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TECHNICAL MEMORANDUM

To: Jeff Humphrey
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From: SWCA Environmental Consultants, Third-Party Project Contractor and Designated Federal Representative for the Tonto National Forest for the Resolution Copper Project Section 7 Consultation Process

Date: October 2, 2020

Re: **Resolution Copper Project Biological Assessment Addendum No. 2 / Arizona Consultation Code: 02EAAZ00-2020-F-0822**

INTRODUCTION

SWCA Environmental Consultants (SWCA), as the Third-Party Project Contractor and Designated Federal Representative for the Tonto National Forest for the Resolution Copper Project Section 7 Consultation Process, has prepared this technical memorandum to add, change, correct, and clarify portions of the proposed action, conservation measures, and other sections of the Biological Assessment (BA) for the Resolution Copper Project (herein called the project). This memorandum also provides an analysis of effects on species listed under the Endangered Species Act (ESA) for Pinal and Gila Counties, and serves as BA Addendum No. 2.

PROPOSED ADDITIONS, CHANGES, CORRECTIONS, AND CLARIFICATIONS

SRP Vegetation Maintenance

Salt River Project (SRP) has provided additional details on Operations and Maintenance (O&M) activities along power lines, including vegetation maintenance (appendix A). Although the description of O&M activities includes mechanical mowing (section 2.2.1 in appendix A), SRP has agreed not to use mechanical mowing as a vegetation treatment method on the project, and the following seven conservation measures will be implemented for Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*):

- Work crews will be educated on the avoidance of Arizona hedgehog cactus prior to scheduled work in potential habitat. The training for work crews will include one or more members of the crew and the supervisor or utility employee overseeing work. The training will include education on the appearance of Arizona hedgehog cactus; reference materials to assist in avoidance in the field; field visit, if needed, for refinement of search image; and procedures on identifying and

avoiding any Arizona hedgehog cactus or similar-looking cacti not found during pre-work inventory.

- Do not use a mechanical mower for routine vegetation maintenance within Arizona hedgehog cactus occupied habitat (U.S. Forest Service 2012).
- For vegetation maintenance work, drive vehicles only on existing roads and utility access routes to access the right-of-way. Do not drive vehicles off-road within the right-of-way.
- Prior to each vegetation management cycle, a survey for Arizona hedgehog cactus will be conducted by a qualified botanist or other professional experienced in the identification of this plant. GPS coordinates of found plants will be recorded and reported to the Forest Service.
    - For manual cutting of vegetation, all Arizona hedgehog cactus within and immediately adjacent to the work area are to be flagged for avoidance.
    - In an effort to be conservative, all Arizona hedgehog cactus and those similar to it may be included in the flagging for avoidance.
- During vegetation management work, crews will check for Arizona hedgehog cactus under target plants prior to treatment. If crews find a cactus, they will implement appropriate conservation measures to avoid the cactus.
- During manual vegetation maintenance work, if an Arizona hedgehog cactus occurs underneath and is shaded by a shrub to be cut, the target shrub will be left untreated. In very rare circumstances, the nurse plant may be selectively trimmed in a manner to maintain the same shading protection for the Arizona hedgehog cactus. No more than 30% of the nurse plant may be trimmed.
- Prior to ground-disturbing line maintenance activities, a qualified botanist or other professional experienced in the identification of this plant will identify all cacti within and immediately adjacent to the work area. Arizona Public Service (APS) will flag plants for avoidance. In an effort to be conservative, all Arizona hedgehog cactus and those similar to it will be flagged and avoided.
- For line maintenance, drive vehicles only on existing roads and utility access routes to access the right-of-way. If driving off road within the right-of-way is necessary for line maintenance repairs, inventory, flag, and avoid Arizona hedgehog cactus prior to the work.

Recreation

Mitigation measures designed to offset the loss of recreation opportunities on the Oak Flat Federal Parcel have been incorporated into the conservation measures of the proposed action. These mitigation measures include construction or improvement of 9.3 miles of motorized trail and 11.3 miles of non-motorized trail, including improved access to the “Inconceivables” rock climbing area, and development of the Castleberry Campground (appendix B).

Figure Updates

Several figures in the BA have been updated to reflect changes in the project components and action area (appendix C).

Arizona Hedgehog Cactus

A geographic information system (GIS) error in calculating the number of Arizona hedgehog cactus within the action area was discovered; thus, we are providing new numbers for that section on pages 96 and 97 of the BA:

Surveys conducted by WestLand since 2004 to identify individual Arizona hedgehog cactus occurred on about 729.6 acres within the known species' range in the project area and on an additional about 2,423.7 acres within the action area. The area surveyed within the project area is about 88.7 percent of the total project area within the known species' range and about 1.8 percent of the total known species' range (39,725.3 acres). The additional area surveyed within the action area is about 27.0 percent of the total additional acreage in the action area within the known species' range and about 6.1 percent of the total known species' range. Surveys did not cover about 93.2 acres within the project area in the known species' range and about 6,559.8 acres of the action area within the known species' range. The action area covers about 22.6 percent of the total known species' range. These surveys were conducted prior to the determination of the proposed action and for other efforts and thus do not cover the entire project and action areas.

In total, 165 Arizona hedgehog cacti have been documented during project-related surveys within the project area. An additional 1,962 individuals were located outside the project area but within the action area. The number of individuals is representative of surveys on about 88.7 percent of the known species' range within the project area. Assuming that the species is present on the remaining 11.3 percent of the known species' range within the project area at the same density as the surveyed area, it is estimated that 21 cacti occur in that area, bringing the total to 186 individual Arizona hedgehog cactus estimated in the project area (table 10). Sixty additional Arizona hedgehog cactus individuals were added to the 186 estimated individuals, as we assume additional individuals would be found during pre-construction surveys, for a total of 246 individual Arizona hedgehog cacti estimated to occur in the project area. Assuming that the species is present throughout the action area at the same density as in the 27.0 percent of the action area surveyed, it is estimated that there are 7,272 individual Arizona hedgehog cactus in the action area not including those in the project area within the known species' range.

Table 10. Arizona hedgehog cactus survey summary

Proposed Action Component	Project Component (acreage)	Project Component within Known Species' Range (acreage)	Percent of Project Component Surveyed within Known Species' Range	Individuals Observed during Surveys	Individuals Estimated for Project Component
Access Roads	3.6	1.6	75.3%	0	0
East Plant Site and Magma Road realignment	188.8	22.1	100%	[redacted]	[redacted]
Filter plant/Loadout facility disturbance	552.5	–	–	–	–
MARRCO corridor	685.2	–	–	–	–
Silver King Road realignment	13.0	–	–	–	–
Subsidence area (excluding East Plant Site disturbance)	1,672.4	387.1	100%	[redacted]	[redacted]
Skunk Camp tailings storage facility fence line	5,609.0	–	–	–	–

Proposed Action Component	Project Component (acreage)	Project Component within Known Species' Range (acreage)	Percent of Project Component Surveyed within Known Species' Range	Individuals Observed during Surveys	Individuals Estimated for Project Component
Skunk Camp tailings pipeline	137.4	56.7	98.3%	[redacted]	[redacted]
Skunk Camp tailings storage facility disturbance	4,002.1	–	–	–	–
Transmission line 115-kV corridor	42.5	3.0	100%	[redacted]	[redacted]
Transmission line 115-kV/ Tailings pipeline collocated corridor	831.9	294.9	68.9%	[redacted]	[redacted]
Transmission lines collocated	61.0	57.3	100%	[redacted]	[redacted]
West Plant Site	940.1	–	–	–	–
Total Project Area	**14,739.5**	**822.8**	**88.7%**	**165**	**186**

H&E Ranch

The configuration of the various parcels on the H&E Ranch where specific mitigation activities are planned has changed. Mitigation activities are planned on a 300-acre Terrace Reestablishment Area and a 15-acre Wetland Reestablishment Area (see appendix D: section 4.2.3, and figure 10). No existing riparian vegetation would be removed, as shown in figure 10 of appendix D and clarified through emails between Jeff Johnson (SWCA) and Kathy Robertson (U.S. Fish and Wildlife Service) on September 23, 2020. The effects analysis in the BA formerly stated that a single strand of riparian vegetation would be removed along the eastern bank of the San Pedro River.

Breeding Season Dates

At mitigation areas, vegetation clearing activities would be avoided during the period of May 1 through September 30 so as to cover the breeding seasons for both southwestern willow flycatcher (*Empidonax traillii extimus*) (May 1 through September 15) and yellow-billed cuckoo (*Coccyzus americanus*) (May 15 through September 30). These dates were erroneously given as May 15 through September 30 for the MAR-5 discharge area (page 49) and the H&E Ranch (page 50).

In Section 5.3, Southwestern Willow Flycatcher and Yellow-billed Cuckoo Conservation Measures, conservation measures 1 and 4 (page 84) apply only to yellow-billed cuckoo. The avoidance dates for these conservation measures are May 15 through September 30, rather than May 1 through September 30.

There was an additional error in conservation measure 4 (section 5.3, page 84), which erroneously stated that vegetation clearing and ground-disturbing activities "**not** be completed before May 1 or after September 30." The corrected text is:

- In areas where surveys show presence of yellow-billed cuckoo, to prevent direct effects on cuckoos (injuries or fatalities to adults, eggs, or young), vegetation clearing and ground-disturbing activities associated with pipeline construction within 500 feet of the ordinary high-water mark of Mineral Creek will be completed before May 15 or after September 30, outside the breeding season for the species.

In the Analysis of Effects section for southwestern willow flycatcher, all references to the breeding season dates for flycatchers should be May 1 through September 15. The dates given in the Power Transmission Facilities Closure and Reclamation section (page 153) were erroneously stated as May 15 through September 30. Similarly, all references to the breeding season dates for cuckoos should be May 15 through September 30. The dates given in the Tailings Pipeline Corridor section (page 166) were erroneously stated as May 1 through September 15.

Tailings Pipeline and Collocated 115-kV Transmission Line Creek Crossings

Throughout the BA, the sections discussing the tailings pipeline and collocated 115-kV transmission line refer to the crossing of Mineral Creek. The trenchless pipeline crosses Mill Creek just above the confluence with Mineral Creek whereas the 115-kV transmission line crosses Mineral Creek just above the confluence with Mill Creek, parallels Mineral Creek, and then crosses Mineral Creek again to rejoin the pipeline. The location of the pipeline and transmission line crossings is now referred to as Mineral/Mill Creek.

The analysis of the effects of the collocated 115-kV transmission line on yellow-billed cuckoo (page 167) omitted discussing the crossing of Devil's Canyon and is modified as follows:

- Old text: Surveys of Mineral Creek have resulted in repeated detections of cuckoos and have suggested that breeding cuckoos may be present in the area; thus, the power lines that would cross Mineral Creek in two locations and parallel Mineral Creek for 0.5 mile would present a collision hazard for migratory, transient, and breeding cuckoos.
- New text: Surveys of Mineral Creek have resulted in repeated detections of cuckoos and have suggested that breeding cuckoos may be present in the area; thus, the power lines that would cross Mineral/Mill Creek and parallel Mineral Creek for 0.5 mile would present a collision hazard for migratory, transient, and breeding cuckoos. The power lines would present a collision hazard for migratory and transient cuckoos at the crossing of Devil's Canyon.

ADDITIONAL EFFECTS ANALYSIS

SRP Vegetation Maintenance

The mitigation measures identified as part of SRP's O&M activities are designed to benefit Arizona hedgehog cactus by identifying and avoiding Arizona hedgehog cactus during O&M activities, and no adverse effects are anticipated as a result of adding these conservation measures to the proposed action. Therefore, the determination of effect for Arizona hedgehog cactus remains as described in the BA—i.e., *may affect and is likely to adversely affect*. The addition of these conservation measures to the proposed action is beneficial, so the adverse level of the overall effects will be lessened.

Recreation

The only portion of the recreation mitigation measures that overlaps habitat that might be used by species analyzed in the BA is Castleberry Campground, which would be developed along Queen Creek. Development of the campground would result in the alteration or removal of up to 35.5 acres of riparian vegetation, which provides potential migratory/stopover/foraging habitat for southwestern willow flycatcher and yellow-billed cuckoo. Both cuckoos and flycatchers occur infrequently along Queen Creek, and these impacts are expected to be insignificant and discountable. Therefore, the determination of effect for southwestern willow flycatcher and yellow-billed cuckoo remains as described in the BA—i.e., *may affect, but is not likely to adversely affect*.

Figure Updates

The changes in the project components and associated action area affect only the Arizona hedgehog cactus, which is addressed below.

Arizona Hedgehog Cactus

The number of acres of expected disturbance within the Arizona hedgehog cactus range has not changed. The estimated number of known Arizona hedgehog cactus that would be removed or transplanted remains at 165, and the estimated number of additional individuals decreased by two from 23 to 21, for a total of 186. In addition, we assume approximately 60 additional Arizona hedgehog cactus individuals would be found during pre-construction surveys, leading to potential impacts on up to 246 individuals. This represents a very slight decrease in the estimated number of individuals affected, and the determination of effect remains as described in the BA—i.e., *may affect and is likely to adversely affect*.

