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Mr. Neil Bosworth, Forest Supervisor
Mr. Tom Torres, Deputy Forest Supervisor
Tonto National Forest
2324 East McDowell Road
Phoenix, AZ, 85006

Sent by email to:
nbosworth@fs.fed.us
ttorres@fs.fed.us
comments@resolutionmineeis.us
tonto_webmail@fs.fed.us

RE: Scoping Comments for the Resolution Copper Mine DEIS

Earthworks, a 501 (c)(3) non-profit organization focused on the environmental and social impacts of the mining and oil and gas industries, wishes to thank the Tonto National Forest (TNF) for the opportunity to submit scoping comments for the Resolution Copper Mine Draft Environmental Impact Statement (DEIS). We are confident that our comments will best reflect the concerns of our 1000+ members who reside in Arizona and who will be impacted by the construction, operation, and post-closure challenges of the Resolution Copper Mine, as proposed. As the Forest Service prepares to take a hard look at the impacts of the mine plan, and begins to analyze potential alternatives to mitigate environmental and social impacts, we are optimistic that our comments will be taken into consideration in a meaningful way as a DEIS is being written.

Introduction:

The Resolution Copper Mine (RCM, or "the project") would become one of the largest copper mines in the world, directly affecting over 10 square miles of land – most of which is currently owned by the American public and beneficially used in a variety of ways. Between the proposed tailings location near Queen Valley and the well known recreation and spiritual site of Oak Flat, existing beneficial uses include off road vehicle recreation, spiritual ceremonial gatherings, rock climbing, hiking, camping, bird watching and many other uses.

The use of Oak Flat in prehistoric times is well documented in the archeological record, and tribes continue to attest to the area's sacred importance. This record spans all the way to the 1950s when presidential order withdrew Oak Flat from mineral entry, and in the ensuing decades, Oak Flat's popularity with outdoor recreation grew with the population of Arizona. These comments are drafted with all of these uses and people in mind, as well with the knowledge that Oak Flat's water resources are exceptional in the area, with both wildlife and people suffering the impacts of the mine's immense dewatering footprint as well as drawing water from other competing sources. Indeed, the DEIS for this mine must not only analyze impacts from the current mine proposal in great detail, but it must consider a range of alternatives that provides meaningful and significant reductions in these tremendous impacts, not simply alternatives that make impacts slightly more bearable. What follows are not listed in numerical order of importance; all points should be given full consideration by reviewers.

1.) Alternatives to block caving

Block caving will result in the loss of Oak Flat due to subsidence, and the DEIS must consider alternatives to this mining practice that would enable mining to occur without significant surface disturbance. Other techniques could be employed by RCM, and with concurrent filling of workings (including the possibility of filling block cave voids) with tailings as the mine life proceeds, mining could occur in such a way as to limit underground void space to a small fraction of that of block caving, virtually eliminating the potential for surface subsidence. The DEIS should evaluate these possibilities thoroughly. If RCM claims that this is not feasible, it should be able to provide TNF with detailed reasons as to why alternative techniques cannot be employed from an engineering – rather than economic – standpoint. Existing cut and fill (or similar) operations throughout the world should be used as a comparative tool, and third party mining engineers should be consulted with to verify or challenge RCM's findings regarding the technical (not economic) feasibility of alternative mining techniques that do not result in surface subsidence.

Employing rigorous mine backfilling techniques will also reduce the necessary size of a tailings impoundment substantially. Because tailings would be pumped back underground, only a fraction of the tailings would need to be placed in a tailings impoundment. The DEIS should provide models showing the difference in tailings size requirements under this scenario compared to the current plan.

2.) Alternatives to aqueous tailings

Aqueous tailings present numerous risks and problems, and alternatives to them should be considered in the DEIS from the standpoint of both water conservation as well as catastrophic failures. Wet tailings at RCM would require enormous amounts of water to be added to tailings for slurry transport. This water will be lost from the local hydrological system, as it will be embodied within the tailings for decades or more and will not serve to recharge local aquifers. The DEIS should independently verify RCM's claimed amounts of water that will accumulate in the tailings impoundment over time.

