

**APPENDIX F. ALTERNATIVES CONSIDERED BUT  
DISMISSED FROM DETAILED ANALYSIS**



## **Alternatives Considered but Eliminated from Detailed Study**

Federal agencies are required under the National Environmental Policy Act (NEPA) to rigorously explore and objectively evaluate all reasonable alternatives which were eliminated from detailed study, and to briefly discuss the reasons for their having been eliminated (40 Code of Federal Regulations [CFR] 1502.14). All comments received from the public, cooperating agencies, tribes, and the project team during the scoping period in response to the proposed action that provided suggestions for alternative methods for achieving the purpose and need were considered for analysis (SWCA Environmental Consultants 2017b). Some of these alternatives were determined to be outside the scope of the project, duplicative of the alternatives already being considered in detail, unable to fulfill the purpose and need, technically or economically infeasible, or involved components or actions that would cause unnecessary environmental harm, and therefore, were not considered for detailed analysis. A number of alternatives were initially considered and analyzed but later dismissed from further detailed analysis in the environmental impact statement (EIS) for reasons summarized in the following text. Additional information can be found in the “Resolution Copper Project and Land Exchange Environmental Impact Statement Draft Alternatives Evaluation Report” (SWCA Environmental Consultants 2017a).

### ***Alternative Mining Techniques***

Substantial public comments were received concerning Resolution Copper Mining, LLC’s (Resolution Copper’s) proposed panel caving mining technique (panel caving is a form of block caving), in particular requesting that alternative mining techniques be considered or required. Public comments asked for alternatives considering the following items:

- use of traditional mining methods, including less-mechanized forms of mining,
- investigation of alternatives that would result in minimal surface disturbance, and
- use of alternative mining methods to reduce the volume of tailings produced.

The proposed panel caving mining method is seen as having two major drawbacks. First, panel caving results in the creation of a subsidence area at the surface, which impacts a variety of resources. Second, because panel caving does not leave any opening or cavity belowground, there is no opportunity to backfill tailings as a potential disposal alternative. The U.S. Department of Agriculture Forest Service (Forest Service) agreed that if an alternative mining method were found to be reasonable, it could reduce certain resource impacts, and the agency undertook an investigation into the technical and economic feasibility of using alternative mining techniques.

### **OPEN-PIT MINING**

Open-pit mining was considered but eliminated from detailed analysis because it would result in surface disturbances greater than those in the proposed action (panel caving), causing unnecessary environmental harm. Specifically:

- The footprint of the open pit would need to be approximately 10,000 acres, which is eight times larger than the projected maximum disturbance from subsidence (approximately 1,200 acres).
- The resulting pit would result in the removal of all of Oak Flat, all of Apache Leap, approximately 4 miles of U.S. Route 60, approximately 3 miles of Queen Creek, and approximately 3 miles of Devil’s Canyon.
- The pit would have a stripping ratio (waste rock to ore) of 35:1 and would result in approximately 205 billion tons of waste rock. This represents more than 100 times more volume than the

projected volume of tailings under the General Plan of Operations (GPO). The waste rock generated from mining would need to be disposed of at some surface location, and a tailings impoundment would still be required.

## ALTERNATIVE UNDERGROUND MINING TECHNIQUES

The term “stope” used in mining simply indicates an underground excavation or room, and the term “stopping” refers to any underground mining technique that removes ore from these areas. A spectrum of underground mining techniques was assessed, including naturally supported stopping methods (open stopping, open stopping with pillars), artificially supported stopping methods (shrinkage stopping, overhand and underhand cut-and-fill), other caved stopping methods aside from panel caving (sub-level caving), and other stopping methods like vertical crater retreat. These alternative underground mining techniques are described in detail in the “Resolution Copper Project and Land Exchange Environmental Impact Statement Draft Alternatives Evaluation Report” (SWCA Environmental Consultants 2017a). Each of these stopping methods is suited to certain characteristics of an ore body, including ore and host rock strength, the depth and type of overburden or cap rock, and the size and shape of the ore body. As shown in table F-1, very few of these underground stopping methods have characteristics that are well suited to the Resolution copper deposit, even though technically these methods could be used.

**Table F-1. Summary of underground stopping methods and their applicability to the Resolution Copper Mine ore deposit**

Underground Stopping Method	Ideal Ore Body Characteristics	Ideal Ore Strength	Ideal Host Rock Strength	Backfill with Tailings Materials
<i>Resolution Copper Mine Deposit</i>	<i>Low grade, massive, thick</i>	<i>Weak–Moderate</i>	<i>Weak–Moderate</i>	<i>No</i>
Cut-and-fill	High grade, irregular, narrow to wide	Strong	Weak*	Yes
Open stopping	Small	Strong	Strong	Possible
Open stopping with pillar support	Low grade, horizontal or flat dipping	Strong	Strong	Possible
Shrinkage stopping	Fairly high grade, narrow to wide (4 to 100 feet) thick	Strong	Moderate*	Possible
Vertical crater retreat stopping	>40 feet thick	Strong	Strong	Possible

\* Indicates a match with the characteristics of the Resolution Copper Mine ore deposit

While there are other underground stopping techniques that could physically be applied to the Resolution copper deposit, each of the alternative underground mining methods assessed was found to have higher operational costs than panel caving. Higher operations costs would result in a shift in the “cutoff grade” of ore that could be profitably mined. The cutoff grade (given as a percentage) is the lowest grade of copper for a ton of ore that equals the cost of stripping, drilling, blasting, mining, hauling, crushing, and processing the ore (as well as administrative costs, taxes, and other overhead costs), given the current price and mill recovery.