H&E Ranch

Avoidance of all riparian vegetation at H&E Ranch changes the analysis of effects for compensatory mitigation areas in the following sections of the BA:

- Southwestern willow flycatcher (section 6.4.2, page 154)
    - Old text: Tamarisk removal and drainage reconstruction could benefit flycatchers by promoting the establishment and maintenance of native riparian vegetation but could also include a temporary reduction in available foraging/migratory/dispersal habitat due to removal of a single strand of vegetation along the eastern bank of the San Pedro River.
    - New text: Drainage reconstruction, reconnection of the uplands with the mainstem of the San Pedro River, and revegetation could benefit flycatchers by promoting the establishment and maintenance of native riparian vegetation.
- Yellow-billed cuckoo (section 6.5.2, page 172)
    - Old text: Drainage reconstruction could benefit cuckoos by promoting the establishment and maintenance of native riparian vegetation. Mitigation efforts could also include a temporary reduction in available foraging/migratory/dispersal habitat due to removal of a single strand of vegetation along the eastern bank of the San Pedro River.
    - New text: Drainage reconstruction, reconnection of the uplands with the mainstem of the San Pedro River, and revegetation could benefit cuckoos by promoting the establishment and maintenance of native riparian vegetation.
- Yellow-billed cuckoo proposed critical habitat (section 6.6.2, page 177)
    - Old text: A single strand of riparian vegetation within proposed critical habitat along the eastern bank of the San Pedro River could be removed by drainage reconstruction. Drainage reconstruction and subsequent planting of native species could benefit proposed critical habitat by promoting the establishment and maintenance of native riparian vegetation.
    - New text: Drainage reconstruction, reconnection of the uplands with the mainstem of the San Pedro River, and revegetation could benefit proposed critical habitat by promoting the establishment and maintenance of native riparian vegetation.

- Southwestern willow flycatcher critical habitat (section 6.7.2, page 179)
    - Old text: A single strand of riparian vegetation within designated critical habitat along the eastern bank of the San Pedro River could be temporarily removed by drainage reconstruction. Drainage reconstruction and subsequent planting of native species could benefit designated critical habitat by reestablishing natural runoff and promoting the establishment and maintenance of native riparian vegetation.
    - New text: Drainage reconstruction, reconnection of the uplands with the mainstem of the San Pedro River, and revegetation could benefit designated critical habitat by promoting the establishment and maintenance of native riparian vegetation.

Although the habitat effect at H&E Ranch that was previously described in the BA no longer exists, the determination of effects for both species remains as described in the BA—i.e., *may affect, but is not likely to adversely affect*.

Breeding Season Dates

The correction of errors in breeding season dates has no impact on the analysis of effects for either southwestern willow flycatcher or yellow-billed cuckoo.

Tailings Pipeline and Collocated 115-kV Transmission Line Creek Crossings

The update in creek crossing names has no influence on the analysis of effects for any species.
The addition of text acknowledging the possibility of yellow-billed cuckoo colliding with transmission lines at the Devil's Canyon crossing also has no influence on the determination of effects, which already explicitly incorporated these collision risks.

CONCLUSIONS

These additions, changes, and corrections should now be considered as part of the BA and also be included in the proposed action for the Section 7 consultation and resulting Biological Opinion.
The effects determinations for all species remain the same.

APPENDIX A

SRP Power Line Operations and Maintenance

SRP POWER LINE OPERATIONS AND MAINTENANCE

Operations and Maintenance (O&M) activities comprise the actions that are taken to address the performance and upkeep of property and equipment. These include, but are not limited to (1) actions focused on scheduling, procedures, and work/systems control and optimization; and (2) performance of routine, preventive, predictive, scheduled, and unscheduled actions aimed at preventing equipment failure or decline with the goal of maintaining or increasing efficiency, reliability, and safety. Inadequate maintenance of energy infrastructure can lead to threats of wildfire and risks to public safety.

O&M activities for transmission facilities are dictated by the inspection and maintenance requirements determined by SRP. SRP has established a priority ranking system that defines the type and frequency of inspections of poles and towers, equipment, access routes, and vegetation management. SRP considers the general age of the infrastructure, the number and types of customers on the circuit, the surrounding geography and environmental constraints, accessibility, and the impact of failures on the transmission network. Additional factors determining the frequency of inspection and maintenance activities include environmental conditions present in a particular geographic area (e.g., vegetation, dust, and bird droppings), the level of vandalism of facilities (e.g., insulators damaged by gunshot), the severity of storms (e.g., monsoons, winds), other natural disasters (e.g. fires, floods) and accidents, and the normal aging of the facilities.

O&M activities required to maintain electrical transmission infrastructure, and ancillary facilities, require the use of various types of equipment to access, inspect, and fix equipment. Activity types, frequency, duration, and vehicles/equipment needed depend upon voltage, structure type, and location.

An overview of O&M activities identifying the voltage, frequency, duration and types of equipment are described in detail within ***Table 1. Operations and Maintenance Summary Table*** based on the current maintenance practices.

Table 1. Operations & Maintenance Summary Table

Activity	Line Voltage	Frequency[1]	Duration	Amount of Each Circuit	Equipment	Comments
Transmission Line Maintenance						
Line Maintenance Aerial Inspection	Transmission	2 per year	Hours/Days	Entire Circuit	Helicopter	
Line Maintenance Ground Inspection	All overhead	Every 5 years	Days/Weeks	Entire Circuit	Helicopter Pickup truck UTV	Helicopter only used if area is inaccessible
Line Maintenance	All	Minor repairs - Every 1-10 years Structure replacement - Every 10-60 years (approximately)	Days/Weeks	Single location or select locations on a circuit.	Backhoe Boom truck Bucket truck Cable puller truck Caterpillar D4 Caterpillar D5 Crane Helicopter Hole digger truck Other repair trucks Pickup truck UTV Trailer attachments	Line maintenance repairs are limited to a single structure or small numbers of structures and occurs infrequently. Minor repairs include replacing insulators, bolts, and other hardware. Helicopter used if area is inaccessible and/or in emergency situations.

[1] Frequency is listed for SRP's entire system, not just the proposed transmission line. This gives a relative indication of the frequency of this type of activity.

Activity	Line Voltage	Frequency[1]	Duration	Amount of Each Circuit	Equipment	Comments
Unscheduled Emergency Inspection	All	Infrequent - About 10 hazards identified per year	Hours/Days	1 span to entire circuit (entire circuit infrequent)	Helicopter Pickup truck UTV	Identified by helicopter, pickup truck or UTV first, then other vehicles used for repair work.
Emergency Line Maintenance	All	5-10 per year	Hours/Days	Single location or select locations on a circuit.	Backhoe Boom truck Bucket truck Cable puller truck Caterpillar D4 Caterpillar D5 Crane Helicopter Hole digger truck Other repair trucks Pickup truck UTV Trailer attachments	Repair vehicles and helicopter only utilized if hazard warrants use of these vehicles
Vegetation Management						
Vegetation Aerial Inspection	Transmission	Annually	Hours/Days	Entire Circuit	Helicopter	

Activity	Line Voltage	Frequency[1]	Duration	Amount of Each Circuit	Equipment	Comments
Vegetation Ground Inspection	All overhead	Every 1-5 years	Hours/Weeks	Entire Circuit	Pickup truck UTV Walk	
Routine Vegetation Maintenance	All overhead	Every 1-5 years	Weeks/1-2 Months	Entire Circuit	Bucket truck (infrequent) Chipper trailer (infrequent) Mechanical mower (some lines) Pickup truck UTV	Portions of power line where line is high above vegetation or where incompatible vegetation does not occur or has not regrown would not be treated.
Hazard Vegetation Treatment	All overhead	Infrequent - Less than 1 per year	Hours/Days	1 span to entire circuit (entire circuit infrequent)	Pickup truck UTV Walk	

1 TRANSMISSION LINE MAINTENANCE

Inspection programs are used by SRP to monitor the integrity of the system and to detect problems prior to failure. Line maintenance involves visual inspections (aerial and ground) to identify problem areas along overhead transmission lines, structures, and hardware, as well as the repair and replacement of these problem areas. Defects identified in the inspections can be categorized as hazardous, which require treatment as soon as possible, or non-hazardous, which are treated according to a priority level system.

1.1 AERIAL INSPECTIONS

SRP conducts aerial inspections of their transmission lines. During the inspections, a helicopter flies along the power line at 35 to 70 mph at or just above the height of the structures at about 50 to 150 feet off the ground, except where terrain or trees are such that a higher elevation is required. The low-level flights are intended to get a close look at the power line, structures, and associated equipment to identify areas that require repair. The helicopter may hover or circle over the lines to get a closer look and may land near a potential problem site. The problems identified during the flight are recorded and scheduled for treatment.

The SRP transmission aerial inspections include 115, 230, and 500kV power lines and are conducted twice per year where air-space access is not restricted. Currently, the flights occur in the spring sometime between mid-March and mid-May and again in the fall between October and December 1 but could potentially occur at any time of year. The aerial inspections take five to seven days to complete per cycle.

1.1.1 LIDAR Inspections

In addition to the routine inspection flights, SRP may conduct flights for gathering aerial photography and Light Detection and Ranging (LIDAR) data along the transmission power lines. SRP does not currently have programs to collect LIDAR data on any rights-of-way (ROW) but may in the future.

Should SRP decide to collect LIDAR data, it is anticipated that LIDAR flights could occur during any time of year, but ideally would be scheduled in the late spring or early fall timeframe when there are leaves on the trees. The helicopter would fly between 300 and 1,000 feet above the ground and directly over the power lines. The helicopter will make one pass on each transmission line.

Prior to a LIDAR flight, a crew may place ground control global positioning system (GPS) devices and weather stations in the ROW in multiple locations for a line or close group of lines. The stations are portable and about 5 to 6 feet tall. They sit temporarily on the ground while the flight

is conducted for that line, then taken off site once the flight is complete. The stations would be placed along or adjacent to the side of established roads within the utility ROW.

1.2 GROUND INSPECTIONS

Ground inspections include a detailed survey of all lines, structures, hardware, and associated equipment along the lines. The inspections are typically conducted by one or two inspectors driving a pickup truck, utility terrain vehicle (UTV) or by walking into areas to document future repair work. The inspector may inspect the structure foundation condition and access issues, and sometimes conducts minor repairs during the inspection such as tightening hardware or replacing insulators.

SRP may conduct additional hazard inspections on transmission lines as a result of a decrease in system reliability, a customer or agency reporting an issue, an adverse line condition, a fault on the system, or following storms or other adverse conditions. These inspections can occur anytime and anywhere to determine the cause of the hazardous situation. Hazard inspections generally occur using a pickup truck, but other vehicles may be used. A helicopter can also be used.

1.3 LINE MAINTENANCE REPAIR AND REPLACEMENT WORK

The life span for most power line equipment ranges from 30 to 60 years. However, repair or replacement of the equipment may be needed at any time and the frequency of work is difficult to predict. Once problem areas are identified, repair and replacement work is prioritized to address hazardous problems first and non-hazardous problems according to priority level. Emergency and routine line maintenance work involve the same activities however, the timeframe and urgency depend upon the priority work level. SRP transmission line repair and replacement work is conducted following bi-annual flight inspections, and in relation to operational issues, such as faults or flashovers, which can occur in any area at any time of year.

Work on overhead lines may include maintenance on conductors, poles or towers, cross-arms, insulators, guy-wires, and all other supporting equipment and hardware. Repairs may include replacing flashed or broken insulators, tightening loose hardware, replacing missing hardware, repairing damaged conductors, replacing or repairing broken or lose ground wire connections, replacing cut/stolen ground wires, repairing twisted or damaged hardware, removing foreign objects, and repairing structure foundation conditions. Work on steel transmission structures is similar to work on wood transmission structures.

Small-scale maintenance includes repairing and replacing insulators and other small hardware and require only a bucket truck and a lineman to climb the pole to perform the work. Small-scale repairs occur more frequently than large-scale repairs, which may include pole and/or cross-arm replacement and repair or replacement of damaged conductor and ground wires.

Pole replacement may involve a single pole, small group of poles, or multiple poles along a larger section of a line, up to the entire length of the line. Replacement along a large section of line is infrequent and may occur every 30 to 60 years. Repair work involves 1 to 3 crews of 3 to 11 people (3 to 33 people total). Work operations occur any time of day or night depending upon priority level (i.e. emergency work can occur at night).

Pole replacement involves removing the old, existing pole by cutting it off at ground level and removing it from the site. Installation of the new pole requires a large hole digger truck to access the ROW and dig a hole 20 to 36 inches wide and 5 to 15 feet deep near the location of the previously existing pole. The hole depth is usually dug to 10 percent of the new pole height plus an additional two feet (e.g., a 30-foot pole is dug to 5 feet deep). The pole is set using the hole digger truck or a boom truck. If access does not allow for the boom truck to enter the ROW, then crews drive a UTV or walk in a hand rock drill and air compressor to dig the hole.

Vehicles that may be used during the maintenance work include pickup trucks, UTV, bucket trucks, cranes, backhoes, boom trucks, caterpillars, hole digger trucks (for replacing wood poles), cable puller trucks, and various trailer attachments with equipment. Large semi-trucks may also be used on major established roads to haul in equipment. Crews may walk in if no access routes are available. Helicopters may also be used to transport crews and equipment (e.g., replacement parts or conductor wire) into an area.

SRP may conduct erosion control work around transmission structures if erosion has occurred around the footers or poles. If erosion control around footers or poles is needed, the work involves a bulldozer or backhoe entering the area and fixing the eroded location. If a bulldozer or backhoe cannot access the area, then work is done by hand. Erosion control is an infrequent action (less than one occurrence per year).

1.4 Emergency Line Inspection and Maintenance

Wherever and whenever an emergency situation with SRP equipment or within SRP ROW exists, SRP will respond immediately to take whatever corrective actions are necessary to protect life, property, and the environment, and to maintain electric power services. Emergency response can involve activities that require crews to respond immediately to address an imminent threat as well as activities to address emergency situations that result in damage to SRP infrastructure and equipment. Unscheduled inspections may be required to locate and assess the emergency.

