

FEIS Analysis Concerns – GW Hydrology & Seeps, Springs and Riparian Areas & Biological Resources DRAFT– Jeff Simms, Fishery Biologist

General Statement of Problem – The ground water modeling is based on an accurate and complete assessment of the hydrogeologic setting in the analysis area. This forms the basis for the majority of impacts to sensitive resources on the LCNCA. Unfortunately the USFS did not set out in the beginning to analyze the project area and the larger watershed. The subsequent addition of the area of analysis to the project area presented a need in which there was insufficient existing data to model the potential impacts. The EIS was not postponed to collect the kinds of hydrogeologic data necessary to improve the reliability of the modeling exercises. This approach violates the basic tenet of a sound scientific approach.

- 1) Comments concerning fractured bedrock, reliability of modeling and need for better site characterization were not adequately addressed. The FEIS maintains that the models adequately depict the hydrogeology using available data. The USFS did not agree that further investigation was warranted. BLM disagrees and the USFS chose to use the “best available data” to characterize the site and surrounding area. Vast uncertainty will remain as long as the movement in the extensive fault and fracture system remains unknown. Therefore, the principle of using a scientific approach was sacrificed for expediency. We provided them with literature that substantiates our position: Doughty and Karasaki (2010), EPA (1989). EPA (2001).

P290 - The Coronado undertook additional technical investigations in order to ensure that the models were reasonable with respect to their prediction of impacts. These investigations included the following: posing specific technical questions to Coronado contractors (Ugorets, Cope, and Sieber 2012); convening a panel of experts to discuss various groundwater issues directly and in person with Federal cooperating agencies, Forest Service resource specialists and the Forest Service decision maker (Garrett 2012h); and requesting and assessing additional information on groundwater boundary conditions from Rosemont Copper (Rosemont Copper Company 2012g; Ugorets, Cope, and Sieber 2012). A final groundwater panel meeting was held in October 2012 that consisted of Coronado-contracted groundwater modeling specialists, Forest Service resource specialists, the Forest Service decision maker, Rosemont Copper’s groundwater modelers, and Federal cooperating agencies (Garrett 2012g).

A series of comments was made concerning the overall hydrogeologic framework of the area, most notably the possibility that a relatively direct hydrologic connection exists between the proposed mine pit and distant waters such as Cienega Creek. In the comments, this connection was variously hypothesized as being either related to faults or fractures not discovered or modeled or as being related to karst features in Cretaceous-age sedimentary rocks that underlie the Cienega Basin. In order to further investigate this question, the Coronado asked their consulting geological experts to prepare an analysis that answered specific

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questions. The Coronado then conducted two meetings with experts from cooperating agencies to discuss this issue. This investigation is fully detailed in the “Geology, Minerals, and Paleontology” resource section. With respect to the groundwater analysis, the Coronado determined that the hydrogeologic framework that forms the basis for the models is reasonable and supported by available evidence and that no evidence suggests that a regionally connected karst system exists that would form a direct connection between the open mine pit and distant waters such as Cienega Creek.

While a karst system was determined to be unlikely, the existence of an extensive network of fractures radiating from faults was never investigated and evaluated through collection of physical data. The geologic maps of the area show that an extensive fracture system exists. The recognition that the extensive fault and fracture system comprises the regional aquifer should make characterization before modeling a fundamental requirement (basic principle of a scientific approach)

P327 - The majority of the proposed mine pit would be completed in faulted and fractured bedrock.

P291 - Together, the fractured rock and basin fill form the regional aquifer of that groundwater basin (see figure 43). During active mining, water from the mine pit would be actively pumped, which would cause drawdown in the regional aquifer. This drawdown would cause impacts on wells, springs, streams, and riparian areas.

P293 - More importantly, the groundwater models are built to predict impacts in the regional aquifer; for many individual wells, the connection to this aquifer is not known, as these wells often intersect small pockets of alluvium or localized fracture systems.

P311 - Although it is recognized that flow within the aquifer occurs almost exclusively through fractures and faults, the model also treats the aquifer as if it were porous media, which as previously discussed is appropriate, given the regional scale of the model.

BLM disagrees with the last statement. The modelers have no way of knowing to what degree the faults and fractures affect the average rate of movement of ground water without site investigations. The conductance rates are generated indirectly by a very limited set of well tests. The wells are unlikely to be located in a representative group of fractures that would provide good estimates of water conveyance to the pit following excavation.