The current cutoff grade as proposed by Resolution Copper is a greater-than-1-percent copper shell, which would result in the greatest potential volume of ore from within the deposit that can be profitably mined. The alternative underground techniques considered would shift the cutoff grade much higher and substantially reduce the amount of ore that could be profitably mined. As shown in table F-2, at a 2 percent cutoff grade, it is estimated that less than 20 percent of the deposit identified by Resolution Copper could be mined. At a 3 percent cutoff grade, it is estimated that less than 1 percent of the deposit

could be mined. For comparison, the average grade of ore removed from the historic Magma Mine has been reported to be 5 percent. This higher grade of ore was able to support a cut-and-fill mining technique.

**Table F-2. Estimated volume of Resolution Copper Mine deposit at various cutoff grades**

Cutoff Grade	Estimated Volume (tons)	Percentage of Volume Proposed to Be Mined in GPO (%)	Source	Average Grade of Ore above the Cutoff Grade
1%	1,969,000,000	100	Resolution Copper	1.54%
2%	386,437,500	19.6	Independent estimate from Resolution Copper data	Unknown
3%	7,545,919	0.4	Extrapolation from first two data points	Unknown
4%	1,478,469	0.08	Extrapolation from first two data points	Unknown
5%	289,676	0.02	Extrapolation from first two data points	Unknown

### Reasonableness of Alternative Mining Techniques

The Forest Service recognizes and acknowledges scoping comments that suggest the use of mining techniques other than panel caving could substantially reduce impacts on surface resources, both by reducing or eliminating subsidence and by allowing the potential of backfilling tailings underground. For this reason, the potential for using alternative mining techniques was investigated explicitly during the alternatives development process.

In the end, alternative mining techniques as applied specifically to the Resolution Copper Mine deposit were not found to be reasonable, with the following rationale:

1. Panel caving is a standard mining method used in the industry and is commonly used for deposits with the grade, size, depth, and geological characteristics of the Resolution Copper Mine deposit.
2. While several underground stopping techniques could physically and technically be applied to the deposit, the ore and host rock characteristics typically favorable for these techniques differ from the characteristics of the Resolution Copper Mine deposit. While physically feasible, it is unlikely that any of these techniques would be chosen as a reasonable technique for a similar deposit.
3. Use of any of these alternative underground stopping techniques would result in higher per-ton mining costs, and as a result the cutoff grade for the deposit would need to be higher to be economically feasible. An increase in the cutoff grade from 1 percent to 2 percent removes an estimated 80 percent of the tonnage of the deposit from consideration for development. The tonnage is likely to be even lower at a 2 percent cutoff grade, as many of these areas of high-grade ore are not contiguous or continuous. Accepting this level of reduction to accommodate an alternative mining technique is not economically feasible and would not be reasonable.

This threshold of reasonableness is consistent with guidance contained in the Forest Service minerals and geology manual (Forest Service Manual [FSM] 2800) (U.S. Forest Service 2006):

The claimant has the right to see or otherwise dispose of *all locatable minerals*, including uncommon varieties of mineral materials, on which the claimant has a valid claim. (FSM 2813.12, emphasis added)

In managing the use of the surface and surface resources, the Forest Service should attempt to minimize or prevent, mitigate, and repair adverse environmental impacts on National Forest System surface and cultural resources as a result of lawful prospecting,

exploration, mining, and mineral processing operations, as well as activities reasonably incident to such uses. This should be accomplished by imposition of reasonable conditions *which do not materially interfere with such operations*. (FSM 2817.02, emphasis added)

The Forest Service found the substantial decreases in ore development that would result by requiring an alternative mining technique would not meet the definition of reasonable, would not allow Resolution Copper to dispose of all locatable minerals on which it has valid claims, and would materially interfere with its operations. For the above reasons, alternative mining techniques were considered but eliminated from detailed analysis.

### ***Brownfield Tailings Disposal***

During scoping, public comments requested that the Forest Service identify a “brownfield” location (a site that is largely disturbed by previous activity) to store the tailings waste generated in the mining process. A list of potential brownfield sites was developed by reviewing possible mining brownfield sites in Arizona that could potentially hold all or a portion of the tailings anticipated to be produced through mining operations described in the GPO.

Fourteen existing pits or brownfield mine sites were originally considered for tailings disposal and are described in the following text.