SRP will coordinate with the Forest Service as soon as practicable, providing notification of the actions taken and any follow-up actions required to address the situation.

2 VEGETATION MANAGEMENT

The long-term vegetation management strategy for electric utility corridors is to apply the methods of Integrated Vegetation Management (IVM). IVM is the practice of creating and fostering the formation of low-growing herbaceous and woody plant communities within the ROW. The desired outcome of IVM is the development of shrub/grass/forb (low-growing) plant communities that will not interfere with overhead power lines, pose a fire hazard, or impede access.

Vegetation management practices are based on the "Bramble & Byrnes" model, which is the utility preferred standard accepted in the Utility Vegetation Management (UVM) Guidelines, unless there are documented resource-related reasons for doing otherwise. This wire zone–border zone concept divides the ROW into two sections: the wire zone (the area directly beneath and within six feet of the power lines) and the border zone (transition zones that fringe each side of the wire zone to the extent of the ROW).

The ideal wire zone is comprised of grass, forbs, and low shrubs bordered by low-to-medium sized shrubs in the border zone. Low-growing trees account for the outer edge of the ROW where the border zone meets the natural forest. This broad standard shall be applied along the entire ROW, except in locations where other overriding agency resource objectives require different measures. These measures may include preservation of visual quality, wildlife habitat conservation measures, or heritage resource protection.

2.1 VEGETATION INSPECTIONS

Aerial and ground inspections of vegetation are conducted on a regularly scheduled basis by power line circuit and geographical region. Aerial inspections occur annually on all transmission power lines. The inspection may take from one week to three months depending on the information required by the Forest Service district, the length of the line, the width of the ROW, the method of inspection (e.g., aerial versus ground), and the degree of difficulty for access. During the inspection, information on vegetation type, terrain, method of treatment are identified. Inspection work is performed by a one to two person crew by driving a pickup truck, UTV, or by walking. Inspections typically occur during daylight hours from Monday to Friday. Additional ground inspections may occur for hazard vegetation on an infrequent basis along certain sections of power line. Below is a description of how SRP performs vegetation inspections.

2.1.1 Aerial Inspections

Aerial inspections are primarily used for transmission ROW and are performed using a passenger helicopter. To approach the ROW, the helicopter cruises about 2,000 to 3,000 feet above the ground at about 115 to 160 miles per hour (mph). Once the power line is reached, the helicopter

flies about 50 to 300 feet above ground at 50 to 95 mph above or adjacent to the power line. Flights occur anytime during the day from Monday through Friday during daylight hours.

During inspection flights, the helicopter may hover or circle over areas to get a closer look at the trees and may land occasionally to ground inspect a specific location; landing the helicopter during vegetation inspections is rare. Hazard vegetation found during aerial inspections is noted and later inspected to confirm whether the vegetation is truly a hazard.

Annual aerial inspection of transmission lines are typically accomplished in three separate flights occurring potentially at any time of year. These flights are scheduled routinely. Any aerial inspections that are not part of the routinely scheduled annual aerial flights generally occur for a single line or area and are not considered a routine annual inspection. Inspections may also be subject to the timing restrictions of habitat conservation measures, depending on the area.

2.1.2 Ground Inspections

One to three inspectors are involved in conducting ground inspections by driving a pickup truck, UTV, or by walking. These inspections may occur singly or in conjunction with others. They can occur at any time of year and generally occur during the day from Monday to Friday. Inspections may also be subject to the timing restrictions of habitat conservation measures, depending on the area.

2.1.2.1 Hazard Ground Inspections

On transmission lines, hazard ground inspections typically occur as a follow up to verify hazards identified during an aerial hazard inspection. These types of inspections are conducted only on portions of line where hazards were identified during aerial inspection but not present along the entire line. Occasionally, a hazard inspection covering an entire power line would be conducted if numerous hazards have been identified on the respective line, if tree die-back results following an event such as bark beetle infestation or fire, or if the line has a high incidence of drought or disease affected trees.

2.1.2.2 Ground Audits

Ground inspections are also conducted to audit routine vegetation maintenance and hazard vegetation treatments (though this work may also be audited during aerial inspections). The audit may involve a sample of the work area or up to the entire work area. These ground audits are conducted by SRP Utility Foresters and could occur at any time of the year depending on the timing of the work.

2.2 ROUTINE VEGETATION MAINTENANCE

Routine vegetation maintenance is the process of identifying and removing / pruning vegetation within the ROW at set schedule to provide safe, efficient, and reliable delivery of electricity. Proper clearance must be maintained at all times between power lines, trees, ground, buildings, and other structures. Work is conducted on a specific clearance cycle every one to five years.

SRP manages ROW to low growing conditions using the manual and mechanical methods described below. The amount of vegetation removal during routine vegetation maintenance varies depending on multiple factors including, but not limited to terrain, accessibility, density of vegetation, vegetation composition, rate of vegetation regrowth, and power line voltage. SRP designs prescriptions for vegetation management as a collaborative approach with each Forest to determine the best approach for each vegetation condition, location, and required conservation measures.

SRP has not yet had the opportunity to closely examine the vegetation communities along the proposed route. However, the ROW corridor proposed for transmission lines supporting Resolution Copper operations traverse non-forested vegetation communities. References to timber in the following description of vegetation management activities may be outside the actions for these particular transmission lines.

Maintenance of vegetation within ROW occurs on a routine schedule based on the maintenance needs for an individual line. Lines are maintained on a cyclical basis every one to five years with most power lines maintained every two to five years. The frequency of maintenance differs depending on factors such as vegetation type, location of the line, power pole structure, and clearance standard.

SRP inspects each power line on the ground to plan work just prior to the management of the vegetation during the vegetation re-entry cycle (e.g. for a power line that is scheduled every five years, the line is inspected on the ground every five years and if vegetation management is needed, it would be conducted shortly after this ground inspection). The power lines will continue to be inspected according to the re-entry cycle.

Routine vegetation maintenance work is performed by a two to four person crew, which may be in-house or contracted labor. The crews may use a combination of manual or mechanical methods to treat the ROW as described below. The work is typically performed during daylight hours from Monday to Friday, though crews sometimes work over the weekend when special circumstances are required.

Routine vegetation maintenance work is conducted using four-wheel-drive pickup trucks, bucket trucks, UTVs, and walking. If mechanical treatment is scheduled, a mower is driven to and operated within the ROW. The mower may get reloaded onto the pickup truck and driven to another access point within the ROW, and the process is repeated. At times, after the initial

mower unloading, it may not be necessary to reload/unload if the crew can drive the mower on the dirt/gravel roads to the next location. If crews are unable to access a site by vehicle, they hike in from the nearest vehicular access point.

2.2.1 Mechanical Treatment Methods

Mechanical treatment of vegetation involves the use of a cutting device which cuts and masticates vegetation and is mounted on a vehicle with rubber tires or tracks. The mechanical method of maintaining vegetation is quick and cost effective in many areas and includes masticating vegetation into small chipped pieces. This is often the preferred method for transmission lines. The equipment generally operates at sound levels of 90 to 100 decibels (dBA).

Terrain, presence of archaeological sites, and ROW access are the major limiting factors in determining whether a mower or mechanical equipment can be used for a project. Every power line has the potential for mechanical treatment where archaeological sites, access, and terrain do not limit the use of this method. However, SRP does not anticipate use of mowers along the transmission lines to be constructed for the Resolution Copper project due to terrain and vegetation type.

If a portion of the line is deemed suitable for mowing, it would be conducted as follows but the need for these activities is unlikely. Mechanical equipment is typically operated by one driver and one ground person. The ground person directs the mower and may operate a chainsaw to cut trees that the mower is unable to access while traversing the ROW. A manual (hand) crew may also follow the mechanical equipment to clean up, scatter debris, and prune or fell trees that the mechanical equipment could not access. All vegetation masticated by the mower is left on site in the ROW and piled no higher than four inches.

2.2.2 Manual Treatment Methods

Manual treatment of vegetation involves the use of a cutting device performed by hand. Hand crews are trained in utility vegetation management to remove and prune trees in a safe and effective manner. Manual methods are performed in a ROW where mowing is not possible. Manual methods may also be utilized in mowing areas as a secondary treatment.

Removal of trees generally involves the use of chainsaw felling techniques and a rope. Trees may also be climbed and dropped in pieces using a rope, climbing saddle, chainsaw, pole saw, and hand saw. Climbing of a tree generally only occurs in circumstances where felling could result in the tree striking the power line or structures (e.g., a tree overhanging the wires) or if there are species or resource concerns (e.g., avoid felling a tree on an archaeological site or avoid damaging extra trees in sensitive species habitat).

Project size will dictate the number of field crews needed. Typically, SRP employs anywhere from 5 to 60 crew members for manual vegetation treatment work. The workers are generally spread

out in crews of two to five people along a line. If the extent of work is small-scale a minimum of one, two-person to five-person crew and a foreman will be scheduled. Large-scale projects may employ up to 100 workers if timing constraints require a large amount of work to be conducted in a short period of time. The need for up to 100 crew members rarely occurs.

Hand crews operate during daylight hours at any time of year, except where restrictions apply, such as conservation measures for species or fire restrictions.

2.2.3 Pole Clearing

Vegetation maintenance is conducted around transmission poles, guy wires, and anchors during routine vegetation maintenance or as a separate cycle of utility maintenance. Pole clearing only occurs within the permitted ROW. The purpose of pole clearing is: 1) to provide a fire break to minimize burning of structures during a fire under or near the power line; 2) to maintain the integrity of the structures by preventing trees or vegetation from falling on guy wires or other equipment; and 3) to provide access for line maintenance vehicles or a helicopter.

Typically, SRP maintains a 40-foot radius clear of vegetation from the pole or tower on 115, 230, and 500kV lines. These distances around structures may vary depending on the type of construction of the line, terrain, vegetation type, and voltage. The vegetation maintenance involves the removal of shrubs and trees within the appropriate radius to the extent that fuels are reduced and vehicles can access the pole or tower. The extent of vegetation maintenance ranges from the complete removal of all woody vegetation in areas of high fire risk or high vegetation density, to only thinning out existing vegetation to the extent that only grasses, forbs, and small growing shrubs remain.

2.2.4 Vegetation Disposal

Once vegetation is cut for utility vegetation management (hazard or routine maintenance), various disposal methods are used to disperse the wood and debris. The overall objective in vegetation disposal is to dispose of and/or distribute the slash and logs in a cost effective and efficient manner that minimizes impacts to plant and animal species and resources on the forest while mitigating fire risk under and surrounding the power lines and structures. The method of disposal for a particular power line or project is determined through an agreement with the Forest Service and SRP and is described in the corridor management plan in accordance with the Utility Vegetation Management Guidelines.

Below is a list of potential methods of disposal that may be used by SRP, which provides general methods for the purposes of analysis of effects to threatened and endangered species. SRP considers land uses, terrain, aesthetics, fire concerns, and species concerns to determine the appropriate method to be employed at any particular location.

All Methods

1. Stumps from tree removal are cut within six to 12 inches of the ground or, if possible, stumps are cut flush with the ground.
2. All areas with the potential for flowing water (e.g., culverts, ditches, and washes) are kept free of slash, logs, and debris from tree removal operations.
3. Logs are not hauled off site by SRP.

Mechanical (Mower) Vegetation Removal

1. When a mower is used for routine vegetation maintenance, the mower masticates the tree or vegetation to small chips. The chips are broadcast across the ROW at a thickness no greater than four inches.

Manual (Hand Crew) Vegetation Removal

1. Lop and scatter inside the ROW: This is the preferred method of disposal and is generally used in most areas, especially remote areas away from busy roads and campgrounds. This method is also the predominant method for disposing of hazard vegetation.
    a. Limbs and logs of less than 9 inches diameter are lopped and scattered throughout the immediate area in a manner such that limbs and logs are cut down in pieces no taller than 18-24 inches from the ground.
    b. Logs over 9 inches diameter remain where felled, with the exception of access roads. These logs are left at full lengths as much as possible while lying as flat to the ground as possible. Logs are not dropped and laid across each other (a.k.a. jack-strawed).
2. Lop and scatter outside of ROW: This method is time consuming and costly, but has been used in areas where the Forest Service district has requested this method due to resource concerns on the Forest in a designated area.
    a. Limbs and logs of less than 9 inches diameter are lopped and scattered immediately outside of the ROW in a manner such that limbs and logs are no taller than 18-24 inches from the ground.
    b. Logs over 9 inches diameter are cut and disposed of as described in 2.b.
3. Lop limbs and leave trunk whole: This method has been used where timber may have a merchantable value or where leaving the trunk whole may provide erosion stabilization or species habitat.
    a. Limbs are lopped off of the trunk and disposed of according to 2.a., or 3.a.

b. The felled tree trunk is left whole on site, but not dropped and laid across other logs (jack-strawed).

4. Slash is chipped and broadcast: This method may be used where resource concerns and conditions require it and IF road access allows for a chipper.

    a. Limbs and logs less than 9 inches diameter are chipped and broadcast on site with chips no deeper than 4 inches.

    b. Logs are cut and disposed of as described in 2, 3, or 4.

5. Logs cut to firewood length: USFS has occasionally asked SRP to cut logs into firewood lengths and pile for public use when work occurs near campgrounds or busy roads. Limbs are treated as described in 2, 3, or 4. This method is rarely used and not preferred.