The FEIS discounts the need to locate and characterize faults on page 299. Only one of the models looked at 3 faults and did not consider fractures. The need to collect information on the number, size and conductivity of faults, which can and likely do act as conduits for water flow were dismissed without an adequate rationale.

P299 - The first argument arises from an oversimplification of a complex hydrogeologic system. The assumption that groundwater would automatically drain away to a lower

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elevation may be correct in close proximity with no hydrologic complications, but it cannot be applied regionally as it ignores real world data. Specifically, it ignores the geology between the mine pit and distant waters that has been verified through drilling and seismic investigation; actual groundwater elevations and flow patterns as measured in the field since the 1940s; the conductivity of various hydrologic units as established by aquifer testing throughout the basin; and, most of all, it ignores the element of time.

P299 - The Coronado found that the existing models already take into account known regional faults and fracture zones, that they were modeled appropriately as areas of higher conductivity, and that the points raised to the contrary were not sufficient to demonstrate the existence of significant faults that had not been considered. The potential for a regional connected carbonate aquifer was found to be extremely unlikely, given the evidence from extensive geological mapping and data collection conducted at the site, the lack of hydrologic data to support such a supposition, and the well-established geological history of large-scale faulting and structural changes in southern Arizona.

It appears to the reader, that the seismic and drilling data done in the past are adequate as a basis for understanding the area of analysis. The literature cited above does not corroborate this approach to modeling. The FEIS further insinuates that if someone does not present them with the data, then they are not required to do an extensive site investigation to verify the hydrogeologic setting in the area of analysis (i.e., the available data will do).

Doughty and Karasaki (2010)

United States Environmental Protection Agency. 1989. Stephen G. Schmelling and Randall R. Ros, Contaminant Transport in Fractured Media: Models for Decision Makers. United States Environmental Protection Agency, EPA/540/4-89/004

United States Environmental Protection Agency. 2001. *The State-of-the-Practice of Characterization and Remediation of Contaminated Ground Water at Fractured Rock Sites*. EPA542-R-01-010.

2) Poor logic has created a misunderstanding of the effect of drawdown in the aquifer adjacent to riparian and aquatic resources.

P295 - While drawdown of less than 5 feet could cause impacts to springs and surface waters, natural variability in groundwater levels is already causing changes of this magnitude in the vicinity of sensitive surface waters in the analysis area. This makes identification of drawdown that could be due to the mine dewatering impractical in the field because there is no reliable method for separating out ongoing seasonal or annual variation from impacts from the mine. Given this natural variability, as well as the limitations of the model to predict impacts below this level, the 5-foot drawdown contour was determined to be the appropriate threshold for predicting impacts to groundwater levels in the FEIS. It should be noted that the limitations of the models for analyzing

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impacts to perennial stream flow and riparian areas is explored further in the “Seeps, Springs, and Riparian Areas” section of chapter 3.

This statement is not correct, scientifically speaking. The current measured fluctuation is centered on an average aquifer elevation. Both the peaks and valleys of the fluctuation will drop equally for each increment in average aquifer elevation loss. This indicates that the contractor made a fundamental error that the Coronado did not catch. This kind of error caused them to choose the 5ft contour instead of smaller increment (e.g. 1ft or 2ft contour). This means that distance of the effects presented in the figures is artificially small, since a 1ft drop in aquifer elevation has serious consequences to aquatic and riparian resources. Such an error gives one with scientific training cause for pause.

3) The approach to the determination of change in groundwater elevations over time lack scientific rigor, but instead, relied too heavily on professional judgment and assumptions.

P296 - Rosemont Copper recognized early in the process that the ultimate accuracy of the modeling depends strongly on the geological and hydrologic assumptions made in the model. To balance possible subjectivity in the selection of assumptions, Rosemont Copper commissioned Tetra Tech to prepare a second, independent groundwater flow model of the mine site. The only original connection between the models was the underlying hydrologic data used as a basis for the models and the desire to model identical areas; other than this, the interpretation of these data and the design and operation of the models were conducted independently of one another.