#### **AJO**

The expected pumping distance to the Ajo pit is estimated to be over 120 miles and would cross numerous public and private jurisdictions. The environmental harm associated with long-distance transport corridors would be substantial, and this location offers only a partial disposal option and does not prevent the placement of a large tailings facility on Federal land. For these reasons, use of the Ajo pit was considered to be unreasonable and was dismissed.

#### **CARLOTA**

The Carlota site is over an existing heap leach pad and has minimal to no pit capacity for containing all of the potentially acid generating (PAG) material; tailings storage would require an embankment and expansion of this heap leach area. The site is located on a complex geological area that results in high geological and hydrogeological constraints, and tailings located here have the potential to impair water quality in Pinto Creek and would require creek diversions. Location of the tailings storage facility in this location would not address the water quality issues, and the alternative was therefore dismissed.

#### **CASA GRANDE**

Initial estimates showed that the Casa Grande pit potentially had the capacity to hold the PAG tailings material. Upon further investigation, it was determined that it does not have adequate capacity to store the PAG tailings material and is therefore not a suitable option for future tailings storage. This and other pits were also considered further as possible components of an alternative that would dispose of all tailings in multiple brownfield locations, but there was insufficient capacity to store all tailings, even with multiple locations.

## **COPPER QUEEN (BISBEE, ARIZONA)**

Copper Queen Mine is a popular tourist attraction in Bisbee, Arizona. The mine hosts tours, includes a museum, and is visited by many tourists every year. The environmental harm associated with hundreds of miles of pipeline corridor disturbance across Federal, tribal, and other lands would be substantial. For these reasons, it was removed from further consideration for tailings storage.

## **COPPERSTONE**

The Copperstone site does not have the capacity to store all or even the PAG-only portion of the Resolution Copper Mine tailings; this location was therefore removed from consideration for tailings storage.

## **GREEN VALLEY / SIERRITA**

The Green Valley/Sierrita Mine has an ongoing mining operations; for that reason, it was dismissed from further investigation.

## **JOHNSON CAMP**

The Johnson Camp mine has the potential for future mining operations and does not have the capacity to store all or the PAG portion of the tailings. For these reasons, the site was removed from further consideration for tailings storage.

## **MIAMI AND INSPIRATION / MIAMI UNIT AND COPPER CITY**

The Miami and Inspiration / Miami Unit and Copper City mines are located within the Pinal Creek Water Quality Assurance Revolving Fund (WQARF), which is the State of Arizona's equivalent to Superfund. While not absolute, the legal concept of "joint and several liability" that drives Superfund means that use or ownership of these sites would potentially reflect liability on Resolution Copper Mining, LLC. Consideration of these sites was not considered reasonable and therefore they were dismissed.

## **PINTO VALLEY MINE**

The anticipated Pinto Valley Mine operation and closure was considered; however, it was determined that the mine could still be operational at the time when tailings storage is required for the Resolution Copper Project. Because current mine life is projected through 2039, the project team dismissed this location from further investigation. Tailings storage would require an additional embankment and expansion of this area.

## **RAY MINE**

The Ray Mine has an expected reserve life of between 2044 (ASARCO Grupo Mexico 2019) and 2066 (U.S. Army Corps of Engineers 2016) and is in the process of further expansion of a new tailings facility at Ripsey Wash as well as a land exchange with the U.S. Department of the Interior Bureau of Land Management (BLM). The Ray Mine was removed from further consideration because it is in operation and not available for tailings storage in the necessary project time frame.

## **RESOLUTION COPPER EAST PLANT SITE SUBSIDENCE AREA (POTENTIAL FUTURE BROWNFIELD SITE)**

In addition to reviewing existing brownfields, scoping commenters recommended that the tailings be stored in the proposed Resolution Copper Project East Plant Site subsidence area. The feasibility of placement of tailings in the subsidence area, either as slurry or filtered tailings, was considered during alternatives development. In this scenario, the tailings would be placed initially on undisturbed land above the mining panels in the area that would gradually become a subsidence pit. The subsidence area would then be filled with tailings as it expanded over time. This option was dismissed for safety concerns, both aboveground and belowground. In panel caving, it is paramount to control the rate of panel caving and prevent air gaps from developing above the caved zone, which can lead to potentially catastrophic air blasts. Loading of tailings above the panel cave operation could change the rock dynamics in unexpected and unknown ways. If it involves slurry, the added aspect of drainage from above further complicates mining operations. Safety hazards exist for personnel placing tailings aboveground as well, given the active subsidence and earth movement. Overall, it was determined that this option represented unreasonable safety hazards and did not conform to industry norms.