6. Slash piled for burning: USFS has occasionally asked SRP to pile slash off of the ROW corridor to be burned at a future date by USFS. This method is rarely used and is not preferred. Logs are disposed of using any of the methods above that apply

Manual (Hand Crew) Vegetation Pruning

1. For vegetation pruning, the limbs may be disposed of using any of the limb disposal methods from 2 to 6 above.

2.2.5 Hazard Vegetation Treatment

Hazard vegetation is defined as an individual tree, vegetation, or portion of tree or vegetation (e.g., limb) that could come into contact with a utility line, structure, or equipment and cause electrical fault. Vegetation can be considered hazardous if it exhibits a structural defect that increases the chances of it failing and contacting electric utility infrastructure. Healthy vegetation may also be considered a hazard if it has encroached close enough to an electric utility line that it could result in electrical fault (ANSI 2012). In rare instances hazard vegetation could be located outside of the ROW if it could potentially fall and strike an energized power line or cause an electrical fault.

While it is not possible to determine the exact distance that a hazard tree can be outside of the ROW, estimations can be made. Using the ROW width and constants that the terrain is flat with no slope or objects between the tree and the conductor, an estimation of how far outside the ROW the tree is located can be calculated. Utility foresters will use laser finders to determine the height of the tree.

Hazard vegetation can also be categorized as an Imminent Hazard or Off-Cycle Hazard. An Off-Cycle Hazard has the potential to become a public safety or reliability risk prior to the next cycle of routine maintenance. Scheduling removal of Off-Cycle Hazard vegetation typically allows

incorporation of species minimization and conservation measures, such as timing restrictions. In rare instances, Imminent Hazards are identified and must be addressed as soon as possible to assure system reliability and safe operating conditions. Once identified, hazard trees are removed or pruned using chainsaw felling techniques and ropes, or where access allows, bucket trucks may also be used to remove hazard trees in pieces. Trees or limbs are felled in a safe manner while factoring in, power line proximity, terrain, and surrounding vegetation.

3 CONSERVATION MEASURES

SRP has identified and incorporated a number of conservation measures and best management practices (BMPs) into their operation and maintenance and vegetation management activities to avoid and minimize impacts to federally protected species. These conservation measures are described in the U.S. Forest Service's Biological Opinion for SRP's power line operation and maintenance activities on National Forest Service Lands. SRP assumes that these conservation measures and BMPs will be applied to the power lines related to the Resolution project once they are constructed.

APPENDIX B

Mitigation Effectiveness Evaluation of the Superior, Arizona, Recreation Project Conceptual Plan

USDA Forest Service
Tonto National Forest
Arizona

September 2020

Process Memorandum to File - Final

A Mitigation Effectiveness Evaluation of the

Superior, Arizona Recreation Project Conceptual Plan (March 2019)

Submitted by the Recreation User Group (RUG), a subcommittee of the Community Working Group (CWG) of Superior, Arizona

This document is deliberative and is prepared by the third-party contractor in compliance with the National Environmental Policy Act and other laws, regulations, and policies to document ongoing process and analysis steps. This document does not take the place of any Line Officer's decision space related to this project.

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1 Introduction

Land managers and resource specialists from the Tonto National Forest, a unit of the U.S. Department of Agriculture Forest Service (Forest Service), have evaluated several proposed measures intended to mitigate recreation impacts on the Tonto National Forest resulting from actions associated with the proposed Resolution Copper Project and Land Exchange (Resolution Copper Project). The mitigation measures evaluated include the "Superior, Arizona Recreation Project Conceptual Plan" (WestLand Resources 2019) along with other relevant project mitigation suggestions gleaned from the public between March 2016 and November 2019.

In this memorandum, we describe our mitigation evaluation process and identify those measures that we consider to be legitimate, practicable, and effective at reducing the impacts to recreation resources resulting from the proposed actions of the Resolution Copper Project.

A preliminary evaluation was completed in June 2019 by SWCA Environmental Consultants (SWCA) for inclusion in the Resolution Copper Project and Land Exchange Draft Environmental Impact Statement (DEIS) (SWCA 2019). Tonto National Forest staff reviewed the preliminary evaluation along with new information during discussions held in April and May 2020. This revised memorandum reflects the outcomes of both the preliminary evaluation and the subsequent discussions and analysis performed by the Forest Service during summer 2020. The set of measures found to be legitimate, practicable, and effective as a result of this evaluation process will be recommended for inclusion in the Final EIS (FEIS) and decision document for the Resolution Copper Project.

This document is organized as five sections: Section 1: Introduction, Section 2: Methods, Section 3: Results, Section 4: Recommendations, Section 5: References. The Forest Service is grateful for the technical assistance provided by our third-party contractor, SWCA, for guiding the mitigation evaluation process and preparing this document for the project record.

1.1 Background on Resolution Copper Project Recreation Impacts

Resolution Copper Mining, LLC (Resolution Copper), is proposing to develop an underground copper mine at a site in Pinal County, about 60 miles east of Phoenix near Superior, Arizona. The proposed action involves new mining facilities, existing mining facilities, and existing facilities that are proposed for expansion. The project would progress through three distinct phases: construction (10 years), operations, also referred to as the production phase (40–50 years), and reclamation (5–10 years). At the end of operations, facilities would be closed and reclaimed in compliance with permit conditions. Operational projections are removal of 1.4 billion tons of ore and production of 40 billion pounds of copper using a mining technique known as panel caving.

Some of the proposed mine infrastructure would be constructed and operated across the southern portion of the Tonto National Forest within the Mesa and Globe Ranger Districts (Figure 1). Key project locations and infrastructure include the following:

- The East Plant Site, which includes the underground mining operations, reroute of access road and associated surface subsidence;
- The West Plant Site, which includes mine facilities and reroute of Forest Service and private access roads;
- Underground ore conveyor/infrastructure corridor;
- Existing upgraded and new power line corridors to convey power to the East Plant Site and West Plant Site;
- The Skunk Camp tailings storage facility, including the pipeline corridor needed to convey tailings to the facility and the power line corridor needed to convey power to the facility.
- The filter plant and loadout facility;
- The Magma Arizona Railroad Company (MARRCO) corridor, an existing right-of-way that will contain pipelines to convey copper concentrate to the filter plant and loadout facility, will contain rail lines to convey copper concentrate to market, and will be the location of water supply wells and other water and power lines.

While all mining would be conducted underground, removing the ore would cause the ground surface to collapse, creating a subsidence area in the vicinity of the East Plant Site on lands currently managed by the Tonto National Forest. The crater would start to appear in year 6 of active mining. The crater ultimately would be between 800 and 1,115 feet deep by roughly 1.8 miles wide.

Through the Southeastern Arizona Land Exchange and Conservation Act (Public Law 113-291, Section 3003), Congress has directed the Forest Service (through delegated authority by the Secretary of Agriculture) to convey to Resolution Copper a tract of land known as the “Oak Flat Federal Parcel” which is above the copper deposit location. This 2,422-acre parcel located south of U.S. Route 60 (U.S. 60) includes the Oak Flat Campground and about 5.5 miles of National Forest System (NFS) roads that provide access to a variety of dispersed recreation settings and opportunities.

We published the DEIS for the Resolution Copper Project and Land Exchange in August 2019, disclosing the impacts to the natural, cultural, and social resources in the project area that would occur from implementing the no action alternative, the proposed action, and action alternatives. Two sections of the DEIS are directly relevant to informing the effectiveness evaluation of the proposed recreation mitigation measures: Section 3.5, Transportation and Access, and Section 3.9, Recreation.

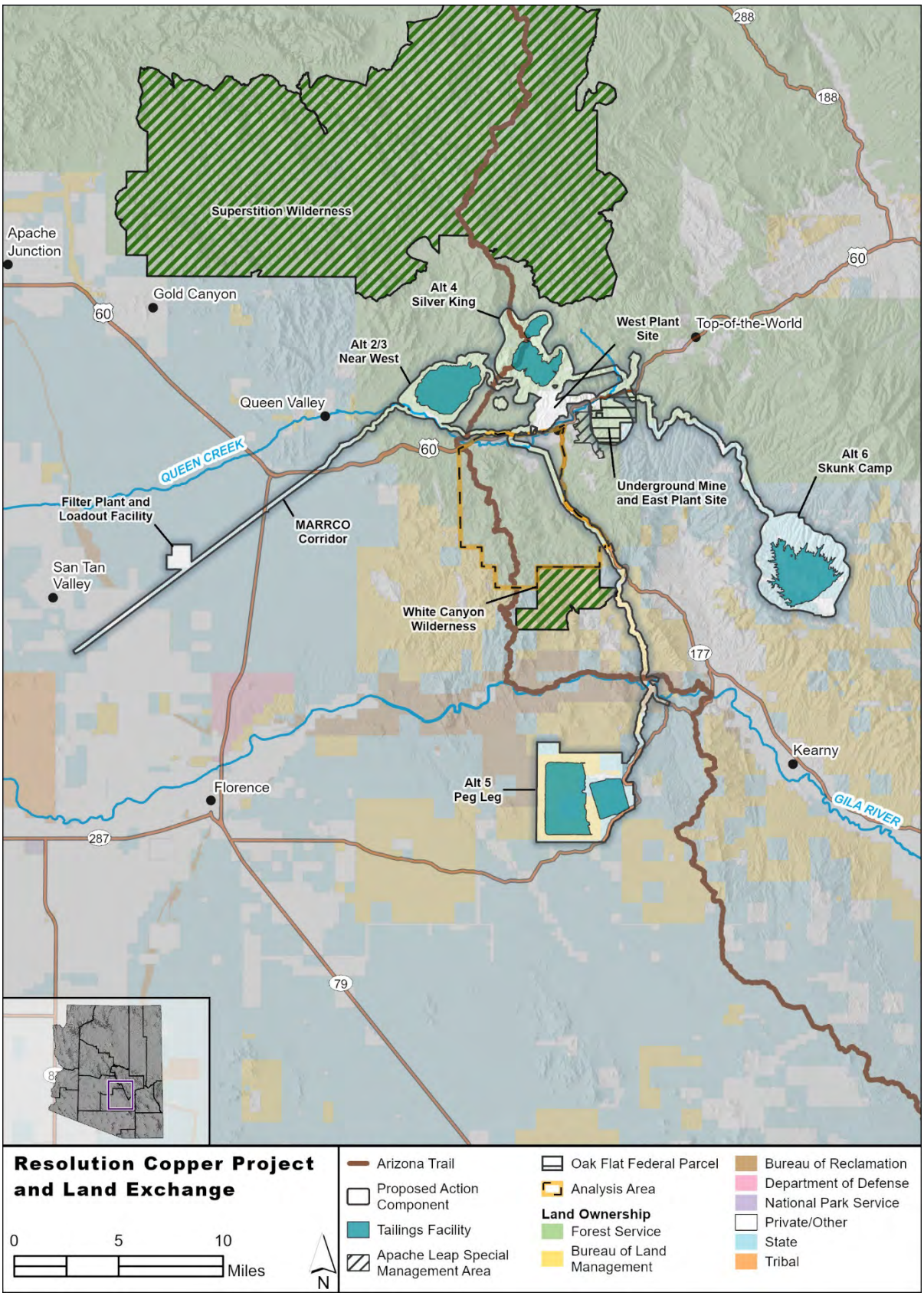

Figure 1. The Resolution Copper Project area and components.

DEIS Section 3.5, Transportation and Access, identifies the NFS roads that would be adversely impacted by the various project components. In aggregate, 10 NFS roads totaling about 8 miles are expected to be impacted by the project as follows:

- For the West Plant Site facility, two roads (NFS Roads [NFSRs] 1010 and 229) totaling 2.54 miles would be impacted. Under all alternatives, Resolution Copper has proposed to reroute approximately 2.17 miles of the Silver King Mine Road (NFSR 229) to maintain through access to the highlands north of the West Plant Site.
- For the East Plant Site and Subsidence Area there are eight NFS roads (NFSRs 2432, 2433, 2434, 2435, 2438, 3153, 3791, and 315) totaling about 5.5 miles that would no longer provide national forest visitor access.

DEIS Section 3.9, Recreation, states that the proposed mine and land exchange would have significant effects on recreation opportunities, including camping and day use in the vicinity of the Oak Flat Campground, as well as loss of access to or use of the Euro Dog Valley and Oak Flat East/West climbing and bouldering areas.

The DEIS identifies Alternative 6 – Skunk Camp North Tailings Corridor Option as the agency's preferred alternative. This preferred alternative would include about 14,931 acres of ground disturbance, of which 2,467 acres is NFS land, 8,207 acres is managed by the Arizona State Land Department, and 4,257 acres is private land.

The loss of recreation opportunities on 2,422 acres of NFS land via the land exchange, along with the loss of forest access along 5.5 miles of NFS roads and an additional disturbance to 2,467 acres of NFS lands from mine infrastructure development, forms the comparative basis for evaluating the impacts of the Resolution Copper Project on dispersed recreation opportunities on the Tonto National Forest.

1.2 Background on the Recreation Project Conceptual Plan

The "Superior, Arizona Recreation Project Conceptual Plan" (hereafter RUG Trail Plan) was prepared in March 2019 by WestLand Resources on behalf of Resolution Copper for the Recreation User Group (RUG); (See Appendix A). RUG, a subcommittee of the Community Working Group (CWG) of Superior, Arizona, engaged volunteers in a multi-year effort to design recreational trail systems in and adjacent to the town of Superior that would meet the needs and interests of different stakeholders. RUG's vision was to not only replace the recreation opportunities lost due to the proposed copper mine, but to also identify recreation opportunities in the adjacent landscape that would promote the local area as a premier outdoor recreation destination (CWG 2020).

RUG identified the following goals for its trail network design:

(a) Consolidate the existing trail network to reduce unauthorized disturbance;

(b) Allow for a diverse range of trail types for both motorized and non-motorized uses;

(c) Maximize and preserve views of the outstanding natural scenery of the area;

(d) Segregate use types as necessary to minimize conflicts and facilitate public safety;

(e) Be sustainable and require minimal maintenance;

(f) Be able to be constructed in phases.