In the first place, it appears strange that “Rosemont Copper” would be making technical and scientific judgment best left to qualified geologist and hydrologists. It indicates to me that the USFS was not being allowed to direct the approach based on input from various experts. Second, if the hydrogeologic assumptions are so important, it follows that an in depth characterization within the area of analysis would be conducted to reduce the need for an almost entirely subjective approach (assumptions where data are lacking). This step has been determined to be crucial in getting correct estimates when modeling water movement or contaminants in fractured bedrock systems (Doughty and Karasaki (2010), EPA (1989), EPA 2001)).

A more rigorous approach was discussed briefly but not considered feasible and conclude that the faults and fractures behave in a way that is equivalent to a porous medium.

P307 - There are other methods for modeling groundwater flow in fractured aquifers; however, for the most part, such modeling methods require extensive data on either individual fractures or homogeneous fracture zones. Collection of this level of data is not feasible for a model of this size (457 square miles), and from a logistical standpoint, there is a limited ability to determine the hydraulic characteristics of individual faulting and

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fracturing features. Further, the hydraulic characteristics of faulted systems over the analysis area are not typically dominated by individual faults. Rather, the hydraulic extensiveness of individual faults is typically limited. Instead, on average, the system of finite but connected individual faults and fractures behaves in a way that is equivalent to the behavior of a porous medium.

The BLM disagrees and the scientific literature indicates that this assumption is precisely the problem with getting good estimates. Without a thorough site investigation of the fault and fracture system, assumptions like this one tend to become necessary and lead to poor estimates. The following statement in the FEIS makes this point about oversimplification clear.

P309 - Difficulties in calibrating water levels on the west side of the model, nearest the mine pit, were identified. This means that the predicted groundwater levels in the immediate vicinity of the mine pit should be used with caution. Overall, the difficulties in calibrating the model in this area result from the use of a porous media model to model fracture flow conditions. On a regional scale, the porous media model is reliable for predicting water-level impacts on seeps, springs, and other hydrologic features; however, the model may not fully reflect the individual fractures that supply water to those features.

If fractures not inventoried and assessed on the southern and eastern edges of the proposed pit, then the “porous media” assumption will have resulted in a drastic underestimate of the rate of discharge into the pit. Think of the fractures as drains from the aquifer into the pit.

The Montgomery mine site model has a list of “potential limitations and current usability” issues. A key limitation is

P310 - It is recognized that while much of the Cienega Basin was included in the model domain, the purpose of this model was to analyze impacts from dewatering of the mine pit; therefore, the model may not be appropriate for use elsewhere in the basin without additional revision.

The upshot is that the modeling efforts employed for the EIS process were not well equipped for the task of determining impacts over an analysis area of over 400 square miles. The numbers generated by all three models, by themselves, do not provide the level of confidence necessary for a decision maker to discern the level of risk to the LCNCA from the implementation of the proposed Rosemont mine project. Both the extent and timing of impacts resulting from ground water depletion are not very reliable.

4) The inclusion of the effects of existing ground water pumping in the basin were not analyzed to the extent needed for meaningful conclusions about their effect on the ground water resource.

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P307- Groundwater pumpage not related to mining within the model area was not simulated. Groundwater pumpage within the basin was estimated to be between 400 and 500 acre-feet per year. This domestic pumping was not included in the model because of the small, dispersed nature of the pumping and because of the speculative information available about the pumping. Furthermore, historic groundwater-level data do not show declining trends in the general area of the domestic pumping near Sonoita. Note that even though this domestic pumpage was not modeled specifically, it has been analyzed in the FEIS as an ongoing trend.

There are nearly 2000 registered wells in the basin. If the average household use for the area were calculated (e.g. ~ 2000 afa, if each family unit uses 1 afa), then it would be a reasonable estimate that is in no way more speculative than modeling results for the mining operation.

5) Cumulative Impacts Section

Some aspects of cumulative impacts are mentioned in passing under the environmental consequences section, but are not addressed adequately. Example:

P328 - In the Davidson Canyon/Cienega Basin, domestic and stock water use associated with residential development has increased with population growth in the Sonoita area and elsewhere. This water use is expected to continue to grow as the population increases. These withdrawals have the potential to impact springs, seeps, and perennial or intermittent streams such as Cienega Creek. Impacts could occur either by direct surface disturbance of the watershed or by changes in groundwater levels resulting from groundwater withdrawal, not only by municipal wells but also by the combined impact from dispersed exempt domestic wells.

