeter piping system construction locations
  7) As-built sump, leak detection system and transfer/monitor piping locations
  8) As-built anchor trench locations for all geosynthetic materials
  9) As-built drawings for any cast-in-place concrete construction features

A Photographic Record of Construction, as commented on above in Section 11, must be fully incorporated as an integral part of the Record Drawings.

- Rosemont Copper is requested to record all locations of photographic documentation, for each phase of construction of the approved base lining and drainage system (liner bedding fill, GCL material anchoring and deployment, LLDPE geomembrane material anchoring and deployment, drain pipe system
installation, overliner drainage system installation, etc) on each of the individual Record Drawings noted above.

✔ If there is insufficient space on the individual Record Drawings, provide the *Photographic Record of Construction* on finalized copies of the Record Drawings. For easy reference, a numeric identifier next to each photographic location should correspond to information recorded on the Photographic Documentation Logs (Section 11) and the actual Photographic Record itself.

**As Proposed, the Flow-Through Drain System is a Tailings Disposal Facility**

The proper and permanent operation of the proposed mine flow-through drain system is one of the most critical components of the planned industrial waste disposal area. Within the Rosemont *ACOE CWA 404 Application* (page 7), it states “The flow-through drains are designed to allow conveyance of the 100-year 24-hour storm volume from the contributing basin through the drain within 30 days.”

One significant problem with the proposed flow-through drain system will be the eventual clogging of the entrances on the western side of the Tailings Disposal Facility. Watershed surface flows, consisting of water from both the side slopes of the tailings mound and the upgradient watershed, will bring sediment-laden stormwater to the entrances of the South 1, South 2, and PWTS flow-through drain entrances.

When the flow-through drain system fails due to various factors, including lack of operational maintenance and clogging of the drain entrances due to the buildup of fine sediments, surface water flow beneath the massive *Tailings Disposal Mound* will eventually trickle down and may cease. The use of a geotextile filter fabric at the drain inlet ponding areas / rock drain interface is not sufficient to allow for long-term operation of the flow-through system, and will not stop blockage at the entrance due to sediment buildup. Similarly, the use of a graded rock filter may assist in passing water into the drain entrance, but will not stop the eventual clogging of the entrance due to sediment buildup. This can only be accomplished by mechanical removal of accumulated sediment which will block the entrances to the flow-through drains.

**Simply put, implementation of the proposed Flow-Through Drain System at the proposed Rosemont Copper Mine is ultimately a Fatal Flaw.** The design function of this earthen-material system will cease in the future – it is only a question of when, not if.

**In turn, this will adversely impact the streams downstream of the mine site, in Barrel Canyon, Davidson Canyon and likely Cienega Creek.**

Rosemont Copper also knows this will happen and plans to wash their hands of the non-functioning flow-through drain system in the mine post-closure period, with no assumption of responsibility:
• Of interest, the document prepared for the APP, Rosemont Copper conveniently assumes plugging of all inlets on the western side of the disposal mound (Rosemont Flow-Through Drain Contingencies, March 2011 Response Letter, Attachment 3: Tetra Tech, March 8, 2011).

• Due to eventual plugging, ponded water along the western and northern boundaries of the Tailings Disposal Facility will pool against the tailings disposal mound, when pooled high enough flow laterally to other lowland areas, or in the case of inlets near the open pit, "report" to the open pit.

• While “protection of the facilities at the Rosemont Copper Project under closure conditions is still maintained”, the function of the flow-through drain system is not maintained. This may lead to increased interaction between “clean” stormwater and disposed tailings materials. As suspected, RC is simply packing it in after closure, for the eventual plugged flow-through drain inlets.

The USEPA also commented on this questionable stormwater design component (Agency Review of the Internal Working Draft of the Rosemont Copper Project DEIS, July 2011):

• “The DEIS should contain more information on the design of the Central Drain. For instance, how will the design ensure that stormwater does not contact tails or contaminant generating waste rock while passing through the Central Drain? How will the Drain be constructed such that fine grain material is not allowed to settle and eventually migrate into the Central Drain? What long-term maintenance is necessary to ensure that the Central Drain remains clear and clog free into perpetuity? What would be the potential impacts, contingency plan and potential costs were the drain to plug? Where would the funding for long-term maintenance come from?”

Request:

With respect to the proper function of the Dry Stack Tailings flow-through drain system, Rosemont Copper has prepared a No Action Plan to deal with the long-term certainty that the flow-through drains will become plugged.

✔ Within Table 4.1.1 of the APP application, Permitted Facilities and BADCT, under the column Facility BADCT, revise the description to clearly describe the non-functioning of the flow-through drains with inlets on the western and northern boundaries of the Tailings Disposal Facility.

✔ Provide hydrologic calculations and design plans which clearly show the public what will happen when the inlets plug on the western and northern boundaries of the Tailings Disposal Facility. Show ponding areas and height of ponding, storage and drainage times, including the cumulative effects of a 100-yr storm event followed by subsequent significant storm events. For each plugged inlet, create cross sections which clearly show maximum ponding heights against the side slopes of the Tailings.
Disposal Facility, including geometries of waste rock buttress materials, encapsulated tailings materials, and drain materials.

Prepare a Construction Quality Assurance Plan for the Flow-Through Drain System below the Tailings Disposal Facility

As part of BADCT Pre-Operational Requirements (draft APP, Section 2.2.3, p. 5), a Construction Quality Assurance Plan must be prepared for the proper installation of the proposed flow-through drain system. There is no mention in this section of any Pre-Operational Requirements for the entire Flow-Through Drain System.

The proposed flow-through drainage system below the Tailings and Waste Rock Disposal Facilities is shown on the figure below. The naming convention provided on Figure 38, Site Water Management Update Report (Tetra Tech, 2010f) lacks identification of the starting upgradient points of the primary North and South “Main” Drains relative to all of the respective tributary drains.

The flow-through drainage system consists of the following drainage components to be constructed below the Tailings and Waste Rock Disposal Facilities, with their approximate lengths:
South Flow-Through Drains (Wasp and Barrel Canyons) – Total Length:

- 7,000 ft South Main Drain – outlets to Barrel Canyon
- 5,300 ft South 1 Drain – inlet by Open Pit
- 700 ft South 1 Collector Drain – inlet at PWTS Pond
- 4,800 ft South 2 Drain - inlet by Open Pit
- 4,200 ft South 3 Drain – Barrel Canyon drain below Waste Rock / Tailings
- 6,700 ft South Finger Drain - north
- 1,700 ft South Finger Drain - south

The total length of the south flow-through drain system is **30,400 feet or ~ 5.75 miles**

North Flow-Through Drains (McCleary Canyon)

- 5,700 ft North Main Drain – outlets to Barrel Canyon
- 1,400 ft North 1 Drain – inlet by Primary Settling Basin
- 1,000 ft North 1 Collector Drain – inlet by Administration Building
- 1,900 ft North 2 Drain – services Detention Basin 2
- 1,100 ft North 2 Collector Drain – services west slope runoff from Tailings Mound
- 2,000 ft North 3 Drain west - services Detention Basin 3
- 600 ft North 3 Drain east - services Detention Basin 3
- 2,500 ft North Finger drain

The total length of the north flow-through drain system is **16,200 feet or ~ 3.07 miles**

The total length of the entire proposed flow-through drain system located below the Tailings and Waste Rock Disposal Facilities is ~ **46,600 feet or ~ 8.82 miles.**

Request

The proper and permanent operation of the proposed mine flow-through drain system is one of the most critical components of the planned industrial waste disposal area. However, there is no mention of any Pre-Operational Requirements for the entire Flow-Through Drain System in the draft APP, which exceeds eight miles in length and which cannot be inspected after construction!


- The Construction Quality Assurance Plan should clearly describe the construction techniques, geosynthetic material deployment, waste rock material selection and testing inspections and recordkeeping requirements, photographic records, and associated activities related to field construction of the 8.8 mile drainage system.

- A complete Construction Quality Assurance Report should be prepared and provided to ADEQ after completion of construction of the Flow-Through Drain System.
✓ Section 2.2.3 of the draft APP specifies pre-operational requirements for Quality Assurance Engineer certification for subgrade, liner, and underdrain. This section should also include QAE certification of the Flow-through Drain system for the Dry Stack Tailing facility.

✓ Develop an alternative to flow-through drains: open drains through existing canyons. This alternative would reduce the likelihood of catastrophic failure of the waste-rock/tailings landform and supplant a fatally flawed design fraught with all kinds of future drainage and potential pollution problems. The Tailings and Waste Rock Disposal Mound could be separated into two distinct mounds, allowing permanent surface water flow through an open constructed canyon (along the general alignment of the existing Wasp – Barrel Canyon drainage or the Scolefield Drainage (depending upon alternative), from the vicinity of the proposed Mine Plant site area on the west to the proposed Compliance Dam on the east). Except for surface water lost to the mine pit footprint and associated limited watershed, the majority of the remainder of the existing site watershed stormwater could then be collected via positive drainage off existing and constructed topographic surfaces. The considerable excess material volume from the creation of a constructed canyon can be utilized in the creation of natural-looking ridge and hilly terrain on the upper surfaces of the two tailings/waste rock disposal mounds.

BADCT Demonstration is Inadequate for Surface Impoundments

This APP assumes that leak detection systems are not needed because the ponds will have liners and meet BADCT. Leak detection has been proven to work and prevent disasters before they happen. Prevention is certainly much less expensive than cleanup. However this APP is only providing leak detection on the PLS and Raffinate ponds; it is recommended that leak detection is provided on all the ponds.

Request:

✓ Include on pp. 25-26 of the draft APP Permit requirement of a leak detection system for the PLS Pond, Raffinate pond and Primary Settling Basin (PSB).

✓ Include requirement for source characterization monitoring for the PLS Pond, Raffinate pond and Primary Settling Basin (PSB).

✓ Stormwater Pond BADCT: This pond is intended to hold PLS when it overflows the PLS Pond spillway. Because it is intended to hold low pH fluids, this pond should be double-lined.
**BADCT Is Needed for Other Areas**

**Request:**

✓ Waste Rock Storage Area BADCT should include a waste-rock segregation plan to separate potentially acid generating (PAG) waste rock. Page 30 of the draft permit states that “Waste rock will be managed by monitoring PAG and non-acid generating (NAG) rock and placing in designated areas per the ADEQ approved Waste Rock Segregation Plan (WRSP) (emphasis added).”

Section 11.3 of the APP Application (Concurrent Reclamation Design) contains the following statement: “Potentially acid-generating materials will not be used for construction of the perimeter buttresses, required drains, or fills. These materials will be placed in the interior of the Waste Rock Storage Area and isolated.”

The August 31, 2010 WRSP also states, in Section 4, “Additionally, potentially acid generating waste rock will not be placed beneath areas designated for water management ponds as part of the final landform.” However, the majority of the Waste Rock Disposal Facility will be affected by stormwater infiltration, waste rock saturation, and constituent leaching, based upon:

1. The *8 Perimeter Containment Areas* which will collect and pond stormwater.

2. Planned series of widespread detention basins and pools both on the upper surfaces of the *Waste Rock Disposal Facility* and along every side-slope bench, which will collect water subject to infiltration into the waste rock mass. These Detention Pools are 6’ – 8’ deep, with 500 yr event capacity.

In summary, no facility is described in the APP where PAG rock may be placed. ADEQ should require that a separate, lined PAG disposal facility or facilities be incorporated into this mine’s design. BADCT for the PAG disposal sites should be described in the APP.

✓ Dry Stack BADCT: The flow-through drain system incorporated under the tailing pile is not an identified BADCT surface water diversion technology. The APP should provide specific details for this construction identifying how tailing material will be precluded from entering the drains.

✓ The list of facilities in Table 2.1 and BADCT descriptions in Table 4.1.1 should include the Compliance Point Dam since this facility has been used as an APP facility for the purposes of delineating the areawide PMA for this APP.

✓ Section 2.2.3 specifies pre-operational requirements for Quality Assurance Engineer certification for subgrade, liner, and underdrain. This section should also include QAE certification of the Flow-through Drain system for the Dry Stack Tailing facility.


**DISCHARGE CHARACTERIZATION**

**The APP Ignores Potential Sources from Mine Treatment Facilities**

Sampling of source waters including the PTWS, Primary settling basin, Raffinate Pond or PLS pond is not included in the Draft APP. We presume that sampling of these sources was not mentioned because the design is considered for zero discharge. However, how will one know what constituents to sample for in the compliance wells if no source sampling is completed to characterize the potential pollutants?

The APP assumes that leak detection systems are not needed for all ponds because the ponds will have liners and meet BADCT. Leak detection has been proven to work and prevent disasters before they happen. Prevention is certainly much less expensive than cleanup. This APP is only providing leak detection on the PLS and Raffinate ponds; it is recommended that leak detection is provided on all the ponds.

The water will eventually generate slurry of elevated TDS and sulfate along with numerous chemicals from the milling and flotation process such as xanthates, Alky Aryl Oxime, Petroleum Distillates, Sulfo succinate surfactant, Alkyl Xanthate salts, Nalco 7873, alcohol/hydrocarbon blends and others. A more detailed water balance of this water and an accounting of the residues it will produce is needed but not apparent in any of the documents examined. In addition, the process water, especially in the sulfide and oxide holding ponds, needs to be sampled and characterized in case a breach in the ponds leaks the liquid to the groundwater.

**Request:**

- Include requirement for source characterization monitoring for the PLS Pond, Raffinate pond and Primary Settling Basin (PSB).
- Include on pp. 25-26 of the draft APP Permit requirement of a leak detection system for the PLS Pond, Raffinate pond and Primary Settling Basin (PSB).

**The APP Ignores Sources of Discharges from Tailings Disposal Facility; BADCT Is Needed For Potential Discharges**

According to Figure 6.7 of the AMEC April 15, 2009 *Dry Stack Tailings Storage Facility Final Design Report (AMEC 2009 Dry Stack Report)*, seepage rates from the dry stack tailings will increase from approximately 5 gallons per minute in production year 8 to 8.4 gallons per minute in mining year 18. Therefore, seepage from the dry stack tailings will increase from an annual rate of approximately 2,737,500 gallons per year to 4,415,000 gallons per year over this decade of mining.
However, process pore water will not be the only water that will interact and infiltrate into the Tailings Disposal Facility.