### **SAN MANUEL**

The expected pumping distance to the San Manuel pit is estimated to be approximately 50 miles (straight-line distance). A review of the site's geology shows a high-angle fault in the area. Hydrogeological conditions are unknown at this time but could present additional concerns. San Manuel was originally considered to represent a reasonable option; however, Resolution Copper raised concerns about its ability to control water quality after placement of PAG tailings in the existing pit, given the proximity to the San Pedro River. These concerns were further investigated by the project team, including review of Arizona Department of Environmental Quality (ADEQ) documents related to the closure of San Manuel. The best available information at this time suggests that use of the San Manuel pit would not successfully address the single driving issue of water quality. Specifically, the disposal methodology would not prevent oxidation of PAG material and current gradients would deliver acid drainage directly to the aquifer. Further, movement of seepage into groundwater and movement of groundwater away from the pit would not be controlled, as the current hydraulic sink would be expected to disappear without a pit lake present. The groundwater gradient would potentially deliver poor-quality groundwater directly to the San Pedro River. For these reasons, the San Manuel pit was eliminated from detailed analysis in the draft EIS (DEIS).

### **TOHONO CYPRUS**

The Tohono Cyprus site does not have the capacity to store all or the PAG portion of the tailings and was therefore eliminated from further consideration.

### **TWIN BUTTES**

Twin Buttes has ongoing operations and future operation plans that make it infeasible for future tailings storage. The location would also require tailings to be pumped almost 100 miles (straight-line distance).

## **Other Alternative Tailings Disposal Locations**

In response to public scoping comments, the Forest Service investigated a number of alternative tailings disposal locations (figure F-1). During the alternative evaluation process, the Forest Service reviewed the regional landscape to identify alternative locations that could potentially solve resource issues. These



locations were then combined with the alternative locations previously identified by Resolution Copper (see section 3.3.10.1 of the GPO) and evaluated to determine which locations should be dismissed and which locations should be carried forward for inclusion in the DEIS. Table F-3 presents the dismissal rationale for the tailings facility alternative locations not carried forward in the DEIS. These locations were dismissed because they do not improve upon significant issues of concern over the proposed GPO location.

## **Agency-Identified Alternative Tailings Disposal Locations and Techniques Considered but Ultimately Dismissed from Detailed Analysis**

As noted in table F-3, the alternative of using filtered (or “dry stack”) tailings rather than slurry tailings was eventually brought forward for detailed analysis at the Silver King location, very near the West Plant Site, rather than at the GPO location. This is now Alternative 4 (described in section 2.2.6) in the DEIS.

Additionally, as a result of extensive meetings and consultations during the latter part of 2017 and early 2018, between the Tonto National Forest, the BLM, and Resolution Copper, together with information provided by the Arizona State Land Department (ASLD), BLM, and other cooperating agencies, four additional alternative tailings locations and/or alternative construction techniques came under serious consideration. The first two of these were proposed near, but not in the exact same location as, the previously considered “BGC C” alternative location shown in figure F-1 and described in table F-3.

This general location south of the Gila River came to be known as the “Peg Leg” site, after the name of a nearby wash. The major advantages it presented as an alternative tailings storage site included a) relative remoteness from population centers and other infrastructure; b) relative proximity to other ongoing and historic mining activities; c) generally level topography on a base primarily consisting of alluvial soils, rather than the more upland, rocky, steeper terrain characteristic of the GPO and Silver King locations; and d) lower recreational use and perceived scenic value than the GPO and Silver King areas.

The two “Peg Leg” alternatives that ultimately emerged were proposed to occupy approximately the same footprint south of the Gila River and west of State Route 177, but each would employ different construction techniques.