Climate change will affect groundwater and surface water resources, as well. For the Southwest, expected changes that are occurring and will continue to evolve include an increase in mean annual temperature, a more frequent drought cycle, a decrease in winter precipitation, and an increased frequency of heavy rains and flooding. These changes will have effects on groundwater levels and on springs, seeps, and perennial or intermittent streams, particularly Cienega Creek, Empire Gulch, Davidson Canyon, and Gardner Canyon. Effects from climate change will exacerbate the stresses on these waters from increased groundwater use for domestic and stock purposes.

BLM feels strongly that cumulative impacts need to be disclosed. For instance the combination of global climate change and increased water development in the basin may, by themselves, diminish or eliminate surface flow in Cienega Creek, adjacent wetlands and riparian areas. To not do this takes the project out of context with other pressures on the LCNCA.

General Statement of Conclusions – When modelers are faced with a limited amount of quantitative and specific qualitative data to model the hydrologic impacts, they are forced to use an array of assumptions based on professional judgment. The outputs from such exercises fall into the category of speculation rather than good, reliable estimates using scientific principles.

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Below are the estimated times to first impact.

Data from table 65, predicted time to first modeled impacts (years after start of active mining), including range of sensitivity analysis.

Location	Montgomery Model	Tetra Tech Model	Dr. Myers Model
Upper Empire Gulch Springs	22 to 172	4 to 97	50 post mining
Gardner/Cienega Confluence	712 to Never	22 to 172	150 post mining
Cienega near stream gage no. 09484550	Never	14 to 172	1,000 post mining

The LCNCA will begin to have impacts within the first 50 years according to some of the model results. Others predict that impacts will be widespread after more than a century. If these models are incorrect due to the fallibility of expert judgment in assigning values for the model or in assumptions made, then the LCNCA will be impacted more severely and sooner than expected.

Furthermore, if the estimates are in error, then there is a very real possibility that most or all of the surface water on the western side of the basin will go from perennial to intermittent in less than 100 years. With the uncertainty surrounding the fractures that criss-cross the mine site and lead to areas of recharge and the aquifer to the south, it is possible and even likely that the models have drastically underestimated the rate of conveyance of water to the pit. Couple this possibility with the effects of global climate change, existing and future use of ground water in the basin and the prognosis for aquatic and riparian areas is rather grim.

In order to meet the public trust responsibilities bestowed on the BLM and USFS, the area deserves a closer look at the hydrogeology (inventories surveys for characterization of conditions) and use of models tailored to fractured bedrock systems before a decision is rendered. To do otherwise leaves some of the rarest natural resources in the region unnecessarily at risk.

6) Cumulative impacts are not adequate (superficial) to convey the additive impacts that threat will reduce ground water levels. The FEIS equates reasonably foreseeable actions with currently pending actions. It fails to take a reasonable approach to cumulative impacts. The FEIS mischaracterized (used a Pima County report without consulting with BLM) the BLM wet-dry survey data (indicator of GW levels) from 2006 to present (baseline 1990) indicates about a 40% decrease in surface water extent from 1990. The fact that the flow stopped entirely is a strong indication of decline. At this point, the system is very sensitive to ground water elevation changes and will contract with modest changes in recharge or ground water extraction. Ongoing pumping and projected ground water use are not analyzed even though both will have a profound impact on the ground water and, therefore, surface water resources. The impacts in combination are likely to be catastrophic to springs, streams, wetlands and the species that depend on these habitat types. FEIS failed to include the BLM wet-dry survey data from 2006

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to present (baseline 1990) which indicates about a 40% decrease from 1990. At this point, the system is very sensitive to ground water elevation changes and will contract with modest changes in recharge or ground water extraction.

7) Mitigation of ground water draw down is virtually nonexistent. The LCNCA would be impacted permanently with no way perpetuate resources dependent on shallow ground water and surface water.

Springs Seeps and Riparian Areas

General Statement of Problem – Because all predictions of impacts to seeps, springs, wetland, streams and riparian areas are dependent on the results of a well conceived plan of site characterization and modeling, the FEIS does not provide information of the quality required for making a reliable assessment of resource impacts. This is further hampered by the lack of a well developed and complete section on cumulative impacts. Nonetheless, the FEIS indicates there is the possibility that the impacts to these resource could be extensive and severe.