Saturation of Stacked Tailings Materials

With Rosemont Copper’s stated intention during operation to place tailings as fill behind perimeter waste rock buttresses, all precipitation falling on the surface of the growing tailings stack, from the start of stacking to the end of mining, will necessarily percolate into the tailings material.

In the AMEC 2009 Dry Stack Report within Sections 5 (Surface Water Management) and 8 (Facility Closure Concept) the following statements are made:

- “Runoff from the tailings top surface will not be discharged and instead will be collected using perimeter ditches and by sloping the tailings to drain to low spots or evaporation ponds located on the tailings surface where water can evaporate or be pumped to containment ponds.”

- “The surface will be graded so that runoff from the PMP is directed towards low point(s) and, if required, an overflow rundown off the TSF will be included.” Two decant structures have been designed to drain overflow waters from detention basins located on top (northwest and northeast corners) of the Tailings Disposal Facility.

As proposed in this APP, therefore, the management of surface water by ponding will promote infiltration of water into the tailings mass, with associated saturation of tailings materials and increased seepage rates and leachate production.

Mixing of Non-Contact Surface Water and Stacked Tailings Material

The use of flow-through drains below the base of the Tailings Disposal Mound, as depicted on Fig. 600-Cl-940 of the AMEC 2009 Dry Stack Report, guarantees the mixing of surface water flows from watersheds adjacent to the tailings mound (non-contact water), contact surface water from the side slopes and upper surface of the tailings mound, and seepage fluids / leachate from the tailings stack.

Mixing of collected “non-contact” surface water and stacked tailings will occur at the plugged entrances to the “flow-through” drain system along the western and northern sides of the Tailings Disposal Facility.


- Due to eventual plugging, ponded water along the western and northern boundaries of the Tailings Disposal Facility will pool against the tailings disposal mound, when
pooled high enough flow laterally to other lowland areas, or in the case of inlets near the open pit, "report" to the open pit.

Tailings Leachate Production

According to Section 4.5 of AMEC’s November 2008 report, Filtered Tailings Dry Stacks Current State of Practice (AMEC 2008 Dry Stacks Review):

- “Even though the hydraulic conductivity (unsaturated permeability) is very low, dry stacks do have the potential for oxidation and therefore can have unanticipated leachate issues. Leachate may be limited in quantity but the concentrations could be high. Full geochemical characterization of the tailings in their filtered state is essential to determine the potential effect.”

PHREEQC Model

As pointed out by U. S. Department of Interior’s review of the Infiltration, Seepage, Fate and Transport Modeling Report (section 6.3.3, pages 76 – 78; section 6.4.3, pages 84 – 85), the detail provided on the PHREEQ model is insufficient to understand the accuracy of the predicted chemistry of the tailings seepage. How much alkaline material (limestone) was included in the PHREEQ model of the tailings stack and is that really representative? The resulting pH from the model for the seepage solution from the tailings is 5.87. This relatively high modeled pH is most likely controlling the low metal concentrations in the predicted tailings seepage. Also, only nine samples are used to represent 720 million tons of tailing material. To get a good statistical representation, more testing than this should be performed for a facility of this magnitude.

Contrary to documents prepared by Rosemont Copper to date, saturation of portions of the Tailings Disposal Facility will occur both during the operating life of the mine and during the non-ending post-closure period. Mixing of non-contact stormwater and dry stack tailings materials will also occur during the operating life of the mine and during the non-ending post-closure period.

Request

✓ Based upon the parameters described above, Rosemont Copper should prepare updated INFILTRATION, SEEPAGE, FATE and TRANSPORT MODELING to account for stormwater infiltration by a variety of means both during the operational life of the Tailings Disposal Facility and during the extended post-closure period.

✓ Based on the results of the updated INFILTRATION, SEEPAGE, FATE and TRANSPORT MODELING, revise the facility BADCT for the Dry Stack Tailings Facility to reduce the introduction of both contact and non-contact surface water into the disposal mound.
DISCHARGE LIMITATIONS

Errors and omissions in the alert levels and discharge limits must be addressed

Requests:

✓ Table 2.2 and the note regarding AL1 and AL2 should be moved to the Discharge Limitations section 2.3 of the permit. If the LCRS limits are included in the Operational Requirements section of the APP, it implies that these limits do not have the regulatory status of discharge limitations given in A.R.S. §49-201(12) or statutory enforcement provisions that apply to DL violation.

✓ Change the wording in the “note” from “shall be exceeded” to “is exceeded.”

✓ It is understood that the terms AL1 and AL2 are jargon commonly used in technical discussion of liner leakage control. However, the terminology for Alert Level 2 should be changed because it is confusing to have a discharge limitation referred to as an alert level. Alert levels have a specific regulatory function described in A.R.S. §49-243(K)(7). Discharge limitations are distinctly addressed under A.R.S. §49-243(K)(4) and the exceedance of a DL has specific enforcement provisions under the law.

✓ Discharge monitoring in section 2.5.1 of the permit states “Not applicable for this permit.” ADEQ should require monitoring of the stormwater coming out of the flow-through drains to verify that tailing material has been excluded and that the stormwater does not contain low pH fluids.

✓ In section 2.3.1, it is entirely proper to limit the height of facilities as a DL. However, ADEQ should specify the exact height limitation here so that the DL is clearly established within the permit. Referring to the permit application for this limitation makes for an ambiguous permit that may be difficult to enforce.

✓ Monitor carbon disulfide in this APP. This chemical is regulated under A.R.S. §49-243(I) such that ADEQ should limit its discharge into the aquifer to the “maximum extent practicable regardless of cost.” Therefore, with respect to this pollutant, ADEQ should establish a DL, rather than an AQL or AL, which is set at the non-detect level.
LOCATION AND DESIGN OF POINTS OF COMPLIANCE (POC)

Monitoring is Based on Inadequate Basic Data

Basic data about the position of the aquifer around the mine site is lacking. Inferences that can be made from the groundwater level data about directions of flow are a fundamental basis for designing the monitoring well network and design of individual wells.

No basic groundwater data have been collected by the applicant for the area of impact located in National Forest and outside it, north of the mine footprint including Scholefield and Mulberry watersheds and south of the mine site in the vicinity of the groundwater divide between the upper and lower Cienega groundwater basins (or Davidson watershed versus Upper Cienega Creek and Box Canyon watersheds.). There are springs and wells in the area that should provide the necessary information.

Based on Hargis and Montgomery’s 1982 monitoring data, and a re-mapping of the limited data presented in Montgomery and Associates 2009 by Dr. Robert Casavant, R.G., we believe the applicant’s regional groundwater contour map may show erroneous flow directions. The figure below presents Casavant’s interpretation, which differs significantly from the applicant’s.

The interpretation suggests that the aquifer is structurally influenced, and segregated into smaller basins that may direct the movement of groundwater in ways not predicted by the applicant.
This map depicts Casavant’s hand-contoured interpretation of the regional aquifer conditions based on 1982 well monitoring and springs, supplemented by more recent observations. It was contoured independently of the position of faults and streams. Faults are mapped by Arizona Geological Survey and Anamax (shown in red and purple). Intermittent streams, blue lines, are based Pima County mapping.

According to Casavant, “the recontoured data exhibits a dominant NE component (minor NW trend) of structural control on the groundwater distribution and levels located east of the range crest.”

The natural spring in the NE corner of the map area (Scholofield Spring) may be related to the intersection along a major NE fault zone and intersection with a minor NW fault. These fault sets have described elsewhere in the range as undergoing repeated reactivation. The fault fabrics, structural kinematics, and published papers on the tectonic evolution of Santa Rita mountains point to a history of repeated fault reactivation, both which link to episodic hydrothermal upwelling, groundwater infiltration, and associated dissolution, mobilization and reconcentration of rock and minerals.

Casavant has stated that “What all this implies is that for many faults zones in the Rosemont [sic] proposed area--some mapped, others not--they are likely to still be transmissive to great depths and distances from the area, depending on individual fault segment orientations, lengths and infill history. The NE- and NW-oriented fault sets in the Santa Ritas are both prone to dilation (transtension) during the current east-west B&R extension that is taking place today, and therefore, are most likely to be conducive to long-term surface infiltration.
and groundwater recharge within both upland and flank areas (on both sides of the current range crest)—which may be driving current artesian behavior of some water wells, as well as the hidden and under-characterized storage and transport of groundwater along and within long-lived fractured aquifers long after proposed mining takes place in the region.”

Request

✓ Additional data collection and interpretation are needed to better understand the geology, piezometric surface or surfaces in the area, and directions of flow.

**Point of Compliance and Monitoring Well Network Is Inadequate**

Even setting aside questions about the presumed directions of flow and characterization of the aquifer, we find that the POC and monitoring well network is inadequate to protect existing aquifer uses or detect pollutants emanating from the facility.

**The POC locations listed in Table 2.7, p.7 of the Draft Permit are incorrect.**

Based upon Pima County’s plotting of locations shown in the Draft APP, these well locations do not align at the downgradient edge of the PMA. We assume the correct locations are from a Tetra Tech 10/11/11 Figure 1 Titled “Proposed PMA and POC Locations”. Therefore, the following evaluation will be based upon Figure 1 provided by Tetra Tech 2011 and reproduced below for convenience of referral.

Tetratech Figure 1 dated October 11, 2011 Proposed PMA and POC Locations
Request:
- ADEQ should revise the lat/lon locations specified for POCs in the draft APP, and publish a new Public Notice.

**Spacing of the monitoring well network is inadequate for site conditions.**

- **Spacing of Wells** – *The Tailings and Disposal Mound* are aligned in a north-south direction, stretching approximately 17,000 feet. The need for closer spacing of POCs is apparent. The groundwater system in the Rosemont area is a combination of confined and unconfined conditions with various fractures and fissures, and does not behave like a typical basin and range alluvial aquifer. Vertical gradients have been documented and water levels in nested wells vary depending upon screened intervals.

- **Groundwater Flow** – Flow appears perpendicular to the alignment of the *Tailings and Waste Rock Disposal Mound* (Tetra Tech 2011, Figure 1, 10/11). However, recent updated groundwater elevation contours including springs and seeps and other wells, completed by Pima County and Arizona State Parks (ASP and Pima County 2011, Figure 2, attached) indicate water levels and movement are more complex than the simple easterly trend portrayed by the Tetra Tech Map (Figure 1, 10/11). There appears to be a groundwater divide with components to the northeast and southeast from the eastern edge of the PMA. Groundwater contours presented in this updated map indicate significant variability in groundwater movement through the greater than four square mile mining disposal area, and downgradient of the mining area.

- **Distance Between POC #6 and POC #2** is 14,000 ft of PMA. Coverage by two POC groundwater wells is inadequate for monitoring groundwater conditions and flow across a distance of 2.65 miles.

1. The unmonitored distance between proposed POC #5 and POC #6 is **1 mile**.
2. The unmonitored distance between proposed POC #2 and POC #4 is **1.3 miles**.
3. Unmonitored distances of 1 mile or greater along the side of a *Tailings and Waste Rock Disposal Mound* are unacceptable for assessment of contaminated groundwater leaving a massive industrial waste disposal area.

- **APP Proposed POC Well #2** – Due to the questionable location of the PMA at the Barrel – McCleary confluence area, the location of POC #2 is forced to be located on a bedrock hill slope over 100 ft above the Barrel Canyon channel. This location is acceptable if another verification monitor well is situated near the confluence of Barrel McCleary to tap shallow alluvium.
Other Detailed Comments Regarding POC Network

The current APP draft permit lists seven (7) Points of Compliance (POC) for the groundwater monitoring program. One of the POC has one existing well that was utilized or constructed for preliminary groundwater analyses in the area. The well is nested with another in order to evaluate waters in the intermediate and deep aquifer zones. The other proposed POC’s have little detail regarding well construction other than requiring 10 feet of screen above an unconfined water level and 50-foot screen below the water level. For confined conditions 60-foot screen within the uppermost aquifer is required (p.21 draft permit P-106100).

Based upon the proposed facility design, groundwater data and well information, the following detailed deficiencies are noted that should be corrected as part of a final APP. Please refer to Figure 2, attached for locations of our proposed adjusted POC monitoring wells, and the seven Tetra Tech POCS. The mining plan of operations layout is shown in gray, and the Pollutant Management Area associated with Tetra Tech 2011 is shown in red. (Note that the PMA is inconsistent with the layout of the facilities proposed by Rosemont to the U. S. Forest Service. However, we think it unlikely that the either the Tetra Tech 2011 layout or the MPO layout would be chosen by the Forest Service. Better coordination between the Forest Service NEPA process and this APP is needed).

Requests

✓ State the monitoring objectives for each POC well in Table 2.4 or in the body of the permit, Section 2.5.

✓ In subsection 2.5.3.4, item #1, it is not clear why only eight samples rounds are used in the calculation. It would seem that more sample data would provide better statistical treatment. If the purpose of this provision is to limit the timeframe for ambient data collection, it should be stated as a timeframe.

✓ New POC well installation, as described in the table of section 3.0, should include either a tracer test or pump test to verify that the wells installed have significant connection with the bedrock fracture-flow system.

✓ In section 3.0, change the well screen description to read, “The well shall be appropriately screened at least 10 feet above that water table and no more than 50 feet below the water table for an unconfined aquifer, or no more than 50 feet in length at the top of a confined aquifer.”

✓ The compliance schedule should have a requirement for submittal of a well completion report to ADEQ along with an application for permit amendment to include the each new well.

✓ As shown on the Figure 2 above, add two new POC wells to the Point of Compliance monitoring well network in the locations indicated on the eastern
side of the Tailings and Waste Rock Disposal Mound. This includes one additional well between POC #2 and POC #4, and one additional well between POC #5 and POC #6, and the nested verification monitoring wells upgradient of POC #3.