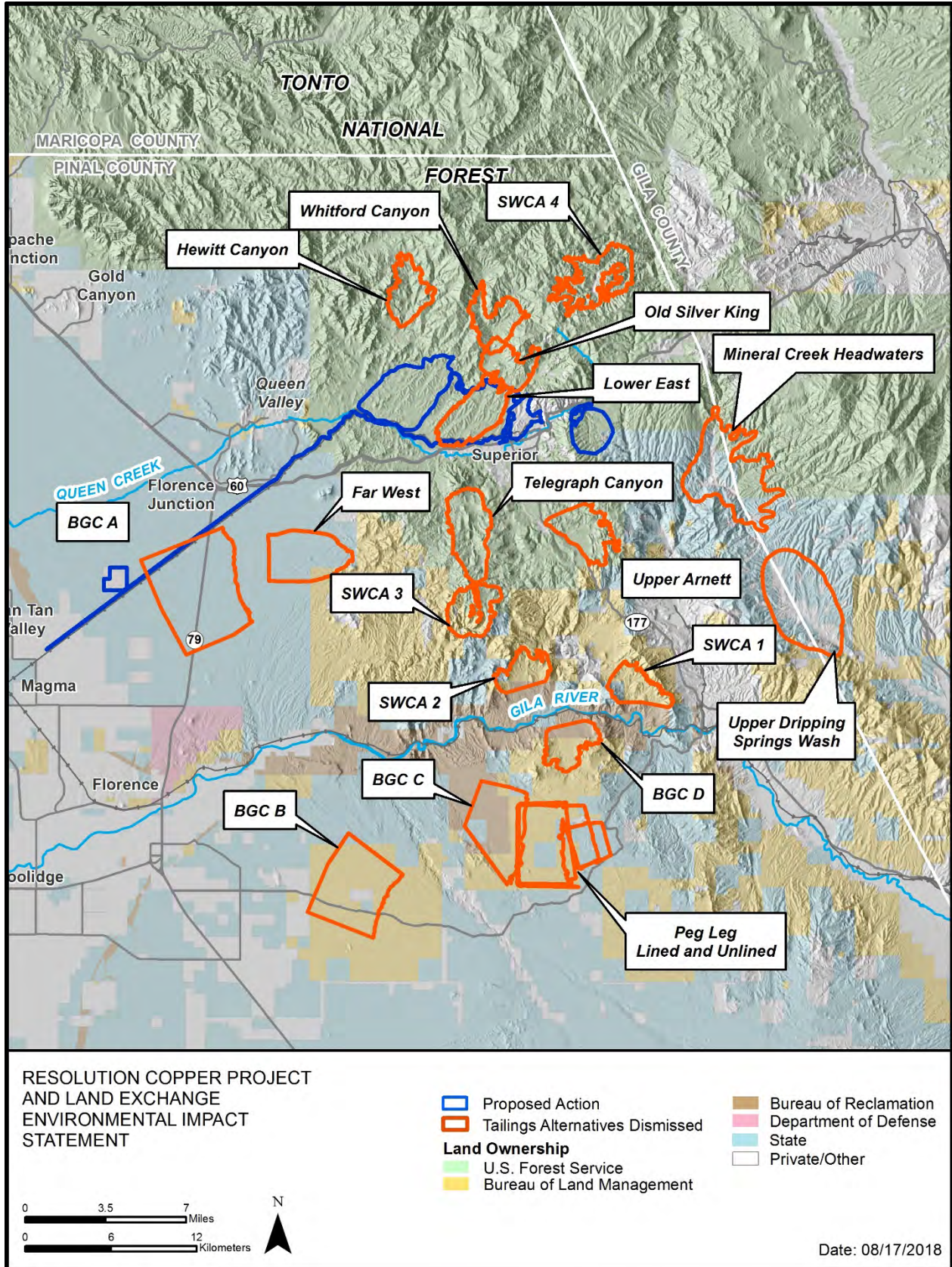


Figure F-1. Tailings facility alternative locations considered but dismissed from detailed study

**Table F-3. Alternative tailings facility locations considered but dismissed from detailed analysis**

<b>Alternative Location</b>	<b>Rationale for Dismissal</b>
Whitford Canyon	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts: higher tributary area relative to other alternative locations.</li> <li>• Very close to Superstition Wilderness designated Class II airshed; too close for permitting.</li> <li>• Recreation impacts: directly covers the Arizona National Scenic Trail and disrupts popular off-highway vehicle loop route connections.</li> <li>• Biological impacts on a larger variety of biotic communities than most of other alternatives, including on areas deemed sensitive vegetation communities.</li> </ul>
Hewitt Canyon	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts: higher tributary area relative to other alternative locations.</li> <li>• Very close to Superstition Wilderness designated Class II airshed; too close for permitting.</li> <li>• Recreation impacts on trails and disrupts popular off-highway vehicle loop route connections.</li> <li>• Biological impacts on a larger variety of biotic communities than most of other alternatives, including on areas deemed sensitive vegetation communities.</li> <li>• Longer tailings pipeline/transfer corridor relative to other alternative locations in the Queen Creek watershed.</li> </ul>
Telegraph Canyon	The location does not provide an overall improvement upon the GPO location for key resource issues (water resources, biological resources, recreation resources): <ul style="list-style-type: none"> <li>• Water resource impacts; hydrology drainage impacts; biological impacts on Important Bird Areas and riparian areas.</li> <li>• Recreation impacts on roads and trails; would cover large portion of the Arizona National Scenic Trail.</li> </ul>
Lower East	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts.</li> <li>• Closer to the receptor Boyce Thompson Arboretum.</li> <li>• Closer to U.S. Route 60 and town of Superior.</li> </ul>
Far West	The Forest Service sent an inquiry to the Arizona State Land Department (ASLD), the landowner, regarding the potential availability at this location for a tailings facility. ASLD responded that the agency has plans for future residential development for the area and therefore it is not available at this time, or in the future, for locating a tailings facility. For this reason, the location was dismissed from further investigation.
BGC A	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts, higher number of wells nearby.</li> <li>• Closer to receptors (residential areas).</li> <li>• Potentially encroaches on area infrastructure (roads).</li> </ul>
BGC B	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impact, proximity to Gila River (potentially already degraded water quality).</li> <li>• Closer to receptors (residential areas).</li> <li>• Visual resource impacts, proximity to Florence area and nearby residential areas.</li> </ul>
BGC D	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts: stormwater management more difficult due to local terrain and proximity to the Gila River.</li> <li>• Recreation impacts, including proximity to the Arizona National Scenic Trail.</li> </ul>
SWCA 1	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts: stormwater management more difficult due to local terrain and proximity to the Gila River.</li> <li>• Recreation impacts, including proximity to the Arizona National Scenic Trail.</li> </ul>
SWCA 2	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts: stormwater management more difficult due to local terrain and proximity to the Gila River.</li> </ul>