1) Mattie Canyon and Cold Water Spring were excluded from the FEIS analysis as it was considered outside of the analysis area.

P488 - It should be noted that the biological opinion authored by the USFWS makes reference to Mattie Canyon, which is not within the analysis area for the “Seeps, Springs, and Riparian Areas” resource section of this chapter. Mattie Canyon is located east of Cienega Creek, very near USGS gage no. 09484550, and is generally beyond the area for which the groundwater models estimate impacts (see the “Groundwater Quantity” resource section of this chapter). Potential impacts to Mattie Canyon would be expected to be similar to those for Upper Cienega Creek, as described in this resource section.

P557 (from table 114) - Cold Water Spring, Outside bounds of analysis.

This is not the case as Mattie Canyon and Cold Water Spring have flow only in that portion located in the Holocene alluvium shared with Cienega Creek. The water source is the same. This is a significant omission as the riparian/aquatic area extends for about 1 mile. The hydrologists working on the EIS apparently did not do any site visits to these locations.

2) Significant error discovered in the FEIS. They misinterpreted BLM comments and assigned a mile of Gardner Canyon as being perennial. They did not go out into the field and verify hydrologic situation in the LCNCA, but instead relied on reports, making assumptions from them. This is not a problem if you substitute the descriptions of impacts to 1 mile of Cienega Creek above Gardner Canyon. Nevertheless, the FEIS gets the geography wrong.

3) FEIS does not disclose the rarity and ecological value of Cienegas and interior marshlands in a regional context. The ready has no idea of the context of degradation or loss (see Minckley and Hendrickson 1984).

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4) The impacts to surface waters and riparian areas are largely speculative, not quantitative as stated in the FEIS.

P501 - It is important to understand that the detailed predictions contained in this section are meant to inform the decision and to show what could potentially happen if the model predictions were to occur as modeled; however, this does not change the overall uncertainty.

P502 - While this approach makes use of all available information, the projection may not provide an accurate depiction of likely outcomes of groundwater drawdown on surface flow and habitat at all locations on Upper Cienega Creek, Empire Gulch, and Gardner Canyon. (note: Gardner Canyon is really Cienega Creek above Garner Cyn).

P505 - Significant disagreement about the severity of impacts that could occur to perennial and intermittent streams has arisen, notably from EPA, BLM, and Pima County. In general, this disagreement has centered on two factors: the application of the groundwater models to predict impacts on distant perennial and intermittent streams, and the consideration of exacerbating factors like drought, climate change, and seasonality. (note: the statement failed to mention the hydrogeology issue, fractured bedrock and need for analysis of basin wide ground water pumping)

If the results are highly uncertain, then putting associating numbers with the results is rather speculative and biases the readers judgment about the quality of the data presented. The disclaimer indicates that the data and methods used are highly suspect. The analysis is really more qualitative in that what we do know is that the aquifer on the LCNCA will be impacted and will likely result in impacts to surface waters. Not adequate for making resource decisions with potential consequences that include the collapse of stream, cienega, interior marsh, and spring ecosystems throughout the LCNCA.

5) FEIS ignored data sent to them on the stream segment located above Gardner Canyon on Cienega Creek.

P502 - There is very little detailed channel geometry or flow information anywhere on Upper Cienega Creek, Empire Gulch, or Gardner Canyon, with the exception of one USGS stream gage on Upper Cienega Creek (gage no. 09484550, Cienega Creek near Sonoita). This stream gage has high-quality stream flow, stage, and depth of water measurements for the period of record from 2001 through 2013. This was a period of persistent and severe drought. These stream gage data allow for detailed analysis of how water levels in the stream react to drought and react seasonally at or near the stream gage.

The USFS seemed reluctant to ask for and use BLM data. Cooperation was minimal on this project.

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6) Cause for concern is real and impacts to surface water dependent resources are likely, but magnitude and timing are areas of disagreement. Nonetheless, the high estimates show that the impacts would be catastrophic for resources dependent on springs, seeps, wetlands and streams.