✓ POC #1 will monitor subsurface movement into Scholefield Canyon, a tributary of Davidson Canyon. A shallow well is needed here to monitor shallow recent alluvium. This POC well would be used to monitor groundwater seepage through the Dry Stack Tailings and possibly the Waste Management Area. There are currently two wells in this area: an intermediate well (HC-4A; perforations from 100-640 feet) and a deep well (HC-4B; perforation from 680-1000 feet). Water levels in these two wells were approximately 75 feet and 296 feet, respectively, in November 2008 and showed an upward gradient.

Figure 2 caption, next page: Applicant’s Proposed Points of Compliance in green triangles, Pima County’s proposed new POCs in red and verification monitoring well in yellow, shown relative to the PMA as defined by Tetra Tech (red line). Pima County proposes an additional verification well, not shown on this map, but described in text. The gray outline shows the Mine Plan of Operations (MPO) submitted to the U. S. Forest Service, which differs slightly from applicant’s identification of proposed facilities. Note for instance that the tailings and the plant site are shown to extend beyond the PMA. All other alternatives under consideration would deviate even more than the MPO from the PMA. The stream network and Casavant groundwater contours are also shown for reference.
Mike’s Figure 2 here
HC4A and 4B wells should either be added to POC #1 as verification monitoring wells for use in contingency planning, or provisions should be made in the contingency plan for drilling new intermediate and deep wells should contamination be detected. The perforation intervals should be reduced by drilling new wells or using spinner logs (electro-magnetic at low flows), video logs, or a combination of down hole methods to assess where flow comes into the wells, and then reducing the interval to 60 feet with packers or bentonite to comply with the 60-foot screen interval discussed in the draft permit.

Design the location and construction of POC2 to detect deep aquifer discharges to Scholefield Canyon. Currently the proposed POC #2 is located too far uphill and will not be screened in recent alluvium along Barrel Canyon. Recent alluvium is more likely to reflect pollutants emanating from the tailings.

Add new verification monitor well site to the permit as shown in Figure 2. We propose that they be similar in construction to existing downgradient wells RP-2A, RP-2B and RP-2C. The proposed nested wells are located closer to the proposed tailings facility than POC3 and should be used as verification monitor wells in the contingency plan for POC3. The contingency plan should identify specific ALs that would indicate a failure of the BADCT system for the lined facilities has occurred.

POC 3 contingency planning needs to use the proposed nested wells as verification monitoring sites.

POC 3 needs to be moved within the PMA to wells RP-2A, 2B and 2C. These existing wells are immediately downgradient of proposed POC#3. RP-2A is currently in recent alluvium and screened 10-30 feet, 30 feet deep with a depth to water of 20-29 feet in 2008-2009. The other wells are intermediate (RP-2B screened 80-200 feet; water level 27-33 feet in 2008-2009) and deep (RP-2C screened 240-500 feet; water level 29-35 feet in 2008-2009), showing upward gradients. These wells should be replaced with appropriate shorter 60-foot screened intervals where water is flowing, or using spinner logs (electro magnetic at low flows), video logs, or a combination of down hole methods to assess where flow comes into the existing wells, and then reducing the interval to 60 feet with packers or bentonite to comply with the 60-foot screen interval discussed in the draft permit. Alternatively, a low flow sampling technique could be used at a discrete position within the screened interval.

A new POC well is needed near the midpoint between POC 2 and POC 4, in the NE1/4 of the SE1/4 of Section 28, Township 18 South, Range 16 East. The new POC should have at least one well covering the shallow to deep aquifer.
zones. Three nested wells similar to wells RP-2A, RP-2B and RP-2C would be superior to one monitoring well, as the shallow well could identify seepage through the dry stack tailings and the deep well could capture possible flow from the open pit.

**POC 4 will need a well to cover the shallow zone** (perforation intervals from near surface to 100 feet). This will cover the recent alluvium and Basin Fill. This well location is close to an unnamed intermittent wash. If the well is dry in recent and basin fill material it should be used to detect recharge from the future dry stack tailings since it is probably not connected to the other deeper formations unless there are fractures or fissures nearby. The current wells near POC-4 site (RP-3A and 3B) are labeled as a shallow and deeper characterization wells. RP-3A has perforated intervals from 100 to 440 feet- Salero Tuff), suggesting that it is more of an intermediate characterization well. The deepest well (RP-3B) at this location has perforated intervals from 460 to 600 feet (Salero, undivided), which is more of a deep characterization well (measured water levels were ~ 75 feet and 176 feet, respectively, in November 2008 from these wells). These wells reflect an upward vertical gradient showing confined aquifer behavior.

**RP-3A and 3B should be added as a POC-4 nest of wells to monitor vertical movement of potential contaminants or be replaced with narrower screen intervals.** The perforation intervals should be reduced by drilling new wells or using spinner logs (electro-magnetic at low flows), video logs, or a combination of down hole methods to assess where flow comes into the wells, and then reducing the interval to 60 feet with packers or bentonite to comply with the 60 foot screen interval discussed in the draft permit.

**POC 5 (RP-4A) needs an additional well to cover the shallow zones.** RP-4A is labeled a shallow well and has perforations from 160 to 540 feet (Basin Fill), which is more of an intermediate and potentially confined aquifer well. A shallow well is needed from 0-230 feet to establish if there is a vertical gradient in the area or this is an unconfined condition. Water level was 181 feet in November 2008 for RP-4A. Perforations are too extensive for RP-4A to establish if conditions are confined or unconfined. RP-4B labeled as an intermediate well has perforations from 580-1,000 feet (Apache Canyon), which covers the deeper confined aquifer. Water level in RP-4B was approximately 195 feet in November 2008, showing confined upward gradient conditions. Wells RP-4A and 4B should be added as a POC-5 nest of wells to monitor potential unconfined conditions and deeper vertical movement of potential contaminants. The perforation intervals should be reduced by drilling new wells or using spinner logs to assess where flow comes into the wells and then reducing the interval to 60 feet with packers or bentonite to comply with the 60-foot screen interval discussed in the draft permit.
POC 6 does not have any existing wells at this time. Three nested wells should be constructed at this site to cover the full range of aquifer levels (shallow, intermediate and deep). Groundwater flows past this point into the Oak Tree Canyon watershed and Upper Cienega groundwater sub-basin.

A POC needs to be added near the midpoint between POC 5 and POC 6 (NE ¼ of Section 5, T19S, R16E) to capture groundwater moving east towards the headwaters of the east fork of Davidson Canyon. Based on the available groundwater contours, the flow direction past this mid-point area is not captured by either POC 5 or POC 6. There are currently no existing wells in this location. Three nested wells should be constructed at this site to cover the full range of aquifer levels (shallow, intermediate and deep).

The POC 7 well to the southwest of POC 6 to evaluate groundwater quality into the sub-basin to the south of Oak Tree Canyon is acknowledged. The wash along E. Singing Valley Road has at least 20 water wells within the two-mile perimeter line, some of which are likely used for potable supply. The lack of hydrologic characterization wells (or sampling wells of any type on the southeast side of the disturbance area) shows a lack of thoroughness by Rosemont in both the groundwater characterization study and the plans for meaningful long-term monitoring. These canyons supply water into the Upper Cienega Creek watershed and private domestic wells. Currently one intermediate/deep well (perforations from 200-600 feet) is in the proposed disturbance area in the SW ¼ of Section 6, T19S, R16E (HC-2A and 2B); Water level was 194 feet in November 2008.

Three nested wells should be constructed at the POC-7 site to cover the full range of aquifer levels (shallow, intermediate and deep).

At least one additional verification monitor well should be established in the both Trail Canyon Wash and on the upstream side of the residences along E. Singing Valley Road for contingency purposes.

Provide another APP Draft with adjusted comment period containing correct POC locations and monitoring objectives for public review, so that an adequate assessment of the monitoring program can be made.

ADEQ should have an opportunity to require modifications of the APP if at any time the impacts exceed those identified in the Forest Service’s record of decision.
MAINTENANCE OF SURFACE WATER QUALITY STANDARDS

The Draft APP Fails to Identify and Fails to Protect Existing Surface Water Uses and Standards

Surface water monitoring in section 2.5.4 of the permit states “Not applicable for this permit.” ADEQ should require monitoring of springs downgradient of the facility to verify that such flows continue to meet surface water quality standards.

The applicant has failed to identify existing surface water bodies and their uses in relation to the proposed APP. A variety of uses have been identified at springs or intermittent flow reaches by either Pima County or Westland Resources at the following locations listed below, most of which are located on the attached Westland map:

- Box Canyon and Box Canyon tributary located southeast of the APP facility, important site for Chiricahua leopard frog and other species, as well as recreation on Forest land;
- Sycamore Canyon north of the facility on Forest land, important for wildlife and recreation;
- Fig Tree Spring, used for recreation and wildlife, located one mile north of the facility, on Forest land;
- Papago Canyon north of the facility on Forest land, important for recreation and wildlife;
- Mulberry Canyon northwest of the facility, on Forest land, important for wildlife and recreation;
- Scholefield Spring and unnamed spring upstream of Scholefield, on Forest land, north of the facility, important for recreation and wildlife;
- Barrel Spring and intermittent reach on Barrel Canyon located downstream and east of the facility on Rosemont’s land; important for recreation and wildlife;
- East Dam, a livestock and wildlife watering site located less than one mile east of the facility, on Forest land, an important site for the Chiricahua leopard frog;
- Questa Spring, a livestock and wildlife watering site on private land, about three miles east of the facility;
- Big Pond, a livestock and wildlife watering site on State Trust land east of the facility;
- East Fork Davidson Canyon, an intermittent and ephemeral stream important for recreation and wildlife, located east of the facility on Forest, state trust and Rosemont land;
- Adobe Tank, a livestock and wildlife watering site, located less than two miles east of the facility on State Trust land in the upper;
- Highway Tank and Oak Creek Canyon Tank, livestock and wildlife watering site located one to two miles east-southeast of the facility, on Forest land and habitat for the Chiricahua leopard frog.

Figure X. Intermittent stream reaches shown as blue lines, located in relation to sections, townships, hillshade terrain, and Highway 83. Springs are shown as blue dots. Map and stream reach data by Pima County IT.
Figure from WestLand Resources updated 2008 survey of the Rosemont holdings, published in 2009. Blue dots are lentic (ponded water) systems, and blue lines show lotic (running water) systems surveyed in 2008.
- 4066 Tank, a livestock and wildlife watering site on Forest land southeast of the facility;
- Deering Spring, located less than one mile southwest of the facility on Forest land, and used for recreation, livestock and wildlife;
- Locust Spring and Unnamed Spring located one mile southwest of the facility and used for recreation and wildlife;
- McCleary MC2 spring, McCleary stock tank, and Upper McCleary Canyon, located one mile or less northwest and upstream of the facility, used for recreation, wildlife and stock purposes

Ambient surface water quality data is lacking for intermittent streams and springs throughout the area of likely impact. In mineralized areas, it is critical to collect such baseline data so that impacts during operation and post-closure may be distinguished from pre-mining ambient conditions.

Farther downstream, ephemeral flows of Davidson Canyon are diverted into a stock tank in the Bar V Ranch by Pima County. This surface water diversion serves a livestock and wildlife watering function. The Bar V Ranch was acquired as part of Pima County’s open space program in 2005.

Cienega Creek base flows are diverted from the stream in Township 16 South, Range 16 East, Section 14 by Vail Water Company. This diversion is made via a grated pipeline that requires periodic sediment removal. This water is currently used for landscape irrigation.

Requests:

- Include in the APP provisions for monitoring narrative and quantitative surface water quality standards for wildlife (warm-water or cold-water as appropriate for the elevation or temperature) at the identified locations above.

- Certain surface water quality standards should be met at all times for POC wells to assure that surface water quality standards for wildlife are met downstream. The surface water quality standards that should be added to the APP as AQLs based on the narrative aquifer water quality standard in R18-11-405(B) should include selenium, copper, arsenic and mercury (Aquatic and Wildlife Warm Water)

**The Draft APP Fails to Address New Surface Water Bodies**

This permit assumes that new surface water bodies will be produced by the project, but no monitoring is provided to assure these water bodies do not exceed narrative and quantitative surface water standards. The *AMEC 2009 Dry Stack Report* within Sections 5 (Surface Water Management) and 8 (Facility Closure Concept) states that there will be “low spots or evaporation ponds located on the tailings surface” and that “The surface will be graded so
that runoff from the PMP is directed towards low point(s) and, if required, an overflow rundown off the TSF will be included.” Two decant structures have been designed to drain overflow waters from detention basins located on top (northwest and northeast corners) of the Tailings Disposal Facility. These new water bodies will be in contact with tailings and therefore are surface water impoundments that must be regulated through this APP.

In addition, we would predict that the waste and tailings will inadvertently create unplanned surface water bodies around the perimeter of the site where natural flows are blocked or where drainage collects. Yet the APP does not provide any contingency plan for monitoring these sites.

Requests:

✓ Include in the APP provisions for monitoring narrative and quantitative surface water quality standards for Aquatic and Wildlife (warm-water) at the locations of planned surface water bodies, to include arsenic, selenium, copper and mercury.

✓ Include annual monitoring to detect and report the location of new surface water bodies, whether intermittent or perennial.

✓ Include contingency monitoring such as detection of new surface water bodies will result in monitoring for maintenance of narrative and quantitative surface water quality standards for wildlife (warm-water as appropriate for the elevation).

The Draft APP Does Not Protect Existing Aquifer Water Uses and Standards, Nor Does It Meet State Statutes

Geochemical modeling of waste rock and tailings only examined metals and nitrogen compounds for which there are numeric Aquifer Water Quality Standards. ADEQ should include consideration of narrative as well as numeric standards:

i. R18-11-405(A). A discharge shall not cause a pollutant to be present in an aquifer classified for drinking water protected use in a concentration which endangers human health.

ii. R18-11-405(B). A discharge shall not cause or contribute to a violation of a water quality standard established for a navigable water of the state.

iii. R18-11-405(C). A discharge shall not cause a pollutant to be present in an aquifer which impairs existing or reasonably foreseeable future uses of water in an aquifer.