<b>Alternative Location</b>	<b>Rationale for Dismissal</b>
SWCA 3	The location does not provide an overall improvement upon the GPO location for key resource issues: <ul style="list-style-type: none"> <li>• Landscape constraints (very steep terrain, occupy two watersheds, high probability of faults for landslides).</li> <li>• Recreation impacts, proximity to the Arizona National Scenic Trail.</li> </ul>
SWCA 4	This location was removed from consideration for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts, drainage into Roosevelt Lake.</li> <li>• Encroaches on Superstition Wilderness, a Class I airshed.</li> </ul>
Upper Arnett	This location was removed from consideration for key resource issues: <ul style="list-style-type: none"> <li>• Water resource impacts, impacts Arnett Creek, higher upstream in the watershed.</li> <li>• Biological resources, contains more unfragmented wildlife habitat, compared with other alternatives.</li> <li>• Proximity to area infrastructure, State Route 177.</li> <li>• Design confined by highway and landscape features provides less design flexibility.</li> <li>• Longer tailings pipeline/transfer corridor relative to other alternative locations.</li> </ul>
Filtered Tailings at the GPO Tailings Facility Location	In response to public scoping comments, the Forest Service considered a tailings alternative of filtered tailings (also commonly known as dry stack tailings) at the proposed GPO tailings facility location. Ultimately, the Forest Service determined that due to the logistical concerns associated with water management and the tailings pipeline/transfer corridor, the evaluation of this alternative tailings technique would occur at the Alternative 4 (Silver King) location.
Silver King	The original location as considered by Resolution Community Working Group was moved to avoid a historic cemetery, underground mine workings of Silver King, mineral estate, and private land. The Silver King location was eliminated as a suitable location for slurry impoundment for water resource concerns but is being moved forward for detailed analysis as a filtered tailings location.
BGC C	This alternative location represented the first iteration of what eventually became Alternative 5 – Peg Leg. This specific location was relocated to move off of U.S. Bureau of Reclamation withdrawn lands; once moved, it evolved into the Peg Leg – Lined and Peg Leg – Unlined alternatives (see below).
Peg Leg – Lined	See more detail in the following text.
Peg Leg – Unlined	See more detail in the following text.
Mineral Creek Headwaters	See more detail in the following text.
Upper Dripping Spring Wash	See more detail in the following text.

## ***Peg Leg – Lined***

The first, known as “Peg Leg – Lined,” would be located primarily on BLM- and ASLD-administered lands (figure F-2) and would be constructed behind a downstream-type embankment, rather than an upstream-type embankment as proposed at the GPO location, and would be fully lined.

Though not as efficient with space or materials necessary to construct as an upstream embankment, the downstream embankment configuration is considered robust and least prone to failure of all tailings embankment types. However, the great disadvantage of the downstream-type embankment is that it requires enormous amounts of non-tailings material (i.e., earthfill) to construct, and it must occupy in perpetuity a substantially greater surface area adjacent to the tailings impoundment itself. The issue with constructing a downstream embankment with borrow materials is that storage requirements would be increased by about one-third because the cyclone sand materials that are used to construct the other embankment options would need to be stored behind the borrow embankment.

Under the “Peg Leg – Lined” alternative, the PAG and non-potentially acid generating (NPAG) cells would be kept separate, rather than merging later during tailings facility development as under the GPO plan, and both cells would be fully lined with an engineered low-permeability liner or equivalent containment system that would continue to be enlarged vertically as the two cells grew in height over time. The PAG cell would be kept continuously saturated to reduce the chances for oxidation/metal leaching, and tailings would be deposited in both cells subaqueously. Any seepage from the PAG and NPAG cells would be collected via the tailings liners and recycled back into the process water, and if necessary treated prior to recycling.

All other major mine plan components such as the East Plant Site infrastructure, block-cave mining, West Plant Site processing, slurry concentrate delivery to the filter plant and loadout facility, and other utility corridors would remain unchanged from those proposed in the GPO, with the exception of a pipeline corridor needed to bring slurry tailings to the Peg Leg site.

### ***Peg Leg – Unlined***

Conscious of both the advantages and limitations presented by the downstream embankment type, the Tonto National Forest decided to conduct preliminary analysis of another embankment type and seepage control methodology at the Peg Leg site.

Rather than a downstream embankment configuration, the “Peg Leg – Unlined” alternative proposed a centerline-type embankment, in which subsequent “raises” or “lifts” to the embankment over time would be built atop earlier levels of compacted cycloned tailings and earthfill.

The decision to proceed with this alternative as an unlined facility was deliberate in that it would allow direct comparison of the environmental effects of an unlined facility at this location—i.e., on a primarily alluvial soil base—versus a fully lined facility at the same Peg Leg location, and also provide an opportunity to evaluate the effects of an unlined facility on alluvium versus an unlined facility at the GPO location, as described in the original GPO Alternative 2 – Proposed Action (since abandoned in favor of detailed analysis of the two GPO Modified Proposed Actions now presented in the DEIS in sections 2.2.4 and 2.2.5).