This community landscape vision statement and goals for a local, sustainable trails network are compatible with the multiple-use management philosophy held by the Forest Service and is consistent with the desired conditions for dispersed recreation resources on the Tonto National Forest Plan (Forest Service 1985) and as described in the Draft Land and Resource Management Plan, commonly referred to as the Draft Forest Plan (Forest Service 2019a).

The RUG Trail Plan (Appendix A) identifies approximately 69 miles of motorized and non-motorized trails, and trailhead/parking lots comprising an additional 3 acres located within the Globe Ranger District on NFS lands generally south of the town of Superior, Arizona, west of State Route (SR) 177 and north of the White Canyon Wilderness Area (administered by the Bureau of Land Management). The plan contains specific trail design and layout concepts that include suggestions for construction and maintenance that are based on terrain and vegetation, existing and projected uses of the area, and land surface ownership patterns.

The RUG Trail Plan (funded by Resolution Copper) was submitted to the Forest Service for consideration in the DEIS as mitigation for potential resource impacts resultant of the proposed action.

1.3 Other Recreation Mitigation Measures Considered

The DEIS for the Resolution Copper Project includes two other recreation-related mitigation measures that are relevant for consideration alongside this evaluation of the RUG Trail Plan. We included these measures (described below) because they would occur within the same geographic area contemplated in the RUG Trail Plan. In the DEIS, the RUG Trail Plan is identified as mitigation measure **RC-214**.

RC-213: Mitigate loss of bouldering at Oak Flat by improving access to the 'Inconceivables.'
To mitigate impacts on recreation through the loss of bouldering areas at Oak Flat, Resolution Copper has proposed to improve the existing but difficult access to an alternative rock climbing area known as the Inconceivables. This area extends along cliffs for approximately 3 miles on Tonto National Forest land and is located off SR 177 via NFSRs 319 and 2259.

The entire length of NFSR 2259 (approximately 0.8 mile) is currently identified for decommissioning and closure as part of the TNF Travel Management Plan draft decision (Forest Service 2019b). Beyond the end of NFSR 2259, there is an unauthorized two-track route that extends about 1.4 miles in a northwesterly direction to the Inconceivables climbing area. To be effective, NFSR 2259 would need to be designated as open to the public, and the unauthorized 1.4-mile two-track route would need to be improved for motorized access and designated open to the public.

RC-215: Provide a replacement campground. Resolution Copper has proposed to establish an alternative campground site, known as Castleberry, to mitigate the possible loss of access to and use of the Oak Flat Campground. The Castleberry parcel is located along the banks of Queen Creek, about 1 mile south of U.S. 60 using NFSR 989. Resolution Copper estimates that the improved access to the property and development of the new campground may involve additional ground disturbance of about 41 acres. Conceptual design plans for the campground are under development.

2 Evaluation Methods

In this section, we identify the regulatory framework and describe the data sources and methods used in our evaluations to determine the legitimacy, practicability, and effectiveness of the proposed mitigation measures (RC-213, RC-214, and RC-215) in alleviating impacts to recreation resources on the Tonto National Forest resulting from the project actions.

2.1 Regulatory Framework

The Land and Resource Management Plan for the Tonto National Forest (1985 Forest Plan) (Forest Service 1985), including amendments, is the primary document currently guiding the forest in meeting the mission of the Forest Service and managing public lands to provide for healthy, resilient ecosystems that meet the diverse needs of the American people.

The 1985 Forest Plan is remarkably outdated and is under revision to comply with the NFS Land Management Planning Rule (36 Code of Federal Regulations 219) and associated planning directives (Forest Service Handbook 1909.12). In November 2019, the Tonto National Forest released a proposed revised plan and DEIS for public review and comment. When finalized, the revised plan will provide strategic, program-level guidance for management of the forest's resources and uses over the next 10 to 15 years.

Before a decision affecting NFS lands and resources can be rendered, project proposals must undergo a consistency review with existing laws, regulations, agency policies and procedures, forest plan standards and guidelines, and any relevant agency decisions in effect at the time of a project proposal. This breadth and depth of review ultimately establishes the legitimacy of a project proposal and its associated mitigation actions.

For our evaluation of legitimacy, we reviewed the RUG Trail Plan and related recreation mitigation measures for consistency and compatibility with the following land and resource management direction:

- 1985 Tonto National Forest Plan (as amended; Forest Service 1985: forest-wide and management area standards and guidelines; Recreation Opportunity Spectrum (ROS) Settings Map, Wildland Fire Management Zones
- Draft Forest Plan (Forest Service 2019a):
    - Developed and Dispersed Recreation

  - Designated and Recommended Research Natural Areas (RNAs) (e.g., Picket Post Mountain)
  - Eligible Wild and Scenic River (WSR) Segments (e.g., Telegraph and Arnett Creeks)
  - National Trails (e.g., Arizona National Scenic Trail)
- Final Supplemental EIS (SEIS) and Draft Record of Decision (ROD) for Travel Management on the Tonto National Forest (Forest Service 2019b):
  - Review of the system of roads, trails, and areas designated for motor vehicle use by class of vehicle and time of year on the Tonto National Forest.
  - Review of routes designated for closure/decommission.
- Other reasonably foreseeable actions within or adjacent to the recreation mitigation analysis area (i.e., community plans and ranger district project proposals)

2.2 Data Sources and Methods

For data, we relied on a variety of spatial and non-spatial data, published references, and the professional judgement and operational knowledge of Forest Service resource specialists and project consultants. We met as a group on three occasions in April and May 2020 to evaluate the mitigation proposals and also individually as needed to track down specific information.

For methods, we used a geographic information system (GIS) to gather, manage, and analyze relevant data including imagery, geospatial features, and natural and cultural resource base maps and linked these to spreadsheets, tables, and maps for display purposes.

Separately and cumulatively, these data were useful for evaluating the legitimacy, practicability, and effectiveness of the proposed routes, trail segments and recreation opportunities within the analysis area. The outcome of these analyses are discussed in more detail in the Results Section.

2.2.1 Analysis Area Description

The analysis area consists of NFS lands within the Globe Ranger District located generally south of the town of Superior, Arizona, west of SR 177 and north of the White Canyon Wilderness Area (administered by the Bureau of Land Management). The area includes private inholdings. The total analysis area (including both public and private lands) comprises approximately 2,454 acres as shown in Figure 2. The analysis area includes portions of an Arizona Important Birding Area (Audubon Society 2020) located along Arnett and Queen Creeks adjacent to the Boyce Thompson Arboretum.

The analysis area includes a system of roads, trails, and areas designated for motor vehicle use by class of vehicle and time of year as described in the 2019 Final SEIS and Draft ROD for Travel Management on the Tonto National Forest. This system of roads and their disposition (open/closed) for this portion of the Globe Ranger District is depicted in Figure 2.

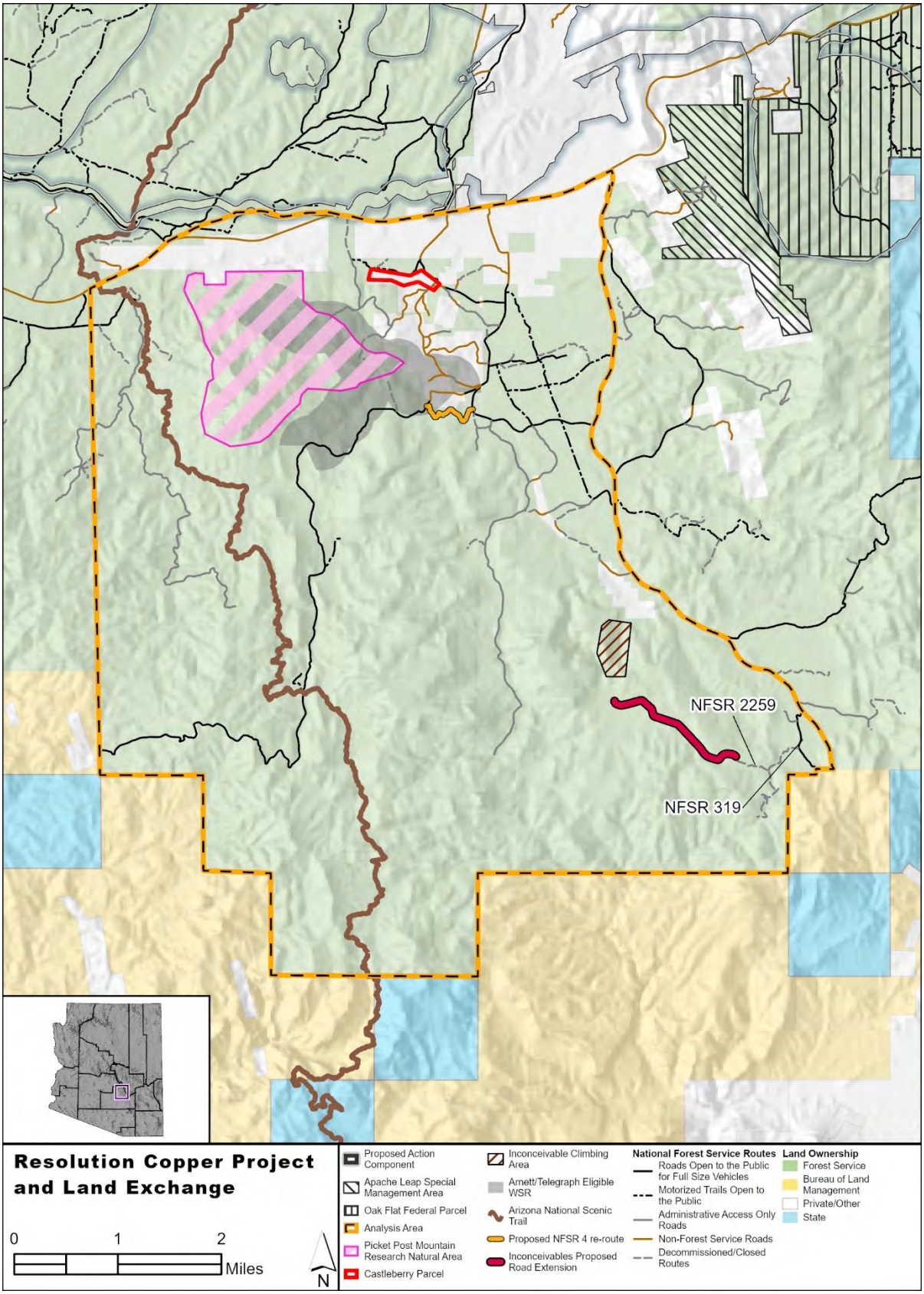

Figure 2. Recreation mitigation analysis area.

In May 2019, NFSR 4, which is used to access an existing trail along Arnett Creek, was blocked at the private inholding boundary of the perlite mine to allow the owners to safely engage in minerals exploratory work. The Forest Service does not have an easement or ROW for the road across the private parcel. During the spring of 2020, Forest Service road engineers identified and surveyed an alternate route that avoids this private property. This reroute is designed to provide safe and continuously open access to public lands along NFSR 4.

The analysis area also includes two areas proposed for special management as identified in the revised forest plan (2019): the Picket Post Mountain RNA and the eligible WSR segments of Telegraph and Arnett Creeks.

Picket Post Mountain Research Natural Area (1,261 acres) contains excellent examples of the Sonoran desert in many of its varied plant community associations on foothill and piedmont topography. The eastern piedmont, bounded by cliffs along Telegraph Canyon and Arnett Creek, represents the Sonoran Desert on gentle upland slopes. Stretches of Arnett Creek are included in the area and have perennial flow that supports a riparian gallery forest (which is rare in the State and on the Tonto National Forest). The varied topography and soils around Picket Post Mountain display a number of unique plant communities within a small area and also represents the limiting cold temperature boundary of the Saguaro cactus distribution. Arnett Creek and the adjacent uplands serve as excellent benchmark examples for Sonoran Desert plant communities and deciduous riparian forests. The area also serves as an important gene pool for Sonoran flora (especially cacti) and fauna, and as a control to study the effects of grazing management (at areas excluded from livestock grazing).

A 3.5-mile stretch along each of Telegraph and Arnett Creeks contain remarkable scenery and fisheries values. The distinctive gorges and broad canyons with solid rock vertical walls provide many novel rock forms. Bare soil, desert pavement, and barren rock textures with unique strings of riparian deciduous trees along the creeks and nearby botanical gardens creates a unique area juxtaposed with the vast surrounding undistinguished desert. The creeks provide high-quality perennial stream habitat for native fishes. Currently, longfin dace occur in the creek and multiple threatened or endangered fish species have been reintroduced to the area. Arnett Creek has an extant population of native aquatic biota, including Sonoran mud turtle and lowland leopard frogs. There is a fish barrier downstream from Arnett and Telegraph Creeks that inhibits upstream non-native species migrations. The segment has been deemed eligible for inclusion in the WSR System and will be managed to protect its outstandingly remarkable values under a “recreational” classification due to the existing levels of shoreline development and evidence of human activity.

As described in the RUG Trail Plan, current land uses within the analysis area consist predominantly of livestock grazing, mining, and outdoor recreation, including hiking, birding, horseback riding, mountain biking, and off-roading. There are seasonal hunting opportunities for javelina, big horn sheep and mule deer (within Game Unit 37B) as permitted by the Arizona Game and Fish Department. There are a number of areas devoid of vegetation that appear to be dispersed camp sites or staging areas. Several isolated illegal trash dumps are also scattered around the analysis area. Where the terrain is rocky and steep, and access is more challenging,

the landscape remains relatively undisturbed. With the exception of the portion of the Arizona National Scenic Trail (AZNST) that bisects the western portion of the analysis area, existing recreation trails on Tonto National Forest lands are primarily unauthorized motorized and non-motorized trails. The Town of Superior's Legends of Superior Trails (LOST) system is located adjacent and directly north of the analysis area; indeed, several of the proposed trails discussed below are intended to connect to LOST.