P555 - Predictions with the most certainty are during the near term, up to 50 years after closure of the mine, during which there are few predicted effects on the Outstanding Arizona Water along Upper Cienega Creek from the headwaters to the confluence with Davidson Canyon. Over the long term (up to 1,000 years after closure (150-1,000)), the risk increases, although predictions are mixed. Some modeling scenarios suggest that there would be no or little change in flow conditions, and some modeling scenarios suggest that the stream could shift from perennial flow to intermittent flow, or even completely transition to ephemeral flow. At the same time, the frequency of low-flow conditions that could degrade water quality would increase. Changes in either the nature of flow or the frequency of lowflow conditions could affect this Outstanding Arizona Water. Predictions of these conditions occurring are highly uncertain due to limitations in the accuracy of the models and the long time frames involved.

P538 & 539 – **Summary of impacts to stream flow**

To summarize impacts to stream flow, it is useful to translate the increase in risk of drying to the definitions of perennial, intermittent, and ephemeral streams. A perennial stream exhibits flow in response to groundwater most of the year, although dry spells do occur, as happened in June 2010 on Upper Cienega Creek. Slight increases in risk of drying, for instance from an average of 3 days per year to 4 days per year, would not shift the stream from perennial to intermittent. However, increases in the risk of drying that suggest dry spells would occur with regularity instead of infrequently could shift the stream from perennial to intermittent. For the purposes of this analysis, an increase in risk of drying to anything more than 30 days per year suggests that dry spells would occur regularly, likely during low summer flows in May and June and therefore would shift the stream from perennial to intermittent. Ephemeral streams flow only in response to storms, which occur approximately 15 days per year; therefore, an increase in risk of drying that extends longer than about 350 days per year would be considered to shift the stream from perennial or intermittent to ephemeral. As noted earlier, drawdown happens steadily over time, and impacts would be present at times other than the time frames of 50, 150, and 1,000 years after closure.

- For Empire Gulch, the lowest estimates of drawdown would not change the perennial nature of the stream up to 150 years after closure, but the stream would be ephemeral by 1,000 years after closure.
- For Empire Gulch, estimates of drawdown for best-fit models are mixed. Two of the best-fit models indicate that the stream would shift from perennial to intermittent by 150 years

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after closure. One of the best-fit models indicates that the stream would be intermittent by 50 years after closure and ephemeral by 150 years after closure. All three best-fit models indicate that the stream would be ephemeral by 1,000 years after closure.

- **For Empire Gulch, the highest estimates of drawdown indicate a change from perennial to ephemeral stream by 50 years after closure.**
- For Upper Cienega Creek, the lowest estimates of drawdown would not change the perennial nature of the stream, even up to 1,000 years after closure.
- For Upper Cienega Creek, estimates of drawdown for best-fit models are mixed. One best-fit model indicates that the perennial nature of the stream would not change even up to 1,000 years after closure. One best-fit model indicates the stream would remain perennial up through 150 years after closure but would gradually become intermittent by 1,000 years after closure. The third best-fit model indicates the stream would remain perennial up through 50 years after closure, would gradually become intermittent by 150 years after closure with dry periods averaging 1 month per year, and would become ephemeral by 1,000 years after closure.
- **For Upper Cienega Creek, the highest estimates of drawdown would not change the perennial nature of the stream up through 50 years after closure, but the stream would gradually become intermittent by 150 years after closure and would become ephemeral by 1,000 years after closure.**
- For Gardner Canyon (note: this is actually Cienega Creek at the confluence of GC), the lowest estimates of drawdown would not change the perennial nature of the stream, even up to 1,000 years after closure.
- For Gardner Canyon (note: this is actually Cienega Creek at the confluence of GC), estimates of drawdown for best-fit models would not change the perennial nature of the stream up through 150 years after closure. At 1,000 years after closure, results are mixed, with one model indicating a perennial stream, one model indicating an intermittent stream, and one model indicating an ephemeral stream.
- **For Gardner Canyon (note: this is actually Cienega Creek at the confluence of GC), the highest estimates of drawdown would not change the perennial nature of the stream up through 50 years after closure. The stream would gradually become intermittent by 150 years after closure, and by 1,000 years after closure, the stream would be ephemeral.**

P540 – Indirect Effect on Water Quality due to Stream Flow Depletion

- For Empire Gulch, the lowest estimates of drawdown indicate that the risk of extremely low flow conditions and degraded water quality occurring does not change.
- For Empire Gulch, estimates of drawdown for best-fit models mostly indicate a substantial increase in the risk of extremely low-flow conditions and degraded water quality starting as early as 50 years after closure, increasing from an average of 4 days per year to at least 146

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days per year, although one model indicates no changes at 50 years after closure. By 150 years after closure, substantial portions of the year (283 days per year) would be experiencing low-flow conditions and degraded water quality.