In desert climates, aqueous tailings result in continuous evaporation from the surface of the water cover, as well as from other areas of the tailings impoundments where moisture is present. A tailings impoundment the size of RCM's proposal can result in the evaporative loss of many thousands of acre feet of water per year (or perhaps more) as the pond grows in size. The DEIS should also independently verify RCM's claimed amount of water that will be lost to evaporation each year from the tailings impoundment.

Dry designs can achieve more than a 60% reduction in water consumption compared to conventional aqueous designs. Desert states like Arizona – places in which competition over water is being experienced, and is getting worse with climate change – should no longer consider water-intensive technologies of yesterday when viable, proven alternatives already exist to greatly reduce water consumption.

In addition to water consumption, there have been numerous catastrophic tailings dam failures in recent years, and new research has determined that tailings dam failures globally are increasing in severity and rate, driven by the use of larger and higher tailings dams to accommodate the waste generated by mining increasingly lower grade deposits.[1] The two following examples of modern mine failures demonstrate just how severe the consequences can be. In addition to the acute impacts resulting from the immediate effects of a tailings dam failure, chronic long-term impacts can result from non-recoverable tailings that result in irremediable effects.

Mount Polley, BC:

On August 4, 2014, a tailings dam failure occurred in British Columbia at the Mt. Polley Mine, where an estimated 25 million cubic meters of tailings were released into Hazeltine Creek and Quesnel Lake – salmon habitat and a tributary of the Fraser River. The spill occurred at a modern mine, built in 1997. The tailings dam, which failed during mine operations, lasted for less than 20 years. Originally designed as a centerline construction dam, it was later allowed to construct an additional raise using an entirely upstream construction.[2] Mine safety experts and media articles have called the spill one of the biggest environmental disasters in modern Canadian history.[3]

[1] Chambers, David M., and Newland Bowker, Lindsey. "The risk, public liability and economics of tailings storage facility failures," July 21, 2015. Available at: http://csp2.org/files/reports/Bowker%20%26%20Chambers%20-%20Risk-Public%20Liability-Economics%20of%20Tailings%20Storage%20Facility%20Failures%20%E2%80%93%2023Jul15.pdf

[2] Independent Expert Engineering Investigation and Review Panel: Report on Mount Polley Tailings Storage Facility Breach, January 30, 2015. Available at: https://www.mountpolleyreviewpanel.ca/sites/default/files/report/ReportonMountPolleyTailingsStorageFacilityBreach.pdf

[3] https://www.salmonbeyondborders.org/uploads/3/9/0/1/39018435/enviro_disaster_cbc.pdf

A member of BC First Nation observes the inundation of Hazeltine Creek by mine tailings from Mount

Mine tailings flow from tailings dam failure at Mount Polley Mine.

Samarco, Brazil:

On November 5, 2015, a major tailings dam burst at the Samarco Mine in Brazil, sending 150 million tons of tailings slurry and contaminated water into the Rio Doce. The tailings buried an

entire village, killing at least seventeen people.[4] The spill migrated down the Rio Doce, killing fish, destroying river banks, and eventually reaching the Atlantic Ocean over 200 miles away. Hundreds of thousands of people have been affected – their drinking water sources destroyed and their agricultural operations heavily compromised.