Under the “Peg Leg – Unlined” alternative, seepage would be controlled through a series of downstream collection embankments and ponds, monitoring wells, and pumpback systems.

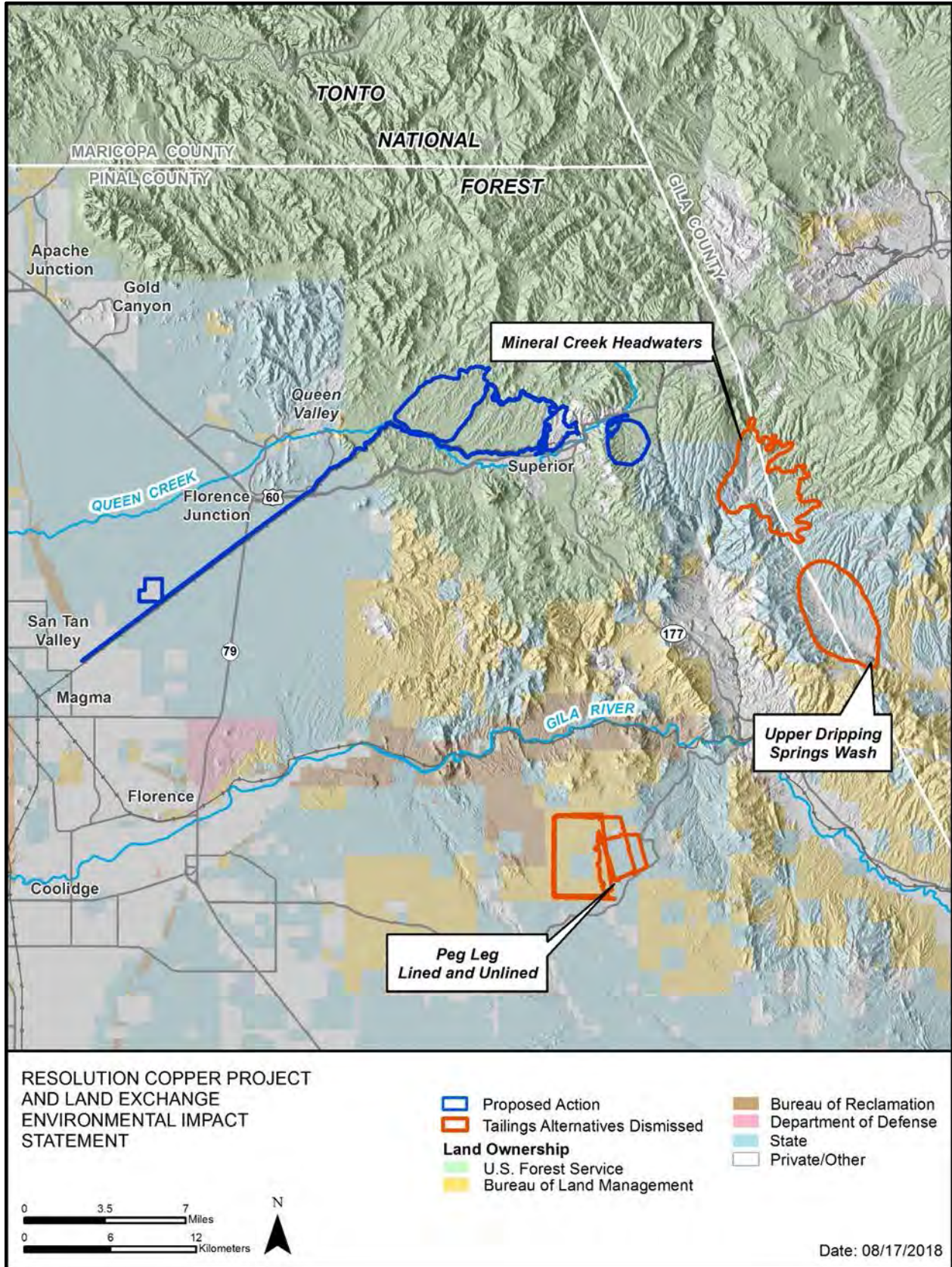


Figure F-2. Alternative tailings facility locations on BLM lands

## **RATIONALE FOR DISMISSAL FROM DETAILED ANALYSIS OF THE “PEG LEG – LINED” AND “PEG LEG – UNLINED” ALTERNATIVES**

After several months of preliminary analysis by Forest Service resource specialists and Resolution Copper technical staff, it was determined that neither the Peg Leg – Lined nor the Peg Leg – Unlined alternatives warranted detailed analysis in the EIS.