No assessment was conducted for chemical species for which narrative standards might apply under R18-11-405(A), such as uranium, or under R18-11-405(C), such as sulfate or TDS.

There are discrepancies between numeric AWQSs and EPA’s primary drinking water standards because of Arizona’s delay in adopting EPA’s new standards into state water quality regulations. Arizona currently has no numeric standard for uranium while the EPA MCL is 30ug/l. Arizona’s numeric AWQS for arsenic is still set at 0.05mg/l while the EPA
MCL is 0.01 mg/l. These discrepancies mean that standards set in the APP will not protect groundwater quality for drinking water use for these constituents.

Narrative standards should be imposed for some constituents due to the potential receptors, including wildlife that depend on springs and humans who use wells in the area, particularly near Singing Valley which is the nearest habitation to the proposed mine. Narrative standards need to be set for downgradient POCs where uranium, excessive sulfates and TDS could cause economic harm to the well user and potential laxative effects from sulfate.

In the APP application, Rosemont Copper compared the expected seepage water quality from waste rock, heap leach, and tailings, respectively with numeric AWQSs and concluded that groundwater quality will comply. However, the values for selenium and perhaps some of the other metals will be a problem since there is a reasonable probability that discharge to the aquifer will connect with surface water via spring flow downgradient of the facility. Because this is possible, ADEQ should apply the narrative standard of R18-11-405(B), and the surface water quality standards—which are more stringent for some of these metals—should be applied at the point of compliance wells in the Aquifer Protection Permit.

At least two flowing springs, MC-1 Spring and Rosemont Spring, are directly affected by the mining operations: MC-1 is located near the planned structures (Section 30, T18S, R16E) and Rosemont Spring is under the proposed dry stack tailings (Section 32, T18S, R16E). Although flowing springs will be monitored prior to mine construction, there is no plan to monitor during operations.

The pit lake that would be created by this permit would have a volume of 96,000 acre-feet, making it one of the largest water bodies in southern Arizona. The pit lake would be accessible to wildlife, and would reflect primarily the characteristics of the aquifer at the mine site but would be influenced by inflows from the pit walls and drain-back from other parts of the mining facilities under plans discussed in the APP. The APP provides no monitoring for the pit lake. The pit water needs post-mining water quality monitoring to assess potential toxicity to wildlife.

Requests:

✓ Provide narrative water quality standards in APP for TDS, sulfate, in POC wells. The narrative standard should be set at 500 mg/l for TDS and 250 mg/l for sulfate.

✓ Flow rates, site conditions and water quality for all of the springs located within the facility should be reported via the APP during mining operations until such time as they cease to be accessible.

✓ Assure pit lake water meets all aquifer water quality standards, as well as water quality standards for Aquatic and Wildlife (warm water or cold water as temperature dictates) for arsenic, selenium, copper and mercury.
ADEQ should apply the narrative standard of R18-11-405(B), and the surface water quality standards, which are more stringent for some of the metals, should be applied at the point of compliance in the Aquifer Protection Permit.
LACK OF REQUIRED CONTINGENCY PLAN FOR PUBLIC COMMENT

ADEQ Must Provide a Contingency Plan for Public Comment

Section 2.6.1 of the APP allows the Contingency Plan to be submitted in accordance with a compliance schedule. ADEQ should require that the Contingency Plan be completed before public notice and comment on the draft APP, as required by A.R.S. §49-243(K)(3). The statutory provision for areawide permitting under A.R.S. §49-243(P) only allows deferral of contingency plan requirements for existing facilities, as described in subsection (4). Rosemont is not an existing facility. The effectiveness of this APP in protecting groundwater quality and human health is heavily dependent on the Contingency Plan provisions. Without this information, the public is not able to evaluate what Rosemont Copper’s actions may be if there is a spill or exceedance of permit requirements.

Request:

✓ Provide a revised APP and new public comment period to rectify this omission.
DEGRADATION OF OUTSTANDING WATERS

The **APP must not Degrade Outstanding Waters.**

The tailings and waste rock facilities have reasonable potential to exceed the numeric standard for suspended sediment concentration found in A.A.C. R18-11-109(D) or the narrative standards found at A.A.C. R18-11-108, which stipulates the following:

A. A surface water shall not contain pollutants in amounts or combinations that:
   1. Settle to form bottom deposits that inhibit or prohibit the habitation, growth, or propagation of aquatic life;
   2. Cause objectionable odor in the area in which the surface water is located;
   3. Cause off-taste or odor in drinking water;
   4. Cause off-flavor in aquatic organisms;
   5. Are toxic to humans, animals, plants, or other organisms;
   6. Cause the growth of algae or aquatic plants that inhibit or prohibit the habitation, growth, or propagation of other aquatic life or that impair recreational uses;
   7. Cause or contribute to a violation of an aquifer water quality standard prescribed in R18-11-405 or R18-11-406; or
   8. Change the color of the surface water from natural background levels of color.

B. A surface water shall not contain oil, grease, or any other pollutant that floats as debris, foam, or scum; or that causes a film or iridescent appearance on the surface of the water; or that causes a deposit on a shoreline, bank, or aquatic vegetation. The discharge of lubricating oil or gasoline associated with the normal operation of a recreational watercraft is not a violation of this narrative standard.

C. A surface water shall not contain a discharge of suspended solids in quantities or concentrations that interfere with the treatment processes at the nearest downstream potable water treatment plant or substantially increase the cost of handling solids produced at the nearest downstream potable water treatment plant.

D. A surface water shall not contain solid waste such as refuse, rubbish, demolition or construction debris, trash, garbage, motor vehicles, appliances, or tires.

E. A wadeable, perennial stream shall support and maintain a community of organisms having a taxa richness, species composition, tolerance, and functional organization comparable to that of a stream with reference conditions in Arizona.

Davidson Canyon contains reaches that are classified as Outstanding Waters of the State of Arizona. The designation as an Outstanding Water of the State of Arizona is relevant
because under 33 CFR 320.4 (b) 5 “...state regulatory laws or programs for classification and protection of wetlands will be considered.” According to the State of Arizona, Tier 3 waters (AZ classification for Davidson Canyon) must be maintained and protected, with no degradation in water quality allowed. These areas downstream of the compliance point are also important under 33 CFR 320.4 b 2 viii, because they are “...unique in nature or scarce in quantity in the region or local area” and have been recognized by Pima County as Important Riparian Areas (IRA) in the County’s comprehensive land use plan.

Over the period of the mine’s development, the 8.2 square mile watershed upstream of the compliance point, in the headwaters of Davidson Canyon, will be modified to retain most of the runoff. Since the entire Davidson Canyon Watershed is only 50.5 square miles, the modifications in the upper portions of the watershed are likely to have significant impact on the Outstanding Waters, especially the frequency of runoff (most likely small storms will be retained and not discharged to downstream).

Furthermore, the 404 application used the PSIAC method (Pacific Inter Agency Committee - PSIAC, 1968) to assess sediment delivery. First, this method is not appropriate. The issues are summarized below. Please see Appendix E of this document for details. The PSIAC method is not capable of analyzing sediment transport. Proposed and alternative plans will change the stream sediment delivery system. Most likely aggradation (deposition) and degradation (scour) patterns in streams will be changed. Sediment transport analysis is necessary to assess the impact of the proposed mining activities on sediment transport. As cited in the DEIS, changes in sediment delivery to portions of Barrel and Davidson canyons downstream of the US Geological Survey gaging station have the potential to cause aggradation or scour, thereby affecting riparian areas in the reaches designated as Outstanding Arizona Waters. The potential impacts to Outstanding Waters are clearly cited in the Draft Environmental Statement (DEIS), Page 338, Line 1-3. As mentioned above, Davidson Canyon contains reaches that are classified as Outstanding Waters of the State of Arizona. Therefore, the analysis of sediment transportation for Davidson Canyon is required, throughout the Outstanding Waters reaches.

Request:

- Evaluate potential impacts on “Outstanding Waters” using the attached scope of work (Appendix D) to qualitatively and quantitatively analyze the impacts of proposed mining activities on volume, frequency, and magnitude of runoff to Davidson Canyon. Pima County requests the applicant to complete the analysis before the application is resubmitted.

- Evaluate the potential effects of sulfate emanating from the tailings to affect wetlands, including the potential to increase tamarisk abundance in affected areas. Complete the analysis before the application is re-submitted.
INSPECTIONS, OPERATIONAL MONITORING, and RECORDKEEPING

The Heap Leach Facilities Piping System Design and Monitoring is Deficient

An undefined piping system will pump pregnant leach solution at 2,500 gpm from the heap leach pad area some 8,000 linear feet over rolling hill topography to the SX-EW plant at the Plant Site for copper extraction. In turn, a sulfuric acid solution will be pumped a similar distance from the Raffinate Pond to the top of the Heap Leach Pad via an undefined piping system. Leakage from either of these piping systems would be detrimental to the natural environment.

Documents provided by Rosemont Copper in support of the APP application do not provide details regarding these Heap Leach Facility piping systems. There are no proposed alignments, material specifications, or plan/profile drawings.

Within Table 4.2.1 of the draft APP, Required Inspections and Operational Monitoring, under Heap Leach Pad (p 31), under Quarterly inspection and operational monitoring, the following is stated:

- “Additionally, all conveyance ditches that convey solutions from or to the Heap Leach Pad must be inspected to evaluate the integrity of the structure over time.”

Request:

- ADEQ is requested to clarify the meaning of “conveyance ditches that convey solutions from or to the Heap Leach Pad”.
- For the APP application, Rosemont Copper should provide details regarding the two Heap Leach Facility piping systems between the Heap Leach Pad and the Plant Site, including proposed alignments, plan/profile drawings, the piping containment system, and material specifications.
- These piping systems should be inspected at least weekly along their alignments to monitor proper function and leakage at the various pipe connections. Should leakage be observed, ADEQ should be immediately notified. If the leakage is documented as significant, as defined by ADEQ, an investigation of surface and subsurface contamination should occur.

Self Monitoring and Log Book Recordkeeping is Inadequate

Reporting and Recordkeeping Requirements are presented in Section 2.7 of the draft APP. Within Section 2.7.2, Operation Inspection / Log Book Recordkeeping, the following information is provided:
• “A log book (paper copies, forms, or electronic data) of the inspections and measurements required by this permit shall be maintained at the location where day-to-day decisions are made regarding the operation of the facility”

• “The log book shall be retained for ten years from the date of each inspection, and upon request, the permit and the log book shall be made immediately available for review by ADEQ personnel.”

A ten year retention period for inspection and monitoring results is not adequate to track long-term environmental compliance for the mining complex. Important records which may impact future investigations or decisions will be destroyed each and every year starting with Mining Year 11.

Request:

For a massive mining industrial facility with an operational life of more than 20 years, a 5-year reclamation period, and long-term / permanent impacts to the public, the Log Book Records should be maintained for the entire life of the APP permit, including the post-closure monitoring and maintenance period. A.R.S. §49-243.K(8) provides a legal authority for ADEQ to do this: “Such other terms and conditions as the director deems necessary to ensure compliance with this article.”

✓ Annually obtain a copy of the Log Book Records from the applicant.

✓ Provide Pima County and the U. S. Forest Service with copies of the Log Book Records annually.
COMPLIANCE SCHEDULE

Compliance Schedule is Deficient – Construction Quality Assurance Report for Flow-Through Drain System of the Tailings Disposal Facility is Needed

Within Section 3.0 of the draft APP (p 21), Compliance Schedule, there is no mention of a requirement for a Construction Quality Assurance (CQA) Report for the Tailings Disposal Facility Flow-Through Drain System within the Actions and Submittals Table. As commented on separately, Rosemont Copper should prepare a Construction Quality Assurance Plan for the 8.8 mile long flow-through drain system proposed for construction underneath the Waste Rock and Tailings Disposal Facilities. The Construction Quality Assurance Plan should clearly describe the construction techniques, geosynthetic material deployment, inspections and recordkeeping requirements, material testing, photographic records, and associated activities related to field construction of the 8.8 mile drainage system.

Request:

✓ Rosemont Copper must prepare and submit a final Construction Quality Assurance Report for the approximately 9-mile mine Flow-through Drain System. Include this requirement in the Actions and Submittals table within Section 3.0, Compliance Schedule, of the APP. The CQA Report must verify that the work undertaken was built in accordance with the Construction Quality Assurance Plan, and final technical documents, design drawings, and specifications.

✓ Require the submittal of this CQA Report within 90 days after completion of construction of the Flow-Through Drain System.
TEMPORARY CESSATION

**Pima County Requests Notice of Temporary Cessation**

Section 2.8 of the APP application, *Temporary Cessation*, provides requirements to Rosemont Copper should they cease operations of the facility for a period of 60 days or greater.

- “the permittee shall submit for ADEQ approval a plan for maintenance of discharge control systems and for monitoring during the period of temporary cessation.”

- “During the period of temporary cessation, the permittee shall provide written notice to the Water Quality Compliance Section and the Southern Regional Office of the operational status of the facility every three years.”

**Request**

- The proposed Rosemont Mine is a massive industrial complex near Tucson which affects a large area of southern Arizona. Both ADEQ and the public must be aware of Rosemont’s plans during any period of temporary cessation, regardless of how short or long the duration might be.

- ADEQ is requested to notify the Pima County Board of Supervisors of any temporary cessation of mining operations, and share with the Board of Supervisors the approved PLAN FOR MAINTENANCE OF DISCHARGE CONTROL SYSTEMS AND MONITORING.

- Written notice of the operational status of the permanent industrial facility should be provided to ADEQ *every 6 months*, and shared with the Pima County Board of Supervisors.

- The APP should specify a maximum time limit for “temporary cessation” and draw a distinction between “temporary cessation” and “closure” by defining a trigger for “notice of closure” and the “closure plan” requirement of Section 2.9.1.
CLOSURE PLAN and CLEAN CLOSURE

A Preliminary CLOSURE PLAN Should Be Prepared for Public Comment as Part of this APP.