The mine is owned by a joint partnership between mining giants Vale and BHP Billiton, and best available data indicates the tailings dam was constructed in 2009.[5] A lawsuit between the Brazil government and the mine puts the damages related to the dam disaster at roughly $4.8 billion.[6]

Samarco tailings dam failure, Brazil, 2015

Tailings Dam Expert Panel:

As a result of the Mount Polley tailings dam failure, the BC government convened a panel of independent technical experts to investigate the cause of the failure and provide recommendations for how to reduce the potential for catastrophic failures in the future.[7] The panel made a number of key recommendations, including using best available technology to

[4] http://www.cnbc.com/2016/01/21/samarco-brazil-move-closer-on-48b-dam-disaster-settlement.html
[5] http://blogs.agu.org/landslideblog/2015/11/10/fundao-dam/
[6] http://www.cnbc.com/2016/01/21/samarco-brazil-move-closer-on-48b-dam-disaster-settlement.html
[7] Independent Expert Engineering Investigation and Review Panel: Report on Mount Polley Tailings Storage Facility Breach, January 30, 2015. Available at: https://www.mountpolleyreviewpanel.ca/sites/default/files/report/ReportonMountPolleyTailingsStorageFacilityBreach.pdf

fundamentally shift tailings storage away from tailings ponds that store water to dry tailings. This included recommendations to:

- Eliminate surface water from the impoundment
- Promote unsaturated conditions in the tailings with drainage provisions
- Achieve dilatant conditions (setting to a solid) throughout the tailings deposit by compaction.

According to the Mount Polley expert panel, "improving technology to ensure against failures requires eliminating water both on and in the tailings: water on the surface, and water contained in the interparticle voids."[8] Only this can provide the kind of redundancy that prevents catastrophic releases.

U.S. Tailings Dam Failures:

Tailings dam failures are an issue at U.S. mines as well. A recent analysis of U.S. copper mines operating in 2010, representing 89% of U.S. copper production, found that 28% had experienced partial or full tailings dam failures.[9] Given these statistics, partial and/or total tailings dam failures should be considered a reasonably foreseeable outcome in the NEPA context, particularly since tailings dams become a permanent feature of the landscape, after mining ceases.

Previous research pointed out that most tailings dam failures occur at operating mines, and that 39% of the tailings dam failures worldwide occur in the United States, significantly more than in any other country (Rico, et. al., 2008a, p. 848). A recent Alaska example of a tailings release involves the overtopping of the Nixon Fork dam in 2012.[10]

For these reasons, the DEIS should include an independent risk analysis of the proposed tailings dam design, in addition to putting forth a range of sub-alternatives for dry tailings management and storage systems and designs.

Resolution Copper DEIS sub-alternatives for dry tailings design:

The RCM DEIS should also consider sub-alternatives regarding the most appropriate type of dry tailings design, based on water consumption, fugitive dust, groundwater protection, and visual impacts. Since different designs have different characteristics and tradeoffs, the public deserves to know which design options are available, and what the pros and cons are for each one, before commenting on the DEIS. These designs and systems should be vetted by the Tailings Dam Expert Panel – prior to inclusion as DEIS sub-alternatives. The TNF should provide water balance analysis and consumptive loss numbers for each sub-alternative.

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[8] Id.

[9] Earthworks, U.S. Copper Porphyry Mines Report: the Track Record of Water Quality Impacts Resulting from Pipeline Spills, Tailings Failures and Water Collection and Treatment Failures. 2012. Available at: https://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=182065

[10] Alaska Department of Natural Resources, "Warning for Violation of Certificate of Approval to Operate a Dam Nixon Fork Tailings Dam," March 19, 2012.

3.) Alternatives to dewatering methods

RCM's proposal would dewater a vast area in order to conduct mining operations, resulting in a large cone of depression that, over time, propagates outwards in many, or all directions. Seasonal and perennial surface water resources essential to wildlife, such as those at Oak Flat, Queen Creek, and Ga'an Canyon, are highly vulnerable to changes in their underlying groundwater systems, and the risk to these waters from mine dewatering operations are significant. The cone of depression may also impact municipal supply wells in Queen Valley, Superior and outlying residential areas. The current proposal would send water pumped from mine workings elsewhere, such as the Magma Irrigation District and/or the mine mill, and would not serve to recharge the local aquifer in a meaningful way.