Resolution Copper’s engineering consultants estimated that generating the huge volumes of earthfill from within the Peg Leg tailings site’s footprint in order to construct a downstream embankment would require excavating 0.9 billion tons of soil to a depth up to 160 feet from throughout the roughly 7,000-acre facility—essentially creating a major open-pit aggregate mining operation in addition to the underground mining proposed at the Oak Flat/East Plant Site. Further calculations estimated the effort would require full-time use of more than 140 earthmoving vehicles (dozers, backhoes, haul trucks, etc.), an increase over the amount of equipment needed for other slurry tailings alternatives. The direct carbon dioxide equivalent (CO<sub>2e</sub>) emissions are 80 to 132 percent higher than the emissions expected at any other alternative embankment types under consideration. The project would have emissions of carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), nitric oxide (NO), volatile organic compounds (VOCs), and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>). The Tonto National Forest therefore decided to eliminate this alternative because the adverse environmental effects of implementing it were determined to be substantially greater than either the GPO Proposed Action or the other tailings site alternatives already under consideration.

Similarly, the Peg Leg – Unlined alternative was eliminated from further consideration because preliminary analysis had shown the subsurface seepage resulting from having an unlined facility atop an alluvial soil base would be so great as to not be controllable, which would in turn require substantial additional pumping of fresh water to make up the lost seepage.

However, after several months of study, Resolution Copper approached officials at the Tonto National Forest with a proposal for yet a third alternative tailings facility design at the Peg Leg site that combined best practice tailings management aspects from both the Peg Leg lined and unlined alternatives. Their recommended design would shift the entire facility slightly to the east so that the PAG cells could be constructed as a physically separate facility atop a broad outcropping of predominately consolidated rock, retained behind a downstream embankment, while the much greater volume of NPAG tailings would remain on the alluvial base immediately to the west, retained behind a centerline-type embankment. The entire PAG facility would be lined with an engineered low-permeability barrier, while the NPAG facility would be partially lined with an engineered low-permeability liner along the interior, upstream side of the embankment. This design preserves an alternative at the Peg Leg location and incorporates key components of the downstream embankment, centerline embankment, and lining.

This new alternative Peg Leg design has been carried forward for detailed analysis in the DEIS as Alternative 5 – Peg Leg (see section 2.2.7).

In late 2017 and early 2018, meetings between Tonto National Forest managers and BLM managers and resource specialists resulted in two additional tailings storage facility locations being put forth for consideration—neither of which either the Tonto National Forest or Resolution Copper had previously evaluated. These two alternative locations, which were initially referred to as the Mineral Creek Headwaters and Upper Dripping Spring alternatives, are described in greater detail in the following text.

## ***Mineral Creek Headwaters***

The BLM identified two general locations in watersheds approximately 7 and 11 miles, respectively, to the southeast of the town of Superior and approximately 3 miles northeast and directly east of the ASARCO Ray Mine as potential tailings sites that the agency believed warranted at least preliminary investigation (see figure F-2).

The first of these, which BLM referred to for planning purposes as the Mineral Creek Headwaters site, is a 6,077-acre area comprising 2.3 acres of BLM-administered public lands, 662 acres of Arizona State Trust surface with Federal mineral estate, 4,304 acres of Arizona State Trust lands with no Federal mineral estate, 80 acres of private surface with Federal mineral estate, and 1,029 acres of private lands with no Federal mineral estate. BLM stated that mining company ASARCO presently holds 21 mining claims within the area. The topography is a steep canyon with smaller side canyons.

Resource specialists and planners at the Tonto National Forest conducted a first-stage screening of the suitability of the Mineral Creek Headwaters area as a site for a future tailings storage facility. Although presumably of sufficient size to store the requisite volume of tailings, the site lies directly atop a perennial reach of Mineral Creek and abundant riparian vegetation. It would also occupy designated critical habitat for Gila chub. For these reasons the Mineral Creek Headwaters site was eliminated from further consideration as a viable alternative for detailed analysis in the EIS.

## ***Upper Dripping Spring Wash***

The second potential site identified by the BLM is known as Upper Dripping Spring Wash, a 7,058-acre area directly east of the ASARCO Ray Mine. The site consists of a broad ephemeral wash bounded on the west by the Dripping Spring Mountains and on the east by the Mescal Mountains and the Pinal Mountains, approximately 13 miles north of the confluence of Dripping Spring Wash and the Gila River.

In terms of jurisdiction, the area identified by the BLM comprises 69 acres of BLM-administered public lands, 800 acres of Arizona State Trust surface with Federal mineral estate, 3,762 acres of Arizona State Trust lands with no Federal mineral estate, and 2,427 acres of private lands with no Federal mineral estate. The BLM identified 13 existing mining claims located within the proposed general boundaries of the site. Resolution Copper considered their initial hydrologic and geological assessments of the area highly promising and they engaged their engineering staff and contractors to develop a preliminary design for a tailings facility near this location. The Upper Dripping Spring Wash alternative was eliminated from further consideration as an alternative for detailed analysis in the EIS. However, based on a design for a 3,995-acre tailings impoundment (exclusive of roads, pipeline corridors, and other auxiliary facilities) on only private and Arizona State Trust lands, the Tonto National Forest approved detailed analysis in the DEIS for Alternative 6 and named it “Skunk Camp” for the nearby Skunk Camp Wash. Please see chapter 2 of the DEIS, section 2.2.8.