Within APP Section 2.9, Closure, p. 20 the following information is provided:

- For a facility addressed under this permit, the permittee shall give written notice of closure to the Water Quality Compliance Section of the permittee’s intent to cease operation without resuming activity for which the facility was designed or operated.

- Within 90 days following notification of closure, the permittee shall submit for approval to the Groundwater Section, a Closure Plan which meets the requirements of ARS 49-252 and AAC R18-9-A209(B)(3).

- If the closure plan achieves clean closure immediately, ADEQ shall issue a letter of approval to the permittee. If the closure plan contains a schedule for bringing the facility to a clean closure configuration at a future date, ADEQ may incorporate any part of the schedule as an amendment to this permit.

Information included in the draft APP application regarding reclamation and closure for the proposed Rosemont Mine is woefully inadequate with respect to management of an industrial complex proposed to leave a permanent footprint on thousands of acres of public land.

There are nine discharging facilities proposed at the mine, including a 1,135 acre Tailings Disposal Facility, a 1,370 acre Waste Rock Disposal Facility, a 170 acre Heap Leach Pad, five industrial Ponds and Basins, and a Waste Management Facility. The single page in the draft APP devoted to closure and post-closure is a disservice both to the public and to ADEQ staff who must manage the regulation of this mining complex. ADEQ’s Mining BADCT guidance states in section 3.6.5 that closure and post-closure must be considered in the design submitted to ADEQ.

Neither the public nor ADEQ should have to search through bits and pieces of technical memorandums and reports, each of which might partially address some aspects of closure for one of the discharging facilities.

Requests:

- Rosemont Copper should prepare a PRELIMINARY CLOSURE PLAN (Closure Strategy?) which specifically addresses—in a single document—the goals, methodologies and designs proposed for achieving clean closure at each of the nine discharging facilities regulated by the APP.
✓ Provide within the PRELIMINARY CLOSURE PLAN a Concurrent Reclamation and Closure Plan, which specifically shows how Rosemont Copper might expect to achieve Partial Closure prior to Full Closure.

✓ Within the PRELIMINARY CLOSURE PLAN, provide specific Grading and Drainage Design Plans with supporting engineering calculations which clearly show the entire facility Stormwater Management System at closure, including full design of all perimeter drainage channels through site bedrock hills and all planned Perimeter Containment Areas where surface water will be trapped against the base slopes of the Tailings and Waste Rock Disposal Facilities.

✓ Within the PRELIMINARY CLOSURE PLAN, provide a Reclamation Revegetation Plan which clearly details all closure areas for the entire Tailings and Waste Rock Disposal Facilities which will be revegetated with a growth media substrate to achieve side slope erosion control and limit infiltration. Also clearly show all final grade areas which will not be completed with a growth media substrate, but only waste rock riprap on the upper surfaces and sideslopes (scree).

✓ Successful vegetation establishment on upper surface and side slopes of the closed Tailings and Waste Rock Disposal Facilities will require an initial application of growth media, and repeat applications as warranted due to slope erosion and rilling. Within the PRELIMINARY CLOSURE PLAN, provide a description, application methodologies, and supporting engineering details which demonstrate the placement of soil growth media on the waste rock side slopes of the Tailings and Waste Rock Disposal Mounds both during concurrent reclamation and at closure.

✓ ADEQ is requested to provide this document for public comment prior to issuance of an APP.

**Need for Soils Management Plans as Part of Closure Plan**

Within Chapter 3, Vol 1 of the DEIS, under the Mitigation Effectiveness section of Soils (p 157), the following reclamation “goals” are provided:

- “……, and a revegetation program on mine waste rock and mine tailings.”

- “……tailings stack, which would include a surrounding rock and soil buttress seeded for revegetation.”

- “In order to enhance revegetation efforts, specifications and goals for the salvage, storage, and reuse of growth media (topsoil) from disturbed areas would be developed, with the goal of providing sufficient cover on all disturbed areas to be reclaimed. Unless otherwise specified, Rosemont Copper would provide for a minimum of 1 foot of growth media cover over final waste rock slopes, waste rock surfaces, waste rock benches, completed tailings buttress, water diversion fill slopes, plant site fill slopes, construction laydown areas, facility plant site following final
removal of equipment, and temporary roads. The areas to be revegetated would be contoured, graded, prepared, and seeded.”

- “Storage of growth media would require placement of growth media stockpiles in locations that are protected from mining operations and associated activities, stable, isolated from surface water, gently sloping, and well drained. Stockpiles would be revegetated with native species no later than the first growth season following construction to minimize erosion.”

- “Sediment control structures would be installed or other best management practices implemented as needed to protect growth media from loss. Finally, growth media stockpiles would be used quickly during concurrent reclamation to minimize the length of storage time.”

Four soil salvage documents have been prepared by Tetra Tech for Rosemont Copper:

- Survey of Salvage Topsoil Resources for the Rosemont Mining Area – Revision 1 (November 2010);
- Survey of Salvage Topsoil Resources (June 2007);
- Storage Area Soil Salvage Estimates (June 2007);
- Operational Area Soil Salvage Estimates (June 2007).

Section 3.3 of the Survey of Salvage Topsoil Resources (2007) contains the following statements:

- “Soil salvage at the Rosemont site will be affected by the topsoil physical and chemical characteristics and by the physiographic position on the landscape and equipment available for salvage.”

- “The topsoil and subsoil horizons in the Project area exhibit the most alteration from the parent material and are the substrates most suitable for use as plant growth media.”

- “The primary chemical property limiting salvage is nutrient content. Nutrient content is variable throughout the survey area, but the pit site exhibited the highest nutrient levels and other qualities that make them suitable as plant growth media.

Insufficient Suitable Growth Media is Available for Successful Reclamation

As stated in the DEIS, almost all areas of the mining site, except for planned side slope scree locations, will be covered with a minimum 1 ft of soil growth media.
However, Rosemont may not even intend to use one foot of soil for this purpose. In the Tetra Tech July 2007 Reclamation and Closure Plan (Figures 17 and 18) the proposed application of soil growth media is constrained in a number of places with the term “as needed”.

A Soil Map Unit Delineation is provided in Figure 1 of the Survey of Salvage Topsoil Resources for the Rosemont Mining Area – Revision 1. The map clearly shows the overwhelming majority of topsoil reserves to be located in the southern half of the proposed mine disturbance area, in the vicinity of the planned Waste Rock Disposal Mound. Some lesser soil resources are located in the east half of the planned Open Pit area.

- As noted in Section 1 of the Storage Area Soil Salvage Estimates report: “The life cycle of the mine will result in the continuing growth in size of the waste rock and dry tailings storage areas. A close association of the salvage soil and facility expansion allows the reclamation operations to be managed without the use of intermediary soil salvage stockpiles.”

- However, a review of disturbed and covered areas over the first half of the mine’s operational life indicate the distribution / availability of suitable soil growth media for successive reclamation will be problematic at best.

Information provided on Figure 3 from both the 2007 Storage Area Soil Salvage Estimates and 2007 Operational Area Soil Salvage Estimates reports demonstrates that by Year five of operations, approximately 75% of the site’s surface topsoil resources will have been removed through excavation (open pit) or covering (heap leach pad, waste rock disposal mound, tailings disposal mound, surface roads, plant site).

- Over 90% of the site’s mapped surface topsoil resources considered to be at least 0.5 feet thick will have been removed through excavation or covering by Year 10 of operations, based upon a review of Figure 4 from both reports.

- In fact, based upon a review of the General Facility Layout at Year 10 of Operations (Figure 9 of the Reclamation and Closure Plan - Tetra Tech 2007), only about 40% of the entire Tailings and Waste Rock Disposal Mound is considered to be either reclaimed or under reclamation at this time.

- Not only are there limited topsoil resources available on-site in Year 10, but there are limited soil resource areas of any kind remaining on the entire mine site

- Rosemont Copper has not prepared topsoil / subsoil excavation and stockpiling plans to demonstrate the adequacy, or professional management, of project soils from the onset of mine operations through the end of the reclamation period.

Apparently, Rosemont Copper is planning on deep excavation of weathered bedrock materials from both within, and to the north and northwest of, the Plant Site in an area classified as having Opportunistic Salvage Only. Besides the generation of soils with
degraded topsoil suitability, the significant topographical alteration required for this excavation task will itself ultimately require formal surface reclamation activities.

- As noted on page 19 of the Training Guide for Reclamation Bond Estimation and Administration, For Mineral Plans of Operation authorized and administered under 36 CFR 228A, USDA-Forest Service, April 2004 (Reclamation Bond Training Guide), within Earthwork:

“The operator should be required to regularly submit an accounting of stockpiled materials such as subsoil, and topsoil so that the reclamation review calculations are based on factual data rather than conjecture. It is incumbent on FS personnel to ensure that the operator is stockpiling any such materials as the mine is developed and that the stockpile volumes are accurate. We do not want to have to ‘mine’ needed reclamation materials from another site in order to reclaim the mine.”

Requests:

- Prepare a Mining Soils Management Plan which clearly addresses the aerial extent and use of site soils throughout the mine’s operational life and through the completion of mine closure and reclamation activities. Define the ultimate disturbance area of mine closure operations which will require surface revegetation remediation.

- As part of a formal part of the Mining Soils Management Plan, provide a clear aerial and sequencing representation of on-site Soils Excavation, Stockpiling, and Use for progressive reclamation goals for mining Years 5, 10, 15, 20 and Complete Reclamation.

- Specify Soil Borrow Sources and Stockpiling for surface and side-slope maintenance for the Tailings and Waste Rock Disposal Facilities, including obtainment of soil growth media for revegetation.

- Given the soil conditions described above for Year 10 and beyond, describe how weathered bedrock (soils with close association with the parent material and with limited nutrient content) will be amended for suitability to successfully establish vegetation across the entire 3 square-mile upper surface of the Tailings and Waste Rock Disposal Mound.

- Revise the Reclamation Closure Cost Estimates provided in Section 13 of the 2009 APP Application to reflect the increased costs after Year 10 associated with complicated soils stockpiling and management, and the addition of appropriate soil amendments to non-topsoil materials to be used for remediation, including weathered bedrock. Also include the costs associated with final reclamation / remediation activities for all proposed soil / weathered-bedrock borrow areas.
**Clean Closure Criteria for Heap Leach Facility Ponds Is Inadequate to Detect or Prevent Leaks**

Per the Rosemont project Technical Memorandum “Prescriptive BADCT Closure for the Heap Leach Facility Ponds”, including the Pregnant Leach Solution Pond, the Raffinate Pond, and the Stormwater Pond (Tetra Tech, January 14, 2010), Rosemont proposes the following closure strategy:

- “The HDPE liner will be inspected for visual signs of liner damage, liner defects, or impact by leakage through the liner system.”
- “If there is no evidence of past leakage, the HDPE liner and GCL will be removed for appropriate disposal.”
- “Where inspection reveals presence of one (1) or more holes or tears or defective seams, the HDPE liner and GCL will be removed and the underlying surface inspected for visual signs of impact. ADEQ may require sampling and analysis of the underlying material to determine whether the potential impact poses a threat to groundwater quality. If required, soil remediation will be conducted to prevent groundwater impact."

The Pregnant Leach Solution Pond and the Raffinate Pond will manage fluids which contain a wide variety of acid and metal components. Residues which have settled on the top HDPE liner will be “collected and incorporated into the sulfide ore processing circuit.”

Visual inspections of primary and secondary HDPE liners to identify defects in either seam or non-seam areas is flawed. Simply walking around the top liner, which is wrinkled and has now been mechanically scraped clean of residue, does not allow for the inspection of defects with any degree of certainty. Visual inspections of even clean seams does not allow for adequate identification of leakage locations by field personnel.

Similarly, visual inspection of the bottom HDPE liner does not allow defect inspection with a high degree of certainty, due to discoloration by fluids within the leak detection system, residues, and the same inability to visually inspect liner seams by the human eye.

**Requests:**

Due to the inability to visually inspect HDPE liners and identify all potential leakage locations with any degree of certainty by the human eye, with additional hindrances of residue and discoloration, ADEQ should unconditionally require the following:

- Remove the HDPE liners and GCL for appropriate disposal.
✓ Perform systematic testing of subsurface soils / weathered bedrock to determine if the industrial ponds have impacted the subsurface environment.

✓ As part of the APP permit requirements, the public needs to know the subsurface sampling methodology and the suite of chemical parameters which will be tested. To this end, Rosemont Copper must prepare a *Heap Leach Facility Ponds Clean Closure Plan* which specifically details this information for approval by ADEQ.

✓ Provide this document for public comment prior to issuance of an APP.

✓ The APP should be valid only for the first phase through end of heap leaching. The impacts associated with the next phase (sulfide operation) should be contingent on the Applicant maintaining compliance with all local, state and federal rules. Such a phased approach would give ADEQ the opportunity to evaluate the closure plan for the heap and to assess whether clean closure has been achieved before Rosemont Copper buries that facility in tailing material.

**Clean Closure of Mine Plant Process Facilities Is Inadequate to Protect Aquifer and Surface Waters**

Mine Plant process facilities handle a variety of reagents, fuels and mixtures which, if released, would contaminate the surface and subsurface environment. Although considered non-discharging exempt facilities in relation to ADEQ APP permitting and BADCT design requirements, these facilities nonetheless must be designed with appropriate lining systems and safeguards to prevent these occurrences during the period of mine operations. For instance, concrete foundations are subject to settlement and cracking, with potential release of contamination to the surface and subsurface environment.

As shown within the APP Application, Younger Alluvial channel material is located in direct proximity downgradient of these facilities. Surface water collected within this porous alluvial material will be transmitted into the proposed North Flow-Through Drain System for transfer through the *Tailings Disposal Mound* and release as surface discharge at the east toe of the mound.

In addition, shallow groundwater levels occur within this area, often as shallow as 20 ft below ground surface, as demonstrated on:

- Table 3 – Estimated Depth to Water (*Rosemont APP-Regulated Depth to Groundwater*, Tetra Tech Technical Memorandum, August 23, 2010).