The DEIS should include an alternative that would allow for this water to be returned to the general hydrogeologic system from which it was taken, injected as deep as possible, in order to reduce the size of the cone of depression which will form around the mine workings and accelerate the time frame for that cone to ultimately recharge after mining ceases. RCM's current plan would remove this groundwater permanently, which can take hundreds, or thousands (or even longer), of years to fully recharge. Removing this water permanently and exporting it to uses far away where it will be lost, is an inferior practice compared to injecting it in strategic locations where it is more likely to recharge the cone of depression and reduce the chances of life-supporting and spiritually significant springs and seeps, as well as municipal supply wells, in the area to permanently dry out or experience lower water tables. The water resources in this area are rare enough, valuable enough, and sacred enough to warrant the TNF to take a hard look at technologically feasible methods to reduce the surface and groundwater impacts from the cone of depression. This practice is common in other mining jurisdictions, and in Nevada, for example, is required by the state water engineer.

4.) Alternatives to the proposed tailings location

The General Plan of Operations does not sufficiently address the barriers to other proposed tailings locations, so the DEIS should. In particular, the DEIS should analyze brownfields sites as preferred locations for tailings deposition. Existing open pits – especially pits with pit lakes formed or anticipated to form, are ideal locations for RCM's tailings. The Pinto Valley mine was briefly discussed as a potential option, yet was disregarded due to some limited ongoing operations at the site. The DEIS should consider Pinto Valley even if placing tailings there would have some impact on what might remain of that operation by the time it would begin accepting tailings from RCM.

The benefits of a brownfield alternative are major. Many square miles of National Forest land currently used for a variety of sustainable uses would be saved from complete destruction, and the potential impact to groundwater underneath these lands would be eliminated. Using pits that have, or will form, pit lakes brings the added benefit of stopping evaporation from the surface of the lakes, as that water is ultimately replaced by a dry surface. This will allow these sites to avoid the perpetual groundwater drawdown fueled by constant evaporation, and will

allow for pre-mining groundwater conditions to return to normal better and faster than if a pit lake were to remain in place.

Geochemical modelling and additional levels of tailings management at RCM will be needed to ensure that tailings placed in existing pits will not lead to increased groundwater contamination at a chosen site, but efforts should be made to study many brownfields alternatives, even if they are some distance away from RCM, as slurry pipelines are capable of transporting tailings long distances, and should be considered. Finally, more than one brownfield sites should be considered in the DEIS. Given that RCM's tailings volume, as proposed, could fill more than one existing open pit, additional sites should be chosen to accommodate all tailings from RCM for it's entire projected life. In a mine backfill scenario, RCM's tailings would be minimal compared to the current plan, therefore making it much more feasible to consider brownfields sites for tailings.

These various alternatives should consider a range of tailings deposition techniques, preferably with an emphasis on dry tailings deposition but also evaluating the option of saturated tailings (the risk of catastrophic failure is zero in existing no-outlet pits) if engineers believe it would be the only feasible method. Indeed, the environmental benefits could still far outweigh the negative impacts even in an aqueous tailings scenario.

5.) Carbon footprint calculations and alternatives to grid-supplied power

RCM's main source of power would be a grid intertie to SRP power. RCM's demand is likely to be in the hundreds of megawatts, and given that SRP power is roughly 85% powered by coal and natural gas, carbon emissions to power RCM will be extremely high. Carbon emissions from both power generation and the operation of all fuel-operated mining machinery must be calculated both annually and over the life of mine in the DEIS. These scoping comments do not intend to go into detail about the scientific consensus as to why climate change is an enormous threat to humans, wildlife, and the economy, especially in desert climates facing water scarcity issues. It is, however, worth reiterating the numerous efforts of the federal government to combat climate change, such as the Clean Power Plan, the Bureau of Land Management proposed methane emissions reductions rule, the EPA methane emissions reduction rule, the Renewable Fuels Standard, renewable energy tax credits, and the vehicle gas mileage standards. Since the TNF is a federal agency, it has an obligation to align its priorities in the NEPA process to that of its sister agencies that are going to great lengths to reduce greenhouse gas emissions. It should also follow the White House Council on Environmental Quality's guidance regarding how to consider climate change impacts in all NEPA processes.