- **(Note: FEIS did not include the high estimate (error?))**
- For Upper Cienega Creek, the lowest estimates of drawdown indicate that the risk of extremely low-flow conditions and degraded water quality occurring does not change up to 150 years after closure. At 1,000 years after closure, the risk increases somewhat from an average of 4 days per year under existing conditions to 88 days per year. These days would occur seasonally during the summer.
- For Upper Cienega Creek, estimates of drawdown for best-fit models indicate that the risk of extremely low-flow conditions and degraded water quality occurring does not change up to 50 years after closure. At 150 years after closure, the risk increases from an average of 4 days per year under existing conditions to anywhere from 88 to 283 days per year. At 1,000 years after closure, the risk increases to anywhere from 88 days to nearly the whole year (339 days).
- **For Upper Cienega Creek, the highest estimates of drawdown indicate a substantial increase in the risk of extremely low-flow conditions and degraded water quality starting as early as 50 years after closure, increasing from an average of 4 days per year to 146 days per year, and eventually to nearly the whole year (352 days) by 150 years after closure.**
- For Gardner Canyon, the lowest estimates of drawdown indicate that the risk of extremely low-flow conditions and degraded water quality occurring does not change.
- For Gardner Canyon, estimates of drawdown for best-fit models indicate that the risk of extremely low-flow conditions and degraded water quality occurring does not change up to 50 years after closure. At 150 years after closure results are mixed, indicating anywhere from no change in risk up to an increase to 146 days of extremely low-flow conditions and degraded water quality. At 1,000 years after closure results remain mixed, indicating anywhere from no change in risk up to nearly the whole year (352 days).
- **For Gardner Canyon, the highest estimates of drawdown indicate an increase in the risk of extremely low-flow conditions and degraded water quality starting as early as 50 years after closure, increasing from an average of 4 days per year to 88 days per year, and eventually to nearly the whole year (349 days) by 150 years after closure.**

P542 - Predicted Effect on Riparian Vegetation in Empire Gulch

Hydroriparian habitat is present. An estimated 407 acres has been mapped as hydroriparian habitat and may be affected.

Highest Estimate - In the near term, the higher estimate of groundwater drawdown (1.8 feet) would be unlikely to cause widespread mortality or transition from hydroriparian to

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xeroriparian habitat, but cottonwood/willow forest would experience stress due to deeper groundwater availability, including a decrease in canopy height and vegetation volume. While total conversion from a hydroriparian to a xeroriparian corridor is unlikely, there is likely to be contraction of the hydroriparian area, with conversion occurring at the transitional margins of the habitat. Herbaceous perennials (bulrush, cattail, grasses) and annuals would experience mortality and reduced abundance. In the long term, the higher estimate of groundwater drawdown (6.0 feet) would contribute to mortality and a transition from hydroriparian to xeroriparian habitat. Cottonwood/willow forest would experience increased mortality rates and a decrease in canopy height and vegetation volume, and the transition from cottonwood/willow forest to deeper rooted tamarisk or mesquite would be encouraged. Herbaceous perennials (bulrush, cattail, grasses) and annuals would experience mortality and reduced abundance. In the near term and long term, wetland complexes within the hydroriparian zone would likely experience drying and mortality of obligate wetland plants, and aquatic vegetation would experience widespread mortality.

P542 Predicted Effect on Riparian Vegetation in Gardner Canyon (Reaches 1 and 2)

Highest Estimate - The higher estimate of groundwater drawdown (up to 0.8 foot) would not be likely to result in widespread changes to riparian vegetation, even up through 1,000 years after mine closure. However, while total conversion from a hydroriparian to a xeroriparian corridor is unlikely, there is likely to be contraction of the hydroriparian area, with conversion occurring at the transitional margins of the habitat.

P543 - Predicted Effect on Riparian Vegetation in Gardner Canyon (Reaches 1 and 2)

Highest Estimate - The higher estimate of groundwater drawdown (up to 0.8 foot) would not be likely to result in widespread changes to riparian vegetation, even up through 1,000 years after mine closure. However, while total conversion from a hydroriparian to a xeroriparian corridor is unlikely, there is likely to be contraction of the hydroriparian area, with conversion occurring at the transitional margins of the habitat.