- Hydrogeologic Section A-A’ of the document *Results of Phase 2 Hydrogeologic and Monitoring Program* (February 2009).
With respect to releases to the environment from these facilities and associated process pipelines, Rosemont Copper must fully describe the environmental containment designs for, at a minimum, the following plant process facilities:

- **Oxide Plant Facilities - Solvent Extraction / Electrowinning Plant**
  Reagents, fuels and mixtures include Sulfuric Acid, Kerosene, Extractant, Cobalt Sulfate, Guar, etc. Includes the Raffinate Pond pumping system, which transports acidified solutions to the Heap Leach pad.

- **Sulfide Plant Facilities – Copper / Molybdenum Flotation and Filtration**
  Reagents, fuels and mixtures, and Tailings thickeners, include Allyl Alkyl Thionocarbamate, Sodium Isobutyl Xanthate, Dowfroth 250, Methyl Isobutyl Carbinol, Pebble Lime, Sodium Met-Silicate, No. 2 Diesel Fuel, Sodium Hydrosulfide, Flomin D-910, etc.

Per Table 13-3 in the APP Application under the Plant Site activity, “Concrete foundations and parking lot areas will be broken and buried in place with cover material, final surface graded to drain.” Also in the table under the Testing activity is this description: “Before burial the foundation concrete (Tank Farm, Truck-Shop, and SX/EW) will be tested for hazardous constituents.”

The ease of contaminant transfer from the plant site area to adversely impact both surface water and groundwater resources is troublesome.

**Request:**

- In order to assess surface/subsurface contamination as part of closure of the mine plant site, Rosemont Copper should prepare a *Plant Site Closure Surface and Subsurface Testing Plan* which describes the methodology for performing a systematic subsurface soil/bedrock sample collection and analytical testing program beneath the concrete foundations and tank lining systems of all plant site facilities which have used or contained hazardous materials or mixes.

- For buildings, this must be performed following the breakage of concrete pads and prior to any “burial in place with cover material.”

- In addition, the Plan should include a testing program which specifies the methodology for sampling and analytical testing of the broken concrete pad materials.
POST-CLOSURE ACTIVITIES and POST-CLOSURE PLAN

Some Post-Closure Activities Are Not Described for Key Facilities; Preliminary Post-Closure Planning Is Needed

Within APP Section 2.10, Post Closure, p. 20 the following information is provided:

- “Post-closure requirements shall be established based on a review of facility closure actions and will be subject to review and approval by the Groundwater Section.

- In the event clean closure cannot be achieved pursuant to A.R.S. 49-252, the permittee shall submit for approval to the Groundwater Section a Post-closure Plan that addresses post-closure maintenance and monitoring actions at the facility.”

Within APP Section 2.10.1, Post Closure Plan, p. 20 the following information is provided:

- “Reserved.”

Information included in the draft APP regarding post-closure for the proposed Rosemont Mine is woefully inadequate with respect to management of post-closure activities at the proposed, permanent industrial complex.

Of the nine discharging facilities at the mine, even assuming clean closure of the five industrial Ponds and Basins, there are four remaining facilities which will likely require post-closure maintenance and monitoring:

- 1,135 acre Tailings Disposal Facility;
- 1,370 acre Waste Rock Disposal Facility;
- 170 acre Heap Leach Pad;
- Waste Management Facility - landfill.

As described under a separate comment, Rosemont Copper has been requested to prepare a PRELIMINARY CLOSURE PLAN which specifically addresses, in a single document, the goals, methodologies and designs proposed for achieving clean closure at each of the nine discharging facilities regulated by the APP. Within the PRELIMINARY CLOSURE PLAN, Rosemont Copper is requested to provide the following:

- Concurrent Reclamation and Closure Plan, should Rosemont Copper be expecting Concurrent Closure;
- Grading and Drainage Design Plans with supporting engineering calculations which clearly details the entire facility Stormwater Management System;
- Reclamation Revegetation Plan.
Reclamation is a key pollutant management feature because the artificial “soil” and established vegetation will play important roles in modulating the flow of water and pollutants in the post-closure period.

Post-closure public access should be limited in order to reduce wind and water erosion and to allow for natural restoration of the area and achievement of standards that will be specified in the approved Mining Plan of Operation. Vehicle access should be limited to existing roads that are not being restored after mining activities. Cattle grazing should be excluded from reclamation areas, at least until the achievement of reclamation standards.

There will be a post-closure period at the mining facility regulated by the APP program. The draft APP already includes numerous citations of a post-closure period:

- Section 1.0, p. 1, 2nd paragraph: “This permit becomes effective on the date of ………….and shall be valid for the life of the facility (construction, operational, closure, and post-closure periods).”

- APP Section 2.9.2 – Closure Completion, p. 20: “If any of the following conditions apply, the permittee shall follow the terms of post-closure stated in this permit: 1. Clean closure cannot be achieved at the time of closure notification or within 1 (one) year thereafter under a diligent schedule of closure actions.”

- Rosemont concurs with ADEQ regarding a 30-year post-closure monitoring and maintenance period (Rosemont APP Closure Costs and Post-Closure Period, August 30, 2011).

- Section 7.4.1: “Routine methane gas monitoring shall be conducted quarterly during the operational lifetime and post-closure period of the non-municipal solid waste landfill.

The bottom line: It is evident that neither Rosemont Copper, nor ADEQ, are fully considering or preparing for post-closure operations and maintenance, and the associated costs, for the massive and permanent industrial complex.

Specific responsibilities for operations and maintenance of the mining industrial complex continue into the post-closure monitoring and maintenance period for the facility. There are a number of post-closure activities which have been clearly stated, but there are additional post-closure activities which must be addressed. However, these activities can’t adequately be addressed until the PRELIMINARY CLOSURE PLAN discussed above has been completed and reviewed by ADEQ as a formal part of the APP.
Requests:

✓ Prepare a PRELIMINARY POST-CLOSURE OPERATIONS AND MAINTENANCE PLAN for the proposed Rosemont Copper mine, detailing all monitoring and maintenance activities projected to occur within the post-closure period, including but not limited to:

- Surface and side slope Erosion Monitoring And Maintenance for the Tailings and Waste Rock Disposal Facilities due to rilling and incision damage to reclaimed slopes, including a description of equipment and operating personnel.

- Surface and side slope Stormwater System Monitoring And Maintenance for the Tailings and Waste Rock Disposal Facilities, including repair and cleanout of surface and perimeter channels, side slope stilling basins and downchutes, detention and retention basins and ponds, diversion berms, cleanout of the perimeter containment areas to prevent stormwater from infiltrating into the Tailings and Waste Rock Disposal Facilities and promoting additional discharges.

- Maintenance of the proposed flow-through drain system as designed, which should not be simply allowed to plug at the inlets as proposed by Rosemont Copper in their Contingency Plan. As discussed in detail in a separate comment, this will require perpetual maintenance to hopefully achieve functional operation by removal of sediment blocking the entrances of the flow-through drains.

- Surface and side slope Vegetation Monitoring And Maintenance for the Tailings and Waste Rock Disposal Facilities, during the 100-year period that will be required for successful revegetation.

- A Mining Post-Closure Soils Management Plan, which clearly details all post-closure soil borrow areas and methods to be utilized for repair of erosion, rilling and incision damage of the final cover slopes of the massive Tailings and Waste Rock Disposal Mound. With an estimated revegetation reclamation period of possibly 100 years or more, the determination of suitable and adequate soil borrow sources is a critical component of long-term facility maintenance.

- As part of the Mining Post-Closure Soils Management Plan, clearly identify what parties will perform the post-reclamation surface and slope work, the equipment to be used, and the techniques to be utilized to revegetate zones of the disposal mounds upper surface and side slopes.
Management and removal of invasive vegetative species should begin with testing of seed mixes and any nursery-provided container plantings to verify compliance with weed-free sourcing.

Surface water monitoring of key surface water sites in and around the facility, including the wildlife and stock watering features and the intermittent flow reaches of Barrel, Trail, Box, Mulberry, Papago, Sycamore and Davidson Canyons.

Groundwater monitoring at each Point of Compliance.

Repair and maintenance of surface water and groundwater compliance monitoring systems.

Landfill gas monitoring at the Waste Management Facility.
Appendices

A. Concerns about Stormwater and Hydrology Methods

B. Specific Concerns about Rosemont’s Hydrologic Inputs

C. Concerns about the Use of the PSIAC Method for Alternatives Analysis of Soil Erosion Impacts

D. Davidson Canyon Hydrologic, Hydraulic, and Geomorphic Scope of Work

E. Qualifications of Pima County Staff Reviewers
Appendix A - Concerns about Stormwater and Hydrology Methods

Comments: Storm water analysis was done by using methods not acceptable to Pima County. Analysis related to “Surface Water Management” was mostly done by Tetra Tech. Tetra Tech should use the methods described in the Technical Policies 010, 015 and 018. Tetra Tech cited that they use the Corps of Engineering HEC-HMS model to characterize peak discharges (Tetra Tech, 2011). Tetra Tech stated that their discharge calculation by comparison with the Regional Regression Equation 13 (Thomas et al, 1997), and performed a return-period analysis using the period of record on Barrel Canyon (Tetra Tech, 2011). However, peak record on Barrel Canyon is 1,900 cfs and the 100-yr prediction will be 5,000 cfs or greater. It is questionable if using such limited observed data (especially observed discharge is much smaller than estimated 100-yr discharge). In addition, Tetra Tech used an outdated regional skew coefficient (-0.2 vs current recommendation of 0.0). Furthermore, RFCD internal study indicated that peak discharge is substantially higher than the peak discharge estimated by Tetra Tech. The studies that the 404 application used to evaluate the impact of the proposed mining plans were done by Tetra Tech in 2010. Storm water analysis was done by using methods not acceptable to Pima County. Analysis related to “Surface Water Management” was mostly done by Tetra Tech. Tetra Tech should use the methods described in the Technical Policies 010, 015 and 018. Tetra Tech (Tetra Tech, 2011) cited that they use the Corps of Engineers HEC-HMS model to characterize peak discharges. However, in comparing a HEC-HMS model at the compliance point with the methods used by Tetra-Tech and those recommended by RFCD models yield dramatically different values at the compliance point, especially for the peak discharge rate:

<table>
<thead>
<tr>
<th>Watershed Area (sq mi)</th>
<th>Critical Storm</th>
<th>Precipitation (in)</th>
<th>Volume (ac-ft)</th>
<th>Peak Discharge (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFCD</td>
<td>7.92</td>
<td>3-hr</td>
<td>3.52</td>
<td>960</td>
</tr>
<tr>
<td>Tetra-Tech</td>
<td>8.2</td>
<td>24-hr</td>
<td>4.75</td>
<td>1003</td>
</tr>
</tbody>
</table>

RFCD follows the FEMA guidance to use the ‘critical storm’ that results in the highest discharge at a point of interest. Since 3-hr storms are typically more intense than 24-hr storms, they tend to be more intense with a shorter duration and result in a higher peak.

This comparison suggests that Tetra Tech’s discharges used for the 404 application are most likely underestimated. Tetra Tech should revise their discharge and runoff calculations. Specific issues of parameterizations for storm water analysis are summarized below.

- Precipitation
  Tetra Tech uses the point rainfall at 31.862N 110.692W, an elevation of 4,429 feet. However, Tetra Tech documents that the mean elevations in the watersheds are between 5,000 feet (Lower Barrel Canyon) and 5,470 feet (Wasp Canyon). In addition, the 404 application (p.12, L13) said that the lower end of the proposed mining site is 4,500 feet. The location Tetra Tech selected for the analysis appears downstream of the downstream end of the project site. Therefore, the rainfall at the selected point is not representative for the entire project site. The elevation is too low, and as a result, rainfall is too low. It is known that rainfall is generally.
higher at higher elevation (due to the orographic effect). Since there is a considerable orographic effect in the NOAA 14 Atlas, this will make a significant impact on discharge rates. When the higher rainfall is used, estimates of runoff volume should be greater than those used to assess the impacts of the proposed and alternative mining activities in the 404 application. Additionally, Pima County has chosen to use NOAA 14 Upper 90% rainfall (Tech Policy 10). Tetra-Tech has simply discounted the use of this value. In addition, the selected Area reduction Factor (0.9) is too low. Because the watershed area is only ~1.93 square feet, the ARF should be around 0.95 per Hydro-40. Tetra Tech should closely look at the Hydro-40, Figure 14. Since there is a considerable orographic effect in the NOAA 14 Atlas, this will make a significant impact on discharge rates.

- Rainfall Distribution
The rainfall distribution used by Tetra Tech has the greatest intensity in the first hour (31.9%), which has the net effect of reducing runoff peak by using the highest intensity portion of the rainfall to satisfy the initial rainfall losses. Arizona State Standard Guidelines on Hydrologic Modeling [ADWR SS 10-07, section 3.3.4] recommends a symmetrical distribution. Pima County requires the use of a USDA-SCS Type I (24-hr) or USDA-SCS Type II (3-hr) storm. Both of these have peak intensity at or near the middle of the hyetograph and do not have peak rainfall at the front of the hyetograph as Tetra Tech has used.

- Runoff Curve Number:
Our assessment (PC-Hydro and HEC-HMS parameterized by Tech 018) and others have noted that runoff estimates are most sensitive to the CN value. The USDA SSURGO soils map indicates that the fee land on the site is hydrologic soils group D. Pima County has used available data to calculate CN values in support of CN tables (Stewart and Canfield, 2009). This analysis showed that values used in PC-Hydro were found to be more accurate in Pima County than those listed in TR-55. Tetra Tech should use the PC-Hydro CN tables and vegetation map with the SSURGO soils map to estimate CN values. The PC Hydro vegetation map indicates cover of Mountain Brush, Desert Brush and Herbaceous. Assuming 40% cover (which is fairly high), the CN for existing conditions is between 86 and 89. Tetra Tech used a CN of 85. Therefore, the CN of 85 is too low for existing conditions.