2.2.2 RUG Trail Plan Data

As stated previously, the RUG Trail Plan proposes a 69-mile network of motorized and non-motorized trails. We made two initial adjustments to the RUG Trail Plan data for our analysis. First, we determined which, if any, routes and trail segments in the proposal already exist as part of the national forest road or trail systems. These existing, authorized routes and trails were dismissed from further analysis. Secondly, we assigned a unique identifier to each of the remaining proposed routes and trail segments as shown in Table 1. Figure 3 displays the locations of each segment of this modified 54-mile network that formed the basis of our evaluations.

Table 1. RUG Trail Plan – List of Proposed Trails and Routes Evaluated

Route ID#	Route Type	Length (miles)	Route ID#	Route Type	Length (miles)	Route ID#	Route Type	Length (miles)
101	Proposed Trail, Non-motorized	2.663	**201**	Proposed Trail, Motorized	0.316	**300**	Proposed Road, Motorized	3.603
102	Proposed Trail, Non-motorized	0.677	**202**	Proposed Trail, Motorized	3.360	**301**	Proposed Road, Motorized	3.198
103	Proposed Trail, Non-motorized	0.589	**203**	Proposed Trail, Motorized	3.731	**302**	Proposed Road, Motorized	0.909
104	Proposed Trail, Non-motorized	0.676	**204**	Proposed Trail, Motorized	3.092	**303**	Proposed Road, Motorized	0.634
105	Proposed Trail, Non-motorized	6.304	**205**	Proposed Trail, Motorized	1.108	**304**	Proposed Road, Motorized	0.384
106	Proposed Trail, Non-motorized	0.119	**206**	Proposed Trail, Motorized	0.714	**305**	Proposed Road, Motorized	1.007
107	Proposed Trail, Non-motorized	0.947	**207**	Proposed Trail, Motorized	0.373	**306**	Proposed Road, Motorized	0.225
108	Proposed Trail, Non-motorized	0.346	**208**	Proposed Trail, Motorized	6.152	**307**	Proposed Road, Motorized	0.421
109	Proposed Trail, Non-motorized	0.487	**209**	Proposed Trail, Motorized	1.401	**308**	Proposed Road, Motorized	1.195
110	Proposed Trail, Non-motorized	5.746	**210**	Proposed Trail, Motorized	1.732	**309**	Proposed Road, Motorized	0.480
111	Proposed Trail, Non-motorized	0.224				**310**	Proposed Road, Motorized	0.135

Route ID#	Route Type	Length (miles)	Route ID#	Route Type	Length (miles)	Route ID#	Route Type	Length (miles)
						311	Proposed Road, Motorized	0.607
Total Non-motorized Trails: 18.778			**Total Motorized Trails:**		**21.979**	**Total Motorized Roads:**		**12.798**
Total Length, All Routes: 53.555								

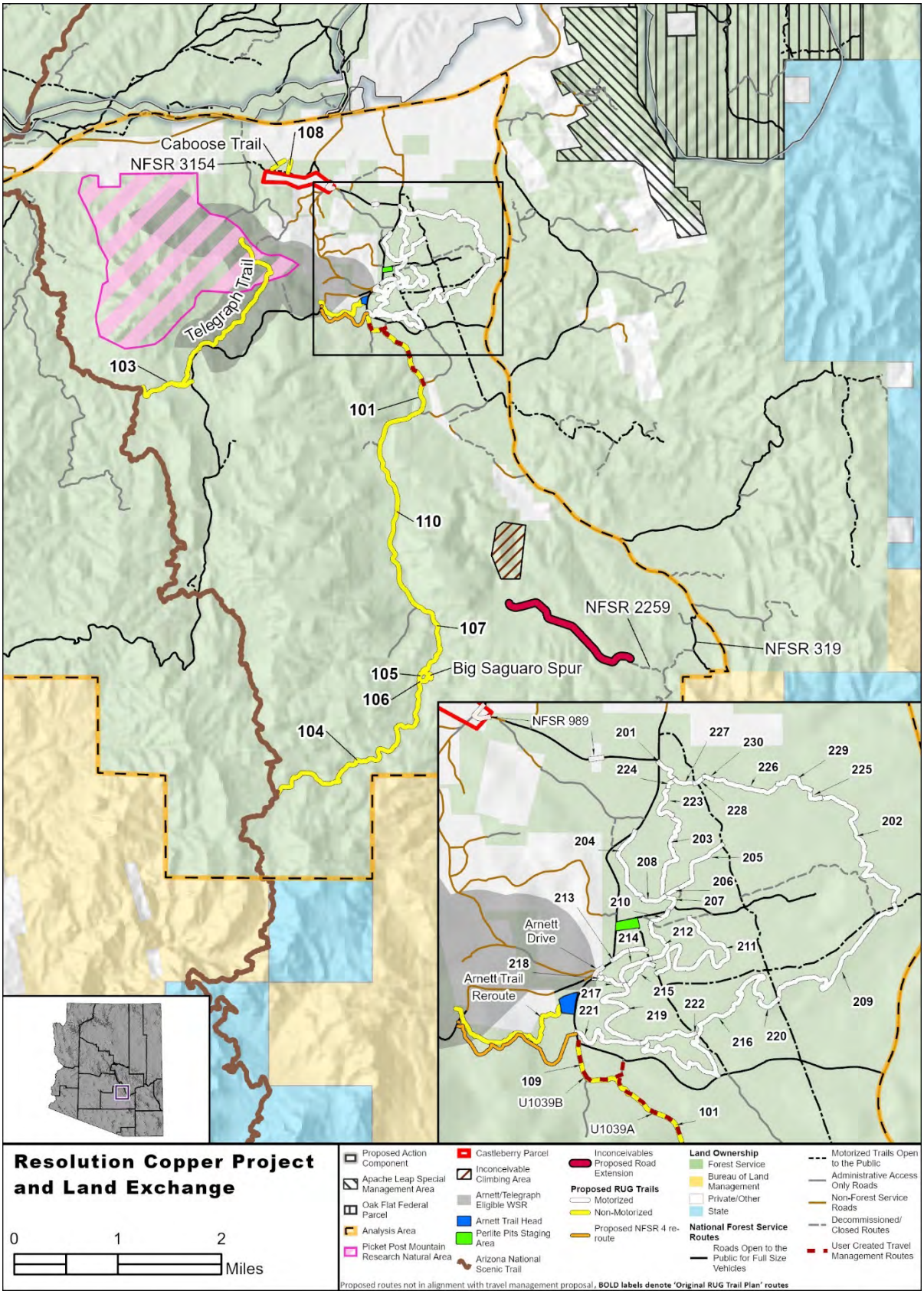

Figure 3. RUG Trail Plan – map of proposed trails and routes by type.

3 Results

We present the results of our analyses in the sections that follow. In addition to the geospatial data, which offered us strong footing for our evaluations, we also identified several working assumptions, management biases, and other factors that would likely influence our deliberations. We attempted to capture those below. We also provide a summary impacts table below based on the preliminary evaluations completed in June 2019. We updated the table to reflect the findings from our 2020 review effort.

3.1 Analysis Assumptions/Considerations

The following is a list of assumptions and considerations that influenced our evaluations and ultimately guided our determinations regarding which set of routes and trails would effectively alleviate impacts to recreation resources resulting from the Resolution Copper Project.

3.1.1 Overall Strategy

- We sought to consolidate the individual segments of the original RUG Trail Plan into complete trails, with consideration of trail intent, destination, and location.
- We reviewed each of the proposed trails and routes for legitimacy with respect to special management area direction available in the proposed revised forest plan 2019 and the 2019 draft decision for travel management on the Tonto National Forest, neither of which was available to the RUG when RUG was developing its proposal.
- We focused on what was practicable and reasonable to implement, given expected Forest Service and private funding opportunities and limitations and the staffing levels needed to manage recreational use in the area and to maintain recreation infrastructure over a long time horizon.
- We identified, to the best of our ability, the current environmental and social conditions within the analysis area, recognizing that some site-specific conditions have changed since March 2019 when the RUG Trail Plan was submitted.
- We recognized that these recreation mitigation measures represent a unique opportunity on the Globe Ranger District to establish collaborative partnerships using a phased approach where volunteers plan, lead, and execute a majority of motorized and non-motorized trail maintenance.
- As an agency, we remain committed to developing partnerships and collaborating with others to:
    - increase forest stewardship, ecological awareness, volunteerism, and user satisfaction;
    - promote a sustainable recreation program; and
    - support local recreation-based economic development.

3.1.2 Recreation Opportunity Spectrum Constraints

We sought to minimize conflicts with the ROS settings established in the 1985 Forest Plan. The ROS settings within the analysis area were overlaid with the proposed routes by type. Several of the motorized routes and trails overlapped with a Semi-primitive Non-Motorized (SPNM) area. Recommending motorized trails in SPNM could trigger the need for a forest plan amendment and change expectations for the recreation settings in the area. ROS provided a good first filter for identifying potential conflicts.

3.1.3 Travel Management Topics

We evaluated the proposed routes and trails for proximity and dependence on NFS roads that are likely to be closed to the public (decommissioned or administrative access only roads) and that are worthy of suggesting a change to the pending travel management decision.

We removed all motorized single-track routes; all motorized trails are recommended as "two-track" to accommodate both:

- All-terrain vehicles which often have a wheelbase width of 50 inches or less, and riders straddle the vehicle, with riders sitting one in front of the other; and
- Utility-terrain vehicles which allow riders to sit side-by-side and may have a wheelbase width greater than 50 inches, but not more than 60 inches.

Taking advantage of a state parks grant, we identified a different set of parking/staging areas and trail head (Perlite Pits and Arnett), in areas having less surface disturbance and already used for off-highway vehicle (OHV) trailer unloading and staging vehicles.

3.1.4 Special Management Areas

We considered the type of route proposed (e.g., motorized, non-motorized) for compatibility with areas that have special management direction. For example, motorized recreation is not a legitimate, compatible use within the Picketpost Mountain RNA and the eligible WSR segments of Telegraph and Arnett Creeks.

We also considered the purpose and nature of the AZNST. The AZNST is a well-defined trail that provides high-quality, primitive hiking and equestrian opportunities, and other compatible non-motorized trail activities, in a highly scenic setting that crosses the State of Arizona. The Alamo Canyon segment provides opportunities for solitude, immersion in natural landscapes, and primitive outdoor recreation. Backcountry skills, self-support, and extended "no-service" areas abound in Segment 17 of the AZNST, Alamo Canyon. Wood Canyon provides unique access to this Segment of the AZNST.

3.2 Summary Impacts

Table 2 displays the determinations of legitimacy, practicability, and effectiveness for each of the motorized roads and motorized and non-motorized trails that we evaluated.

Table 2. Evaluation Summary of RUG Trail Plan – Proposed Trails and Routes

RUG Trail Plan Component			Legitimate? Y/N*	Practicable? Y/N**	Effective? Y/N***	Remarks	Drop or Keep?
Route ID#	**Route Type**	**Length (miles)**					
101	Proposed Trail, Non-Motorized	2.663	Y	Y	Y	Compatible with RNA and WSR classification; Connects w/AZNST	Keep
102	Proposed Trail, Non-Motorized	0.677	Y	Y	Y	Access to AZNST and Telegraph Creek from NFSR 4	Keep
103	Proposed Trail, Non-Motorized	0.589	Y	N	N	Short loop off of NFSR 4; consider w/partners in future	Drop
104	Proposed Trail, Non-Motorized	0.676	Y	N	N	Follows Arnett Creek upstream from Telegraph trail; dead ends at private property	Drop
105	Proposed Trail, Non-Motorized	6.304	Y	N	N	Multiple trail segments off of NFSR 4 in Telegraph Canyon; consider w/partners in future	Drop
106	Proposed Trail, Non-Motorized	0.119	Y	N	N	Short segment off of #105	Drop
107	Proposed Trail, Non-Motorized	0.947	Y	N	N	Limited access when NFSR 1039 is Admin Use Only	Drop
108	Proposed Trail, Non-Motorized	0.346	Y	N	N	Limited access when NFSR 1039 is Admin Use Only	Drop
109	Proposed Trail, Non-Motorized	0.487	Y	N	N	Limited access when NFSR 1039 is Admin Use Only	Drop
110	Proposed Trail, Non-Motorized	5.746	Y	N	N	Limited access when NFSR 1039 is Admin Use Only	Drop
111	Proposed Trail, Non-Motorized	0.224	Y	Y	Y	Provides access to AZNST from 208 Wood Canyon Trail	Drop
201	Proposed Trail, Motorized	0.316	N	N	N	Trail type conflicts with ROS SPNM	Drop
202	Proposed Trail, Motorized	3.360	N	N	N	Trail type conflicts with ROS SPNM	Drop
203	Proposed Trail, Motorized	3.731	N	N	N	Trail type conflicts with ROS SPNM	Drop
204	Proposed Trail, Motorized	3.092	N	N	N	Trail type conflicts with ROS SPNM	Drop
205	Proposed Trail, Motorized	1.108	N	N	N	Trail type conflicts with ROS SPNM	Drop
206	Proposed Trail, Motorized	0.714	N	N	N	Only accessible from NFSR 1039 which is Admin Use Only	Drop