The DEIS should include alternatives for RCM's proposed power supply designed to reduce emissions. Preferably, an alternative would include RCM's own renewable power generation, and hybrid heavy machinery (many mines already use hybrid equipment) to run from these renewable sources. Solar thermal power generation is already being successfully deployed in similar desert environments to provide reliable, baseload power using molten salt as an energy storage medium. Solar thermal operations utilizing dry cooling achieve major water savings

over wet cooling, and should be considered for all new facilities. An SRP intertie could serve as a backup option to provide conventional energy only when RCM's own power systems fail to do so. An alternative such as this will be an important step to showcase that a new mine does not by definition lead to increased carbon emissions.

Also, TNF should consider the downstream carbon footprint of the mine as well, most notably the transportation and smelting of RCM's ore.

6.) Analysis of loss of recreation

Recreation is a major factor in the overwhelming public opposition to RCM. As the TNF is acutely aware, rock climbing, camping, off road vehicle use, hiking, and wildlife viewing are among the most popular uses of Oak Flat, Queen Creek, Apache Leap, Ga'an Canyon, and the proposed tailings location. The loss of these opportunities can and should be quantified and studied in a number of ways within the DEIS:

1.) Direct financial impacts. Recreation brings in direct revenue to nearby communities through the purchase of food, lodging, fuel, and other goods and services. The DEIS should study the fiscal impacts of all the aforementioned activities phasing out over time, even though mine-related economic benefits might occur as well.

2.) Environmental impacts due to increased use at other sites:
When recreation access is severed, the result tends to be that alternative sites see more use, placing a burden on both the environment at those sites and those who manage them. The DEIS should take a hard look at recreation trends at all places impacted by RCM, and study how public lands nearby may be impacted as such recreational use is diverted to new areas. This should include, for example, the costs imposed to the TNF and other land managers for building new campgrounds to account for the loss of Oak Flat, and the cost of trail building and road maintenance should new climbing areas be developed to account for the loss of existing areas.

3.) Psychological impacts resulting from the loss of public access to public land:
Public access to public land is to many a fundamental right of being an American. Americans generally assume that lands they grew up enjoying will be there for their grandchildren, not sold to a foreign mining company. The resentment felt by many over what they may perceive as a fundamental betrayal by their federal government comes with psychological impacts. The DEIS should include a Health Impact Assessment (HIA) based on these psychological impacts. The HIA should include users of all types, and should place a primary emphasis on Native Americans, as their loss of access is tied to thousands of years of history and a type of deeply embedded spiritual connectedness to the land.

4.) Assessment of increased civil disobedience:
The DEIS should also assess the level of civil disobedience that could occur from these recreational and spiritual losses; for example, recurring protests in which activists chain themselves to RCM equipment is likely, considering that many activists have said publicly that

they will never stand down from this fight under any circumstance. The DEIS should assess increased demand on local and regional police forces and specialized law enforcement units with this in mind, and the costs associated with these increased demands.

7.) Analysis of increased light and noise pollution

The DEIS should analyze the effects of light and noise pollution from the mining operation, and include alternatives to reduce these impacts. These include using cutting edge LED technology and generally reducing the amount of outdoor lighting to protect night sky viewsheds and reduce impacts to nearby observatories, campgrounds, outdoor education centers, and residents of Superior and outlying residential areas such as Queen Valley.