From conversations with the staff hydrologist, it is likely that BLM's position will be that all three of the modeling estimates are likely to be low due to the assumptions made about the hydrogeology, because there was not time or money to do a characterization of the fracture system for several miles to the south and east of the proposed pit location to improve quality of model inputs and assumptions. The original conceptual framework for the EIS did not include the LCNCA. This was forced on the USFS after the EIS was well under way. Climate change and well proliferation are superficially addressed in the FEIS, but are critical pieces of information for adequate disclosure of cumulative impacts.

7) Cumulative effects section is meager and confined to the area of analysis. It is rather superficial and dismisses any future impacts that are not already proposed for the area. A detailed analysis of the impacts of wells and future development are conspicuously absent. In the bigger

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context Cienega and interior marshland habitat in the region have diminished greatly. Any loss of these habitats would be very significant.

8) The only mitigations relevant to the LCNCA is a watershed conservation fund and purchase of downstream water rights.

P568 - Establishment of the Cienega Creek Watershed Conservation Fund, to be used for future mitigation to in the Cienega Creek watershed (FS-BR-16). Rosemont Copper would establish an endowment and provide \$2,000,000 of funding. This fund would essentially be established as a resource to help restore the watershed to a functional ecosystem and a mechanism to promote adaptive management and allow flexibility in mitigation to achieve desired outcomes in light of future uncertainties.

This level of mitigation is relatively meager and insufficient to protect the LCNCA from degradation.

P567 - Purchasing of water rights, to be used for mitigating impacts in the Cienega Creek watershed (FS-SSR-01). This mitigation measure includes a suite of actions that involve purchasing, severing, and transferring existing senior water rights on Lower Cienega Creek. The water rights would be transferred to appropriate entities to become in-stream flow rights on Lower and Upper Cienega Creek. Additional actions could include the discharge of water below Pantano Dam potentially could enhance and support riparian areas, along with retirement of a groundwater pumping well near to Lower Cienega Creek.

A state surface water right would not protect Cienega Creek from ground water pumping or surface water diversion on Cienega Creek in the LCNCA.

Biological Resources

General Statement of Problem – The approach to analysis in this section is to use some short excerpts from the BE and BO that give some sort of broad conclusion based on only the “most likely scenario.” The analysis does not use the range of results nor do impacts follow from the springs, seeps and riparian area section. The analysis is superficial. An example is provided below. This does not disclose the impacts as required by NEPA.

P690 - Gila chub — Direct impacts on the Gila chub are not anticipated as a result of the proposed project because there is no habitat or known occurrences of this species within the project area, no direct impacts on upper Cienega Creek have been modeled (this species has only been documented in Cienega Creek upstream of the confluence with Davidson Canyon), and no direct impacts resulting from connected actions are anticipated. Additional impacts could occur on Gila chub populations located within the

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analysis area in Cienega Creek, where groundwater drawdown is modeled to occur as a result of all action alternatives. A range of outcomes was assessed for Cienega Creek, all of which have high levels of uncertainty due to the long time frames, long distances, and small amounts of drawdown involved. The most likely scenario suggests that noticeable reductions in stream flow in Cienega Creek would not occur for hundreds of years after closure and, once occurring, would not result in widespread absence of flow along Cienega Creek. Impacts on Gila chub could also result from prey species of the Gila chub experiencing the same impacts as the fish from groundwater drawdown, hence altering their predator-prey relationships. The analysis area also includes portions of designated critical habitat for the Gila chub, and it is possible that within those areas, the proposed project could indirectly impact two of the three primary constituent elements of critical habitat for this species that are present within the analysis area (at two locations in designated critical habitat that are supported by groundwater—Empire Gulch and Cienega Creek): vegetative cover and water quantity.

Based on this, all action alternatives may affect and are likely to adversely affect the Gila chub and may affect and are likely to adversely affect designated critical habitat for the Gila chub (SWCA Environmental Consultants 2012b, 2012g, 2013b; U.S. Forest Service and SWCA Environmental Consultants 2013). After reviewing the current status of the Gila chub, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, the USFWS's biological opinion is that the proposed project is not likely to jeopardize the continued existence of the Gila chub and is not likely to destroy or adversely modify designated critical habitat (see appendix F).

DRAFT