RUG Trail Plan Component			Legitimate? Y/N*	Practicable? Y/N**	Effective? Y/N***	Remarks	Drop or Keep?
Route ID#	**Route Type**	**Length (miles)**					
207	Proposed Trail, Motorized	0.373	N	N	N	Only accessible from NFSR 1039 which is Admin Use Only	Drop
208^	Proposed Trail, Motorized	6.152	N	Y	Y	Conflicts with ROS SPNM. Creates motorized access to the AZNST; **Change to non-motorized trail**	Keep w/ type change
209	Proposed Trail, Motorized	1.401	N	N	N	Only accessible from NFSR 1039 which is Admin Use Only	Drop
210	Proposed Trail, Motorized	1.732	N	N	N	Only accessible from NFSR 1039 which is Admin Use Only	Drop
300	Proposed Road, Motorized	3.603	Y	Y	Y	Motorized loop – Arnett Hills Trail; connects with Golf Course routes	Keep
301	Proposed Road, Motorized	3.198	N	N	N	Same as NFSR 1039; Admin use only; Access for Wood Canyon Trail	Drop
302	Proposed Road, Motorized	0.909	Y	N	Y	Drop portions that cross private property north of NFSR 4	Keep most
303	Proposed Road, Motorized	0.634	Y	Y	Y	Motorized routes east of NFSR 230 and west of SR 177 are preferable	Keep
304	Proposed Road, Motorized	0.384	Y	Y	Y	Motorized routes east of NFSR 230 and west of SR 177 are preferable	Keep
305	Proposed Road, Motorized	1.007	Y	Y	Y	Motorized routes east of NFSR 230 and west of SR 177 are preferable	Keep
306	Proposed Road, Motorized	0.225	Y	Y	Y	Motorized routes east of NFSR 230 and west of SR 177 are preferable	Keep
307	Proposed Road, Motorized	0.421	Y	Y	Y	Motorized routes east of NFSR 230 and west of SR 177 are preferable	Keep
308	Proposed Road, Motorized	1.195	Y	Y	Y	Motorized routes east of NFSR 230 and west of SR 177 are preferable	Keep
309	Proposed Road, Motorized	0.480	N	N	N	Route crosses private property; access not guaranteed	Drop
310	Proposed Road, Motorized	0.135	N	N	N	Route crosses private property; access not guaranteed	Drop
311	Proposed Road, Motorized	0.607	N	N	N	Route crosses private property; access not guaranteed	Drop

*Legitimate – Proposed route is consistent and compatible with the land and resource management direction

**Practicable – Proposed route is able to be constructed and maintained, and has no logistical concerns

***Effective – Proposed route offsets an impact to recreational resources of NFS Roads caused by the Resolution Copper Project and Land Exchange

^ Under current Travel Management, only a portion of route ID# 208 is proposed as non-motorized trail. The remaining portion is not included.

Table 3 lists the subset of trails from Table 2, along with a few additional trail segments associated with the Castleberry Campground parcel that we determined to be most appropriate and effective as a mitigation package going forward with the FEIS. This results in about a 2:1 replacement ratio for the expected loss of 5.5 miles of NFS roads at the East Plant Site and subsidence area.

Table 3. List of Trails and Routes Meeting Forest Service Criteria

Route ID#	Route Name	Type	Length (miles)	WSR	RNA	ROS
NA	Arnett Drive	Motorized	0.052	0.02	–	0.052 Roaded Natural (RN)
300	Arnett Hills Trail	Motorized	3.827	–	–	3.52 RN 0.30 SPM 0.01 SPNM
302	Arnett Hills Trail – Cutoff	Motorized	0.227	–	–	0.227 RN
NA	Caboose Trail	Non-motorized	0.269	–	–	0.268 Urban
303 - 308	Perlite Pits Area Trails	Motorized	3.76	–	–	3.76 RN
NA	NFSR 4 Reroute	Motorized	0.711	0.12	–	0.711 SPM
101, 102	Telegraph Trail	Non-motorized	2.892	1.69	0.62	2.892 SPM
208	Wood Canyon Trail	Non-motorized	7.217	–	–	1.0 RN 3.71 SPM 2.51 SPNM
NA	Wood Canyon Trail – Big Saguaro Spur	Non-motorized	0.167	–	–	0.167 SPM
NA	Inconceivables Road	Motorized	1.45	–	–	0.80 SPM 0.65 SPNM
	Total Motorized		**9.317**			
	Total Non-motorized		**11.255**			
	Total		**20.572**			

4 Recommendations

Table 4 lists the routes and trail segments that the Forest Service recommends as mitigation to alleviate impacts to recreation resources resultant of the Resolution Copper Project. This network of trails and motorized routes will be carried forward and disclosed as part of the FEIS and included as required mitigation actions (i.e., Resolution Copper to provide funds for design and construction) as part of the Forest Service decision regarding the Resolution Copper Project. Figure 4 illustrates the Final recommended network, along with the revised parking/staging area locations and their relationship to the proposed Castleberry Campground and proposed access road to the Inconceivables climbing area.

Table 4. List of Tonto National Forest–Final Recommended Trails and Motorized Routes

Route Name ***(old Route ID#)***	**Type**	**Length (miles)**
Caboose Trail *(NA)*	Non-motorized	0.268
Telegraph Trail *(101, 102)*	Non-motorized	2.892
Wood Canyon Trail *(208)*	Non-motorized	7.217
Wood Canyon Trail – Big Saguaro Spur *(NA)*	Non-motorized	0.167
Arnett Drive *(NA)*	Motorized	0.052
Arnett Hills Trail *(300)*	Motorized	3.827
Arnett Hills Trail – Cutoff *(302)*	Motorized	0.227
Perlite Pits Area Trails *(303-308)*	Motorized	3.76
NFSR 4 Reroute *(NA)*	Motorized	0.711
Inconceivables Road *(NA)*	Motorized	1.45
Total Motorized		**9.317**
Total Non-motorized		**11.25**
Total		**20.572**

4.1 Descriptions of Recommended Trails and Motorized Routes

4.1.1 Recommended Non-motorized Trails

Telegraph Trail

The Telegraph Trail represents a key non-motorized trail that would be a part of a series of trails that can be pieced together to loop around Picketpost Mountain. Highly desired by both the public and the Forest Service, the Telegraph Trail also provides sweeping views of the eastern slopes of Picketpost Mountain and Arnett Creek Canyon. It is currently being used although is not designated.

Wood Canyon Trail and Big Saguaro Spur

The Wood Canyon Trail follows an old road, now closed to public motorized use, designated by the 2019 Travel Management ROD as "administrative use only." This trail is highly used by equestrians, and is a popular equestrian route used to access the White Canyon Wilderness and Segment 17 of the Arizona National Scenic Trail: "Alamo Canyon," south of the RUG planning area. The Spur Trail provides a safe route to observe an exceptionally large saguaro cactus.

Caboose Trail

The Caboose Trail's name is derived from the red caboose railcar along U.S. 60 in Superior. This landmark provides information and nearby access to the LOST segments through Queen Creek and into Forest Service lands.

4.1.2 Recommended Motorized Trails (two-track full-size)

Arnett Hills Trail and Arnett Hills Trail – Cut-off

This trail provides a loop opportunity for motorized vehicles in an area already heavily used by OHVs and other motorized vehicles. It connects to the popular NFSR 230/Arnett Drive road, accessible from U.S. 60 in Superior and along SR 177. The trail traces the top of a hilly mesa, with excellent views afforded at numerous escarpments, including several with views of Arnett Creek. The Cut-off provides a convenient yet adventurous short cut for a long switchback on Arnett Hills Trail.

Arnett Drive

This short spur provides a connection from the Perlite Pits Area Trails to NFSR 3790/Arnett Drive; it occurs on an existing route across private lands

Perlite Pits Area Trails

These motorized trails occur within the loop that would be created by the Arnett Hills Trail and offer key connectivity to existing NFSRs 998 and 2476 in an area that is already heavily used by OHVs and other motorized vehicles. These trails are also purposefully located nearby the two proposed staging areas, Arnett and Perlite Pits Staging Areas, to provide convenient access to a wide variety of users and, in some cases, room for their haul vehicles and trailers.

NFSR FSR 4 Reroute

The Reroute for NFSR 4 was precipitated by mineral development and the need for public safety. This reroute provides legal and safe public use; whereas the old route was on private lands.

Inconceivables Road

Located at the end of NFSR 2259, this unauthorized route provides key recreation opportunity and access to climbing areas (crags and boulders). This motorized road, if constructed, is tied to the Resolution Copper EIS Mitigation proposal RC-213 (Forest Service 2019c).

4.2 Descriptions of Recommended Staging Areas

The Arnett Trail Head at the corner of NFSR 4 and NFSR 230 is well suited for access by equestrian users and other non-motorized users. Likewise, the Perlite Pits Staging Area has been historically used by motorized users for parking/trailering and using as departure area for OHV trips.

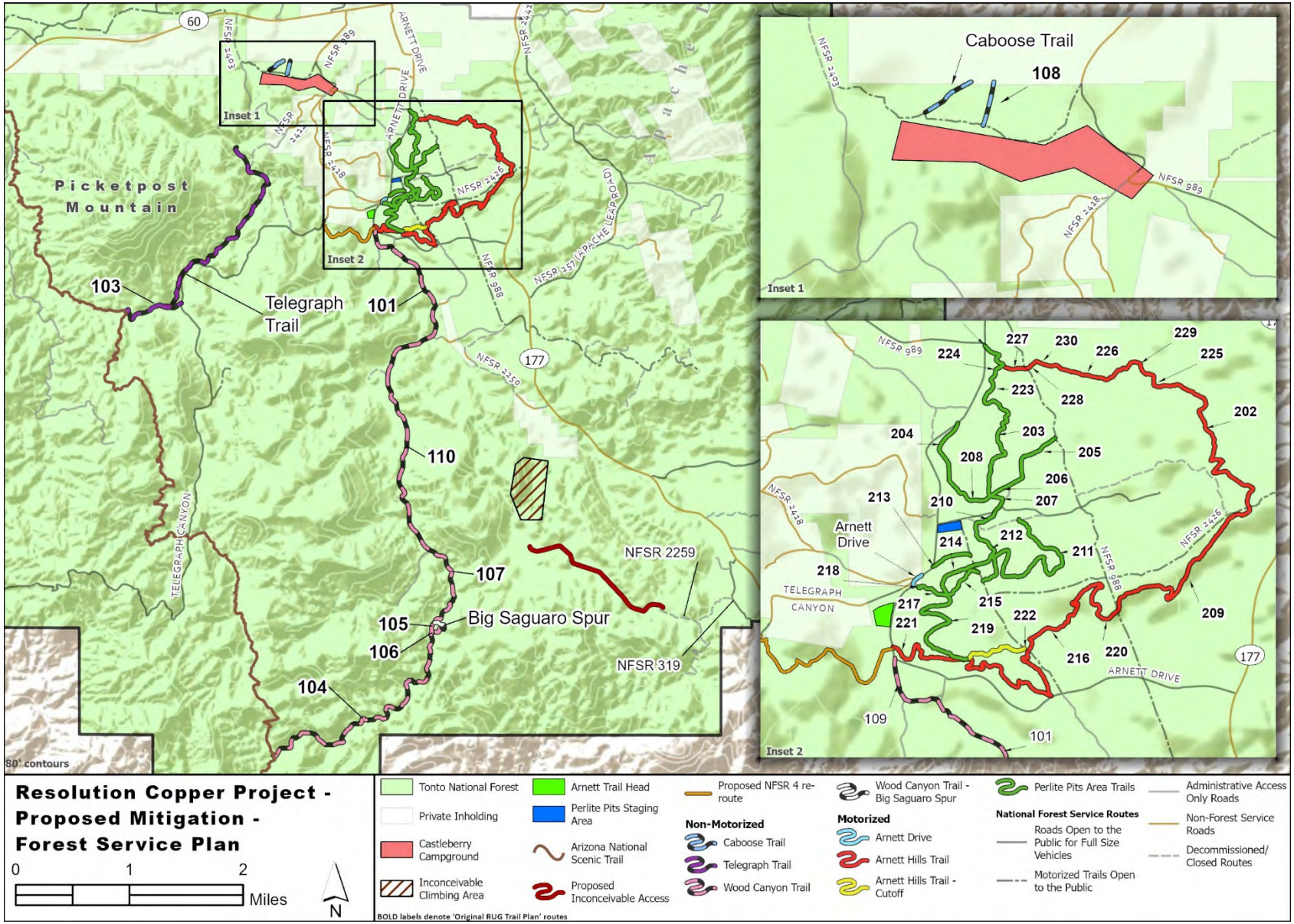

Figure 4. Forest Service–Final recommended trails and motorized routes.

5. References

Audubon Society. 2020. Important Bird Areas of Arizona: Boyce Thompson Arboretum and Arnett-Queen Creeks. Available at: https://www.audubon.org/important-bird-areas/boyce-thompson-arboretum-and-arnett-queen-creeks . Accessed August 1, 2020.

Community Working Group (CWG). 2020. Recreation User Group website: "About Us." Available at: https://superiorazcwg.org/resources/recreation-user-group/. Accessed June 30, 2020.

SWCA Environmental Consultants. 2019. *Process Memorandum to File: Recreation User Group's (RUG) "Superior, Arizona Recreation Project Conceptual Plan" Mitigation Effectiveness Evaluation*. June.

U.S. Forest Service (Forest Service). 1985. *Tonto National Forest Plan*. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3795286.pdf. Accessed August 1, 2020. October.

———. 2019a. *Draft Forest Plan, Coconino, Gila, Maricopa, Pinal and Yavapai Counties, Arizona*. MB-R3-12-05. Available at: https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd680654.pdf. Accessed August 1, 2020. November.