8.) Alternatives to perpetual water treatment liabilities

Acid Mine drainage is one of the most significant and problematic impacts of a mining operation. In the case of RCM, most of the rock extracted from the workings is expected to generate acid (PAG) and increase metals loading to water resources over time, perhaps for thousands of years. This will be most problematic at the proposed tailings impoundment as runoff water and water collected from underdrains will likely be acidic and laden with heavy metals. While the plan of operations notes methods of PAG and NPAG separation and tailings deposition that will help to minimize this threat, acid drainage is still expected, and post-closure water treatment under the current plan is expected to be a significant expense after closure. The DEIS should include an alternative that would not require water treatment in perpetuity – specifically, the mine would achieve neutral drainage chemistry within 10 years of the cessation of mineral production. This alternative would likely rely on some of the other alternatives mentioned in these comments that would vastly reduce or eliminate the need for a new tailings impoundment subject to PAG runoff and underdrain collection. If those alternatives are not included in the DEIS, the tailings impoundment would have to be designed to achieve neutral drainage some other way.

We know from organizational experience that the entire idea of active water treatment in perpetuity is flawed, yet it remains to be incorporated into mine plans and designs even today. Modern mines are commonly proposed and built that will require between $1 and $10 million per year to operate water treatment plants as far as 5,000 years into the future. These plants require expensive parts, filters, lime treatment, and large amounts of electricity into order to protect surface and groundwater from continuous degradation. It is simply out of touch with reality to suggest that any mine company will have a presence thousands of years from now and will be proactively managing toxic water discharges from a mine it built thousands of years before. In reality, these environmental liabilities are certain to either be paid for by taxpayers of the distant future, or simply neglected altogether.

In the case of RCM, the danger lies within the possibility of tailings contaminating regional groundwater supplies used by many throughout the region. A cessation of pumping of tailings runoff and underdrain water would result in a tremendous amount of acidic, toxic water simply

discharging into the ground. A similar situation exists at the Bingham Canyon Mine in Utah, where a contaminated groundwater plume that originated within waste rock dumps has migrated downgradient and has impacted agricultural and residential wells alike. The threat continues, as this plume is constantly moving closer to a major river and more dense housing developments, requiring around-the-clock groundwater pump and treat operations to lessen the impacts, with limited success. A similar plume exists at the Sierrita Mine near Green Valley, Arizona, as well as many other sites throughout the United States and the world.

Given the magnitude of RCM's proposal, it is virtually guaranteed that at some point, acid drainage will begin to have an impact on regional groundwater quality if water treatment in perpetuity is required. It is best to avoid acid generation in the first place using the alternatives described above. RCM has an obligation to future generations to design the mine in such a way that water draining from tailings long in the future discharges at a neutral pH. If this cannot be achieved, tailings should be placed back underground, or at an existing brownfields site(s). It is simply unfair to future generations to place this burden upon them.

9.) Analysis of tailings substrates

RCM's current proposal does not include a liner under the tailings impoundment. The DEIS should closely examine the validity and case history of this practice. Given the acid drainage potential as well as the current plan to use aqueous tailings, detailed study of contamination migration to groundwater must occur. The use of a liner should also be analyzed in the DEIS for dry tailings to decrease acid drainage risk.

10.) Analysis of fugitive dust

The DEIS should study in detail the fugitive dust potential of all tailings designs and systems being considered, as well as study the site-specific impacts fugitive dust problems would have at any of the proposed tailings locations. Mitigating practices – particularly tailings cover design – should be fully assessed and specialists should be consulted regarding these potential practices.

11.) Analysis of cumulative impacts

Increased traffic, water use, energy use, and all other types of cumulative impacts must be quantified in the DEIS. RCM will likely increase the population of Superior and other communities, which brings increased strain on municipal water supply, electricity consumption, and public roads.

12.) Analysis and quantification of water consumption from power generation.

As noted above, RCM's power demands will likely be in the hundreds of megawatts. Thermoelectric power generation in the US, on average, accounts for roughly 40% of the nation's total consumptive water use. RCM's power generation – if using grid power or on-site

solar thermal generation (especially wet cooled solar thermal generation) – will therefore be a major element of the mine's overall water consumption matrix, the estimations for which must be included in the DEIS in addition to direct water consumption from mining operations.