- Time of Concentration/Lag Time:
Tetra Tech did not use the method recommended by Pima County (Tech 018) to estimate Time of Concentration/Lag Time. Tetra Tech also uses methods that are not in the current parameterization of the ‘NRCS Method’ as practiced by NRCS (USDA-NRCS; 1986). The methods Tetra Tech is using to develop the Time of Concentration are un-documented or have been superseded. Since we do not know the origin of some of the equations, we cannot evaluate its appropriateness. Tetra Tech would be best-served by practicing the ‘NRCS Method’ as it is currently recommended by NRCS (NRCS, 1986) unless they provide documentation that another method is appropriate.

- Rainfall Losses:
The CN of 85 is too low for existing conditions. Please see the comment for “Runoff Curve Number”.
• Rainfall Run-off Volume:
The CN of 85 is too low for existing conditions, and therefore the estimated Cw is too low. Please see the comment for “Runoff Curve Number”. It is unclear how the duration and rainfall depth of the General PMP and Local PMP were determined. Please explain. Tetra Tech used the thunderstorm distribution with the peak in the middle, while the Local PMP has the peak within 30 min of the distribution. It is not clear why the highest intensity of the 6-hour Local PMP occurs within the first 30 min.

• Peak Flows, Runoff Volume:
Results of peak discharge and volume should be recalculated by using the method recommended by Pima County (Tech 018) and appropriate methods to determine parameters (see all comments above).

Tetra Tech (Baseline Regulatory [100-Yr] Hydrology and Average-Annual Runoff, Rosemont Copper Project, Tetra Tech, 2010; Mine Plan of Operations Stormwater Assessment, Tetra Tech, 2010) developed a regression equation to estimate average annual runoff using watershed area, average precipitation and mean watershed elevation. According to those the first Technical Memo, estimated annual runoff volume is 1,407 ac-ft. It appears that Tetra Tech used elevation of ~4,625 ft to estimate this volume for a “Baseline” condition. This elevation is too low, because the downstream end of the watershed (USGS Gauge Station # 09484580) is 4,367 ft. The other issue is that it appears that Tetra Tech used the elevation of ~5,000 ft for “MPO Post Mining” (Mine Plan of Operations Stormwater Assessment, Tetra Tech, 2010). There are two issues about the analysis.

1. The elevation for the “Post Mining” should be lower.
2. Elevation for both the “Post Mining” and “Baseline” conditions should be higher than the selected values because the downstream end of the watershed (USGS Gauge Station # 09484580) is 4,367 ft.

In addition to the elevation issue, there is an issue about the selection of rainfall depth. Tetra Tech used 4.82 inches of precipitation to estimate peak discharge. It appears that this value is a mean, 24-hr precipitation at the elevation of 4,429 ft (NOAA Atlas 14). The elevation is too low since the watershed outlet elevation is 4,364 ft. Because of those issues, the annual average runoff estimates used for this 404 application are not reliable.

• Post-Mining Hydrology
Since Tetra Tech did not use parameterization methods approved by Pima County, the estimated pre-mining peak discharge and assessment are not reliable. The volume of the stormwater control basin should be determined using multi-day storms. Storms with the highest peak discharge do not necessarily produce the largest volume. This is because multi-day volumes can substantially exceed single-day return-period rainfall values. Because of the higher elevation and orographic effect in the project site, multiple day storms are common in mountain areas of southern Arizona.
It appears that Tetra Tech used the elevation of ~5,000 ft for “MPO Post Mining”. First, the elevation for “Post Mining” should be higher than the elevation for a “Baseline” condition. Secondly, the elevation for both the “Post Mining” and “Baseline” condition should be higher because the downstream end of the watershed (USGS Gauge Station # 09484580) is 4,367 ft. Additionally, Tetra Tech used 4.82 inches of precipitation to estimate peak discharge for a “Post Mining” condition. It appears that Tetra Tech used the mean, 24-hr precipitation at the elevation of 4,429 ft (NOAA Altas 14). The elevation is too low since the watershed outlet elevation is 4,364 ft. Tetra Tech should provide the information of the location and elevation of the point and explain why this low elevation point was selected. Because of those issues, the annual average runoff and peak discharge estimates in this Memo are not reliable.

Summary:
ADEQ and Tetra Tech should reassess hydrology for pre-mining, post-mining, proposed plan and alternative plans using the methods recommended by Pima County Regional Flood Control with appropriate parameters.

References


Appendix B--Specific Concerns about Rosemont’s Hydrologic Inputs

In addition to the inconsistency about the PMP storms, it should be noted that the method used in the Technical Memorandum is problematic (see more comments for “Surface Water Management”). Tetra Tech selected the NRCS method to determine runoff volumes to size storm management features. One of the problems is that Tetra Tech used 18 inches of average annual rainfall, while the NRCS reported that the average annual rainfall is 24 inches and the rain gage data from the nearby Santa Rita experiment station has mean annual rainfall of 23.41 inches. Because the mine is higher than the Santa Rita gage, and annual rainfall increases with elevation, annual rainfall at Rosemont Mine is expected to be at least greater than 23.41 inches. Tetra Tech justified using the lower rainfall depth (18 inches instead of the NRCS 24 inches) for runoff calculation with the following reasons:

1. Rainfall measurement at the proposed mine site from 2006 to 2008 (Tetra Tech 2009) showed that an annual rainfall depth is 17.12 inches. This closely matched the average annual rainfall recorded at the Nogales 6 N station.
2. NRCS 24 inches of rainfall will produce unrealistically higher runoff.
3. Estimated rainfall at the Rosemont site by Sellers for the period of 1931 to 1970 was approximately 16 inches.
4. Average annual precipitation for Helvetia (nearby the Rosemont site) from 1916 to 1950 was 19.72 inches.

Pima County Regional Flood Control’s (RFCD) comments for those justifications are

1. Rainfall record is less than 2 years from early-2006 to mid-2008 (Tetra Tech, 2009), which is too short to determine “representative rainfall”. Additionally, RFCD looked into the rainfall record for the Santa Rita Experimental Range during the same period. Rainfall at the Santa Rita Experimental Range from 2006 to 2008 (Gage #6, elevation 3986 ft) showed that both the average monthly and annual total precipitations at the Santa Rita were lower than the long-term average from 1970 to 2000 (~23 inches). This suggests that the Rosemont site received less rainfall than a long-term average during the two years from 2006 to 2008. In other word, the period the rainfall was observed at the Rosemont site was “drought”. Therefore, the 2-yr record of rainfall at the Rosemont site should not be used as representative rainfall.

Average Rainfall at the Santa Rita Experimental Range from 2006-2008

| Month | Rainfall (
<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>Jan</td>
<td>0.47</td>
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<tr>
<td>Feb</td>
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<tr>
<td>Nov</td>
<td>0.75</td>
</tr>
<tr>
<td>Dec</td>
<td>0.80</td>
</tr>
<tr>
<td>Annual Total</td>
<td>14.33</td>
</tr>
</tbody>
</table>
2. There was no explanation about “unrealistically higher runoff” other than the simple Tetra Tech’s statement. It is unclear how Tetra Tech can conclude that the estimated runoff is “unrealistic”. It is unclear if Tetra Tech has reasonable measured data to support their assessment. Tetra Tech should clearly show the reason why the 24 inches of rainfall leads to “unrealistically” higher runoff.

3. 1931-1970 rainfall data is too old to justify that 18 inches of rainfall is reasonable. It is known that precipitation pattern and trend change over time.

4. Same as above, 3.

In addition to the above, Tetra Tech cited that the use of 18 inches of rainfall can be justified because the same rainfall depth was used in a Technical Memorandum titled “Baseline Regulatory (100-Yr) Hydrology and Average-Annual Runoff, Rosemont Copper Project” (Tetra Tech, 2010). This indicates that most of the Tetra Tech’s Technical Memos were based on inappropriate calculations.

Tetra Tech also compared their runoff calculation with average runoff for the Tucson Active Management Area (AMA) to justify their runoff estimations. However, Tetra Tech ignores an orographic effect. The Rosemont site is located at higher elevation than the average elevation of the Tucson AMA. It is expected that average annual runoff at the Rosemont site is larger than average runoff in the Tucson AMA. However, the Tetra Tech’s calculated annual average runoff at the Rosemont site is close to the average runoff in the Tucson AMA. This also indicates that the Tetra Tech’s calculation is not reasonable.

References:

Tetra Tech, 2010. Site Water Management Update for the Rosemont Copper Project. Technical Memorandum


Appendix C – Concerns about the Use of the PSIAC Method for Soil Erosion Impacts

The District has previously noted that the PSIAC method (Pacific Inter Agency Committee - PSIAC, 1968) used for this analysis is inappropriate because it is a scoring method that does not explicitly recognize site conditions or changes in site condition resulting from disturbance (like mining) in the analysis. Because it does not recognize the effect of site disturbance, it cannot be used to evaluate alternatives that specifically involve evaluating the impact of site disturbance. While Rosemont’s consultant, Tetra Tech, has reiterated their justification for this method (August 18, 2011, comment 2 - below), their justification is flawed. While the District concedes that the PSIAC method has been proposed for use on watersheds smaller than the 10 sq. miles, the two studies cited by Tetra Tech (Rasely, 1991; Renard and Stone 1982 [Tetra-Tech neglected to mention the co-author Stone]), clearly state that the PSIAC method is inappropriate for site level assessment:

‘The method developed by the Water Management Committee of PSIAC (1968) was intended for broad planning rather than specific project formulation where more intensive investigations are required.’


‘It should be emphasized that the PSIAC sediment yield procedure is quite different from the Universal Soil Loss Equation, USLE, (Wischmeier and Smith, 1978) because the USLE evaluates on-site soil disturbance in relationship to agricultural cropland, which is the gross soil erosion in an individual soil and farm field setting, while the PSIAC sediment yield procedure rates sediment delivery from rangeland and mountainland which is net soil loss in a watershed hydrologic unit setting.”


This quote from Rasely (1991) clearly indicates that PSIAC is meant to be used on undisturbed rangelands and mountainlands, while other methods, such as USLE, are appropriate for assessing the impacts of disturbance. Furthermore, the District contacted Ken Renard (co-author of Renard and Stone, 1981), who re-iterated that the PSIAC method is inappropriate for estimating erosion from mine sites. Therefore, the two sources identified by Tetra Tech as justification for the use of PSIAC method for evaluating the impact of the Rosemont mine actually state that PSIAC is an inappropriate method for evaluating impacts of mining on erosion and soil loss.

As such, there can be no-doubt that the PSIAC method is inappropriate for evaluating the impacts of the different mine alternatives. Therefore, the soil loss, sedimentation and
sediment yield evaluations need to be re-done using a method that is appropriate for mine sites.

The Revised Universal Soil Loss Equation (RUSLE) should have been used to evaluate the erosion impacts of the alternatives. Tetra Tech itself has cited the Revised Universal Soil Loss Equation (RUSLE) as an appropriate tool for evaluating the post-closure soil loss (Tetra Tech, March 10, 2010), noting that specific guidance has been developed for its use on mine reclamation (Toy and Foster, 1998). However, these calculations and the RUSLE model results were not cited in the DEIS, and must not have been used in the alternatives analysis. RUSLE is a defensible model for evaluating the impacts of mining on erosion and should be used instead of the PSIAC model, which is inappropriate for mine sites.

Tetra Tech. 2010. Soil Erosion Estimates – Technical Memorandum from Mike Thornbrue (Tetra Tec) to Kathy Arnold (Rosemont Copper Company), March 11, 2010

Appendix D. Davidson Canyon Hydrologic, Hydraulic, and Geomorphic Scope of Work

Study Purpose

The purpose of the Davidson Hydrologic, Hydraulic, and Geomorphic Study (Study) is to provide a comprehensive analysis of the hydrology, surface water hydraulics, sediment transport and channel stability found within the Davidson Canyon watershed. The study will provide a solid understanding of existing conditions and probable changes to the watershed if the Rosemont mining operations occurred as planned. Mining has been known to significantly disrupt surface and groundwater movement and the habitat dependent on the stability of those systems. Analyzing the existing conditions will establish the baseline for comparison of probable changes to the watershed, over time, with the mine’s proposed land use alterations. This study is necessary to ensure continued public safety and habitat protection and provide information for a determination whether proposed project would have an effect on the Outstanding Waters criteria as well as the Environmental Impact Statement for the Rosemont Copper Mine. The analysis can also help to identify appropriate mitigation measures needed to protect the natural resources and public and private infrastructure downstream should the proposed mining operations occur.

Study Description

This scope of work is for professional engineering services necessary for the identification of existing hydrologic, hydraulic and geomorphic conditions in the area; identification and quantification of changes to the hydrology, hydraulics and geomorphology within the watershed as a result of the mining operations; identification and quantification of changes to the hydrology, hydraulics and geomorphology within the watershed as a result of proposed action undertaken for mine closure; and identification and quantification of changes to the hydrology, hydraulics and geomorphology within the watershed which would be anticipated several decades after the mine is closed and maintenance ceases on the remaining infrastructure.

Location

The Study area should, at a minimum, include all of the Davidson Canyon Watershed (including tributaries) to its confluence with Cienega Creek. If however, any of the computer models used in the analysis reflect continued change between existing and proposed conditions at this confluence, then the analysis should extend further downstream to a logical conclusion.

Study Categories and Tasks

The Study has a number of tasks to be performed in several categories, including:
I Hydrology

I a. Existing Conditions Hydrologic Analysis This task is to identify the various discharge values expected at strategic concentration points within the study area given current vegetation, soils, topographic relief, and adjusted for various spatial and temporal rainfall events. At a minimum, guidelines for establishment of concentration points should be where two washes converge and the smaller of the drainage areas equals or exceeds 20 acres. Utilization of the US Army Corps of Engineers (USACE), HEC-HMS computer model with precipitation sources from the National Oceanic and Atmospheric Administration XIV upper 90% confidence interval to establish rainfall distribution patterns would be encouraged. Hydrologic modeling from seasonal rainfall events, to establish existing soil moisture conditions in the local vadose zone, through to the Probable Maximum Flood (PMF) to analyze catastrophic flood and erosion hazards would be expected. This would include, at a minimum, assessment of the four individual seasonal rains as well as the 1-year 1-hour storm, 2-year 1-hour storm, 5-year 1- and 3-hour storms, 10-year 1- and 3-hour storms, 25-year 1-, 6-, and 24 hour storms, 50-year 1-, 6-, and 24 hour storms, 100-year 1-, 6-, and 24 hour storms, 500-year 1-, 6-, 24-, and 72-hour storms, and the PMF. Durations of six hours or less are to assume an SCS Type II distribution, while durations greater than six hours should assume an SCS Type 1 distribution storm. Methods shall otherwise follow Pima County Regional Flood Control District Draft Technical Policy 018.

I b. 20-years With Project Hydrology, Hydrologic Change Attributable to Mining Utilizing the hydrologic computer model developed in Task Ia (presumably HEC-HMS), the consultant will simulate the hydrologic changes in the watershed that would be expected if the mine is in full operation, 20 years after opening. Model runs will include the return periods cited above and will require the same deliverables. Compare the results from this run to the base line model established in Task Ia and document the changes. Potential hydrologic changes that will be documented include but are not limited to changes in watershed area, changes in soil conditions, changes in vegetative cover, increased amount of impervious surfaces, flow path changes, changes to attenuation of flow resulting from retention and detention within the mine project site, and changes in flow duration and magnitude of perennial and intermittent watercourse reaches in the study area due to alteration of subsurface flows.

I c. 10-years post project Hydrology Utilizing the same hydrologic computer model (presumably HEC-HMS) with all of the flow events referenced in Task Ia, simulate the hydrologic changes that would be expected once the proposed mine is closed but is still maintained; ten years after closing. Document all changes.

I d. 100-years post project Hydrology Utilizing the same hydrologic computer model (presumably HEC-HMS) with all of the flow events referenced in Task Ia, simulate the hydrologic changes that would be expected once the proposed mine is closed and there is no maintenance occurring; 100 years after closing. Document all changes.

II Soil Moisture
II a. **Existing Conditions Continuous Simulation of Soil Moisture and Evapotranspiration (ET)** Continuous simulation modeling of the changes in soil moisture and ET should be undertaken using the HEC-HMS computer model to the existing conditions soil moisture and variability. Use daily soil moisture accounting using the 105 years of daily rainfall at University of Arizona to determine impact to soil moisture in riparian areas across the range of observed rainfall. Because the mine will be at a higher elevation than the University of Arizona, daily rainfall should be increased to account for the orographic effects noted in NOAA 14. The simulation should document all changes in soil moisture using the 105 years of observed rainfall data to identify periods where soil moisture drops below the Permanent Wilting Point of riparian vegetation indicating the risk of loss of riparian vegetation and habitat.

II b. **20-years With Project Soil Moisture and Evapotranspiration** Utilizing the same model (HEC-HMS) developed above, simulate the soil moisture conditions that would be expected if the mine is in full operations 20 years after opening. Potential hydrologic changes that will be documented include, but are not limited to, changes in watershed area, changes in soil conditions, changes in vegetative cover, increased amount of impervious surfaces, flow path changes, retention and detention within the mine, and changes in baseflows of perennial and semi perennial watercourses due to alterations of subsurface flows. The analysis should compare results with the existing conditions simulation (Task IIa) to determine if periods of soil moisture below the Permanent Wilting Point become more frequent or extended, which will indicate an increased risk of loss of riparian vegetation and habitat.

II c. **10-years Post Project Soil Moisture and Evapotranspiration** Utilizing the same model (HEC-HMS) developed above, simulate the soil moisture conditions that would be expected once the proposed mine is closed but is still maintained. Document all changes and potential impacts to riparian vegetation and habitat.

II d. **100-years Post Project Soil Moisture and Evapotranspiration** Utilizing the same model (HEC-HMS) developed above, simulate the soil moisture conditions that would be expected once the proposed mine is closed and there is no maintenance occurring; say 100 years after closing. Document all changes and potential impacts to riparian vegetation and habitat.

III **Hydraulics**

III a. **Existing Conditions Hydraulic Analysis** This task will identify the flow depths, velocities and floodplain delineations for various flow regimes expected along the downstream watercourse reaches. The various flow regimes discharges would be established from existing conditions hydrology as discussed in Task Ia. Utilization of the USACE HEC-RAS computer model with locally acceptable parameters on model variables such as roughness and expansion contraction for all of the rainfall events from seasonal to the PMF would be encouraged. The hydraulic analysis shall determine the footprint of the inundated area for each of the rainfall events described in Task Ia. Methods shall otherwise follow RFCD Draft Tech Policy 019.
III b. 20-years With Project Hydraulics Utilizing the same hydraulic computer model (presumably HEC-RAS) for all of the flow events referenced in Task IIIa simulate the hydraulic changes that would be expected if the mine is in full operations, 20 years after opening. Compare the results from this run to the base line model established in Task IIIa and document the changes. Of particular importance is documenting the change in the frequency of overbank flows and velocity of channel flows.

III c. 10-years Post Project Hydraulics Utilizing the same hydraulic computer model (presumably HEC-RAS) for all of the flow events referenced in Task IIIa simulate the hydraulic changes that would be expected once the proposed mine is closed but is still maintained; ten years after closing. Document all changes. Of particular importance is documenting the change in the frequency of overbank flows and velocity of channel flows.

III d. 100-years Post Project Hydraulics Utilizing the same hydraulic computer model (presumably HEC-RAS) for all of the flow events referenced in Task IIIa simulate the hydraulic changes that would be expected once the proposed mine is closed and there is no maintenance occurring; say 100 years after closing. Document all changes. Of particular importance is documenting the change in the frequency of overbank flows and velocity of channel flows.

III e. Catastrophic Event Under a “Worst Condition Scenario” (tailing dams at there tallest height, watershed under saturated condition and all reservoirs full) simulate dam breaks utilizing the USACE Dam Break (or compatible) computer model. Document the impacts.

IV Geomorphology: Degradation/Aggradation

IV a. Existing Conditions Geomorphic Analysis Existing Conditions Geomorphic Analysis is to establish a base line that simulates long term channel bed elevation changes (degradation/ aggradation) and lateral channel bank stability along Davidson Canyon Wash and appropriate tributaries under a without mine scenario. The existing conditions shall determine the channel-maintaining sediment flux of bed-load and suspended load. The assessment should be based on existing soils and surficial geologic mapping, interpretation of recent and historical aerial photographs and field investigations and modeled utilizing the USACE HEC-6 (or compatible) computer program.

IV b. 20-years With Project Geomorphology Utilizing the same geomorphic computer model (presumably HEC-6) developed in Task Three, simulate the geomorphic changes that would be expected if the mine is in full operations, 20 years after opening. Compare the results from this run to the base line model established in Task IVa and document the changes. Changes in degradation/aggradation and changes in timing and nature of the sediment fluxes of bed load and suspended shall be specifically addressed.

IV c. 10-years Post Project Geomorphology utilizing the same geomorphic computer model (presumably HEC-6) developed in Task Three, simulate the geomorphic changes that would be expected once the proposed mine is closed but is still maintained; ten years
after closing. Document all changes. Changes in degradation/aggradation and changes in timing and nature of the sediment fluxes of bed load and suspended shall be specifically addressed.

IVd. 100-years Post Project Geomorphology Utilizing the same geomorphic computer model (presumably HEC-6) developed in Task IVa, simulate the geomorphic changes that would be expected once the proposed mine is closed and there is no maintenance occurring; say 100 years after closing. Document all changes. Changes in degradation/aggradation and changes in timing and nature of the sediment fluxes of bed load and suspended shall be specifically addressed.

Results and Deliverables

Based upon the above hydrologic, hydraulic, geomorphologic, and soil moisture analysis, access all adverse impacts anticipated as a result of the proposed mining operation and recommend measure to mitigate these impacts. Note the with-project effects to on-site, adjacent, and downstream features or improvements including roads, culverts, habitat conditions, wildlife corridors, and/or any other public or private noteworthy features.

Document procedures, justify parameters, explain any discrepancies, and summarize results.

Electronic Data specifications should meet the Forest Service standards and needs for data use and possible follow-up modeling. Recommendations could include:

- Final deliverables of the hydrologic data shall include digital line point and polygon features in ArcView shape file format.
- Line files shall be for the stream length segments. Attributes are to include stream length identification number from the HEC model, length, elevation change, slope, routing method used (if applicable) and comment field (if applicable).
- Point files shall be for the discharge concentration points. Attributes are to include 100-year and 500-year discharge values, time to peak, location description and comment field if necessary.
- Polygon files are to be for the watershed and sub-basin boundaries. Attributes are to include drainage area, hydrologic basin factors and comment field if necessary.
Appendix E. Qualifications of Pima County Staff Reviewers

James DuBois, R.G
Principal Hydrologist Regional Wastewater Reclamation Department

Jim DuBois is an experienced Hydrologist, Environmental Manager, and Registered Professional Geologist in the state of Arizona. He is currently employed as Principal Hydrologist for Pima County’s Regional Wastewater Reclamation Department. He has been in this position managing groundwater recharge, aquifer protection, surface water discharge, and reuse permit issues since 2008. Prior to joining Pima County, Mr. DuBois spent 2½ years as an Environmental Project Manager handling the City of Tucson’s MS4 permit responsibilities in the Stormwater Management Section of the Department of Transportation. Previously, Mr. DuBois served as a Senior Hydrologist for the Arizona Department of Environmental Quality (ADEQ) for 19 years. At ADEQ Mr. DuBois’ experience with aquifer protection permits for mines included reviewing more than 20 major mines for APP, closure or remedial activities. He co-wrote the initial guidance document outlining Arizona’s Best Available Demonstrated Control Technology (BADCT) for mining facilities. He developed the concept and statutory language for permitting mining facilities with an “areawide” approach. He served on ADEQ’s TQM Committee in 1994-6 to expand/revise the Mining BADCT Guidance Manual into its latest version. He wrote agency policy regarding how to address in a permit the impacts from sulfate and other pollutants not covered by established numeric aquifer water quality standards. Jim has also worked for 5 years as a consulting geologist in Wisconsin, and for 3 years as an exploration geologist for Noranda Exploration, Inc., in Arizona and Wisconsin. Mr. DuBois holds a B.A. in geology from Carleton College and an M.S. in geology with an emphasis in geochemistry and geochronology from the University of Kansas.

Mark Krieski, P.E., Civil Engineering Manager
Pima County Regional Flood Control District

B.S. - Geology, 1979, University of Arizona
M.S. - Geological Engineering, 1984, University of Arizona

Mark Krieski is an Engineer and Geologist, and a registered professional Geological Engineer in the state of Arizona. He is currently employed as a Civil Engineering Manager for the Pima County Regional Flood Control District, where he has managed the Major Watercourse Program for five years, including watercourse management, infrastructure development and maintenance, and associated regulatory programs. Mr. Krieski previously spent 3½ years as Pima County’s Solid Waste Manager, where he was responsible for siting, design, permitting, construction and closure services for a variety of solid waste management facilities. Prior to joining Pima County, Mr. Krieski served as a consultant with SCS Engineers for 14 years, performing geological engineering, geology, hydrogeology and environmental engineering services in Arizona and California. Investigation, design, permitting, construction, closure, compliance monitoring, and remediation services were performed for numerous waste management, mining, industrial, Superfund, and community facilities and contamination sites. Previously, Mark worked for 4½ years with Woodward-Clyde Consultants in California and Arizona, performing similar consulting work with an emphasis in earth hazards, foundation and earthquake engineering, and assessment and remediation of contaminated industrial facilities. After receiving his B.S. degree, Mr. Krieski also worked for 2½ years as an exploration geologist for Amax Exploration in Arizona, Nevada and California. During his undergraduate studies program, Mark performed a variety of geophysical surveys for both Mining Geophysical Surveys and Zonge Engineering throughout the western United States.
Frank Postillion
Chief Hydrologist, Section Manager, Water Resources
MS, Watershed Management and Hydrology

Responsible for coordination of review for impacts to water supply, water resources, shallow groundwater for this projects (2006). 35 years of experience in water resource and water quality evaluations in the public and private sectors. Evaluated the effects of Tucson Copper Mining District copper mining and the effects tailing pond recharge on the ground-water quality of the Upper Santa Cruz Basin. His affiliation and management of the Upper Santa Cruz Basin Mines Task Force led to modeling and management recommendations to pump interceptor wells at a sufficient rate to contain the mineralized sulfate and TDS plumes, and to avoid contamination of public supply wells. Evaluated the effects of coal mining on the hydrology of Black Mesa in Northern Arizona. Currently oversees the Pima County Flood Control District’s groundwater recharge program and other water resource projects.

Julia Fonseca
Environmental Planning Manager
Office of Sustainability and Conservation

B. A. Geology, Rice University
M.S. Geology, University of Arizona.
Hydrologist, Senior Hydrologist, Principal Hydrologist, and Environmental Manager at Pima County Flood Control District 1(986-2007). At the District, Ms. Fonseca led the groundwater recharge and riparian restoration programs, among others.

25 years experience in inventory and protection of natural resources in Pima County Arizona. Supervised preparation of the Aquifer Protection Permit application for the Marana High Plains Effluent Recharge Project. In her capacities at Pima County Regional Flood Control District, Pima County Natural Resources, Parks and Recreation, and Pima County Office of Sustainability and Conservation she worked to develop the natural resource inventories, plans and policies for the Sonoran Desert Conservation Plan. She currently oversees the development of a multi-species habitat conservation plan under the Endangered Species Act, and a related Environmental Impact Statement under the National Environmental Policy Act. In 2004 she evaluated the natural resources of Rosemont Ranch as a potential County acquisition, and has continuously maintained involvement in the Rosemont Ranch on behalf of Pima County, including participation in scoping, defining work objectives for staff and consultants and representing Pima County in Cooperator’s meetings.