———. 2019b. *Travel Management on the Tonto National Forest Final Supplemental Environmental Impact Statement.* Available at: https://www.fs.usda.gov/nfs/11558/www/nepa/59232_FSPLT3_4867872.pdf . Accessed August 1, 2020. October.

———. 2019c. *Resolution Copper Project Draft Environmental Impact Statement.* Available at: https://www.resolutionmineeis.us/documents/draft-eis . Accessed August 1, 2020. August.

WestLand Resources. 2019. *Superior, Arizona Recreation Project Conceptual Plan.* Prepared for Recreation User Group. March.

APPENDIX A

Superior, Arizona Recreation Project Conceptual Plan
March 2019

SUPERIOR, ARIZONA
RECREATION PROJECT CONCEPTUAL PLAN
Recreation User Group

Prepared for:

Recreation User Group

Project Number: 807.135

March 2019

WestLand Resources

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(follow text)

1. INTRODUCTION

In 2016, the Recreation User Group (the Group) was formed to develop a recreational trail design within the vicinity of Superior, in Pinal County, Arizona (the Project Area; **Figure 1**). The Group was charged with developing a conceptual plan for a trail system on the Tonto National Forest (TNF) that will meet the needs and interests of different stakeholder groups while also meeting the management priorities of the U.S. Forest Service (USFS). The proposed trail network occurs on a mixture of public lands or public rights-of-way and private land within portions of Township 2 South, Range 11-13 East, and Township 3 South, Range 12 East (**Figure 2**). The majority occur on the Globe Range District of the TNF, and a small portion occurs on private land owned or managed by Resolution Copper (Resolution).

A network of unpaved roads and trails, many of which are user-created alignments that are not authorized by the USFS, currently exists within the Project Area. These trails and roads have resulted in ongoing resource degradation. The Group, which is comprised of representatives from the Town of Superior's intended recreational users, including hikers, equestrians, mountain bicyclists and off-highway vehicle (OHV) enthusiasts, was created to identify recreational resources and develop a conceptual layout for the recreational trail design (the Project). On July 25, 2018, the Group voted to move forward with the preparation of the conceptual plan for submittal to the USFS.

This report has been prepared to detail the review process used to develop the conceptual plan; the existing conditions within the Project Area; the project construction, maintenance, and funding; the members of the Group; and references cited.

2. BACKGROUND

2.1. HISTORY OF THE AREA

The proposed trail system is located on TNF lands adjacent to Superior, Arizona, a mining town that like many mining towns has been subject to the inherently cyclical nature of the mining industry. The Superior area is a one-hour drive from Phoenix, a city with a population of more than 4.73 million in the greater metropolitan area. With its proximity to Phoenix, the TNF is "one of the most-visited 'urban' forests in the United States (approximately 5.8 million visitors annually)" (TNF 2019)[1].

Superior, which serves as a gateway to the TNF, is surrounded by natural beauty and world class recreation opportunities on the TNF that are currently unrecognized, underdeveloped, and subject to misuse, including unauthorized roads and trails, wildcat dumping, and informal target practice sites.

[1] https://www.fs.usda.gov/tonto/; accessed on February 7, 2019.

2.2. PROJECT PURPOSE

There is a need for a trail system in the vicinity of Superior, Arizona, in order to reduce the haphazard development of unauthorized trails that has led to the degradation of riparian habitat and impacts to wildlife and plant species. The purpose of the Project is to provide a recreational trail system within the TNF with the following characteristics:

- Provides recreation opportunities for hikers, equestrians, mountain bicyclists and OHV enthusiasts.
- Is readily accessible to Superior and the Phoenix metropolitan area
- Offers long-term, sustainable economic benefits to the local community through recreation and ecotourism
- Protects soil resources in this area from erosion, thus preventing sediment yield into surface waters
- Provides access to uniquely beautiful viewsheds within TNF that are not currently accessible by authorized trails

3. PROJECT AREA DESCRIPTION

3.1. EXISTING LAND USES

Land uses within TNF lands near the Project Area consist predominantly of livestock grazing, mining, and outdoor recreation including hiking, birding, horseback riding, mountain biking and off-roading. Additionally, hunting regulated by Arizona Game and Fish Department occurs on TNF lands within and adjacent to the Project Area (Game Units 24A and 37B), and an informal shooting area is located near the upper reach of Arnett Canyon. There are a number of areas devoid of vegetation that appear to be dispersed camp sites or staging areas. Several isolated illegal trash dumps are also scattered around the Project Area. Where the terrain is rocky and steep, and access is more challenging, the landscape remains relatively undisturbed. With the exception of the portion of the Arizona National Scenic Trail (AZNST) that crosses through the Project Area, existing trails on TNF lands are primarily unauthorized motorized and non-motorized trails (**Table 1**).

Table 1. Existing Unauthorized Trails on USFS Lands within the Project Area

Trail Type	Existing (miles)
Motorized	24.6
Motorized (single track)	0
Non-Motorized	17.3
TOTAL	**41.9**

Land uses on private and state lands adjacent to the Project Area include rural and suburban residential neighborhoods, livestock grazing, recreation, industrial activities such as mining and an active quarry. The Boyce Thompson Arboretum State Park, an Important Bird and Biodiversity Area recognized by Audubon Arizona, is located immediately north of the northwestern extent of the proposed trail system. The northeast portion of the proposed trail system consists of private property in Superior and includes facilities such as the Town of Superior waste water treatment plant, Superior Municipal Airport, and the Superior Unified School District. The Perlite Superior Plant is located east of Picketpost Mountain, immediately north of the north central portion of the trail system. Two private inholdings are located along Arnett Creek in the central east portion of the Project Area owned by a cattle company and a living trust.

In general, more extensive human disturbance occurs within the eastern portion of the Project Area, while the western portion remains relatively undisturbed.

3.2. PHYSICAL FEATURES

The Project Area is located in the Central Highlands Physiographic Province, a transitional area between the Colorado Plateau Physiographic Province and the Basin and Range Physiographic Province (Ffolliott 1999). Elevations within the Project Area range from approximately 2,400 feet (ft) above mean sea level (amsl) in the lower reach of Arnett Creek to the summit of Picketpost Mountain at approximately 4,375 ft amsl. Topography within the Project Area is associated with the foothills of surrounding mountains and is dominated by steep to rolling terrain and includes highly scenic features such as standing boulders and other rock outcrops, dramatic rock faces, narrow rocky ridges, and sharply incised canyons.

The terrain within the Project Area can be generally divided into two areas. The eastern portion of the Project Area, between State Route 177 and the eastern ridge of Wood Canyon, is characterized by gently rolling hills. This lowland area affords extensive views of the Apache Leap formation to the east and Picketpost Mountain to the west. The portion of the Project Area located to the west, between Wood and Telephone Canyons, is characterized by more rugged terrain created by the ridges and drainages of the Canyons. These formations follow a roughly parallel course until the two canyons reach the lower slopes of Picketpost Mountain.

3.3. CLIMATE AND AIR

The regional climate in the vicinity of the Project Area is characterized as semiarid, with long periods of little or no precipitation (Western Regional Climate Center 2019)[2]. Precipitation falls in a bimodal pattern: most of the annual rainfall within the region occurs during the winter and summer months,

[2] https://wrcc.dri.edu/Climate/west_coop_summaries.php; accessed on February 7, 2019.

with dry periods characterizing spring and fall. The average annual precipitation in the Superior region is 20.22 inches, with just over half occurring between November and April (U.S. Climate Data 2019)[3].

Air quality within the vicinity of the Project Area currently meets National Ambient Air Quality Standards (NAAQS) standards for the seven "criteria pollutants": carbon monoxide (CO), sulfur dioxide (SO_2), particulates with an aerodynamic diameter less than or equal to a nominal 10 µm (PM_{10}), particulates with an aerodynamic diameter less than or equal to a nominal 2.5 µm ($PM_{2.5}$), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb). The National Park Service has a long-term air quality dataset for the Tonto National Monument located to characterize the air quality in the Superstition Wilderness, located north of the Project Area, which indicates air quality is good and air pollution levels are lower than in populated areas. All of the areas within the Project Area are in attainment status. The nearest non-attainment areas include the Hayden airshed, which is in non-attainment for PM_{10} immediately east of the Project Area, and the Phoenix airshed, which is in non-attainment for O_3.

3.4. VEGETATION

Based on the broad scale biotic community mapping of Brown and Lowe (Brown and Lowe 1980), the majority of the Project Area is mapped as the Arizona Upland Subdivision of Sonoran Desertscrub (Turner and Brown 1982), with vegetation characteristic of that biotic community present, including saguaro (*Carnegiea gigantea*), paloverde (*Parkinsonia* spp.), jojoba (*Simmondsia chinensis*) and occasional crucifixion thorn (*Canotia holacantha*).

Telegraph Canyon, Arnett Creek, Queen Creek, and some of the unnamed side canyons and springs within the Project Area support relatively narrow bands or patches of riparian vegetation consistent with Interior Riparian Deciduous Forests and Woodlands (Minckley and Brown 1994). Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), Arizona sycamore (*Platanus wrightii*), Arizona walnut (*Juglans major*), netleaf hackberry (*Celtis reticulata*), seepwillow (*Baccharis salicifolia*), California buckthorn (*Rhamnus californica*), and the nonnative saltcedar (*Tamarix* sp.) are the dominant species in these areas. The other ephemeral drainages, exhibit xeroriparian vegetation, with plant species composition similar to that of the surrounding upland areas, but in higher stature and densities.

3.5. SURFACE WATER FEATURES

Intermittent and near-perennial surface waters in Arnett and Queen creeks support riparian plant communities and aquatic and wetland features within portions of the Project Area. The riparian woodlands are represented by narrow, linear stands comprised of Fremont cottonwood, Goodding's willow, Arizona walnut, and Arizona sycamore and salt cedar. The linear stands are largely contiguous with occasional breaks in the canopy.

[3] https://www.usclimatedata.com/climate/superior/arizona/united-states/usaz0228; accessed on February 7, 2019.

4. PROJECT DESCRIPTION

4.1. CONCEPTUAL PLAN DEVELOPMENT AND COMMUNITY INVOLVEMENT

The Project was first proposed by Resolution to TNF as a mitigation measure for Resolution's planned mining activities. The Group was developed as part of TNF's efforts to engage the local community throughout the planning and development process. Stakeholders were identified for the Group with the intention of creating a well-designed and well-implemented trail system that meets stakeholder needs. The Group ultimately included representatives from the Town of Superior, the local community, Resolution, and members of the outdoor recreation community (see **Table 3** for Group members). Additionally, TNF representatives attended regularly to provide input and direction for the Group.

The Project is located within Forest Plan Management Area 2F, and the proposed trail system must conform with the management priorities for this management area, which predominantly focuses on wildlife habitat improvement, water quality maintenance, livestock forage production, and dispersed recreation. The Forest plans to manage watersheds to improve them to a satisfactory or better condition and improve and manage adjacent riparian areas to benefit riparian dependent resources (USFS 1985, page 85).

The following is direction provided directly from the TNF Plan (USFS 1985) for the Project Area:

- Continue periodic inspection and maintenance of existing wildlife exclusions and restoration projects. Develop reports as needed to describe results of studies. Improve the level of protection and maintenance at these sites to ensure their continued informational value for wildlife management (USFS 1985, page 87).
- Based on Transportation Operation and Maintenance (O&M) Plans, identify alternative routes for new trails near urban centers and/or main travel routes. Gather information for cost estimating and design criteria. Includes trail location and selection, survey design and field review (USFS 1985, page 89).
- O&M of entire trail system to provide for a variety of user experience levels, resource protection and public safety. Includes trail condition surveys and maintenance plans (USFS 1985, page 89).

During the conceptual plan development for the Project Area, the Group balanced TNF management and recreation priorities with the priorities identified by the stakeholders. Ultimately, the following goals for the trail network design were identified:

(a) consolidate the existing trail network to reduce unauthorized disturbance;
(b) allow for a diverse range of trail types for both motorized and non-motorized uses;
(c) maximize and preserve views of the outstanding natural scenery of the area;

(d) segregate use types as necessary to minimize conflicts and facilitate public safety;
(e) be sustainable and require minimal maintenance;
(f) be able to be constructed in phases.

The Group has met on a regular basis since 2016 (**Table 2**). Conceptual trail routes were developed using aerial imagery, topographic information and the local expertise of Group members. The Group engaged an environmental consultant (WestLand Resources, Inc.) to review cultural and biological resources within the proposed trail routes as well as a trail design consultant (Southwest Trail Solutions) to assist with the development of the trail design and resource review process.

Table 2. Recreation User Group Meeting Dates *

Day	Year
September 24	2015
November 30	2015
February 10	2016
April 13	2016
September 14	2016
December 7	2016
February 8	2017
April 12	2017
October 10	2017
November 9	2017
December 13	2017
February 14	2018
April 11	2018
July 25	2018
November 14	2018
January 9	2019

* List of meeting dates is based on information provided on the Superior Arizona Community Working Group website: https://superiorazcwg.org/category/meeting-notes/recreation-user-group/. CWG Recreation & Access Task Force Meeting dates are excluded from this list.

The stakeholder representatives comprising the Group membership are listed in **Table 3**.

Table 3. Recreation User Group Members

Representative	Organization
John Bricker	Tonto Recreation Alliance
Rich Smith	Tonto Recreation Alliance
Kevin Patterson	Tonto Recreation Alliance
Mila Besich-Lira	Town of Superior
Todd Pryor	Town of Superior
Elizabeth Butler	Friends of Tonto National Forest & Equestrians
Jim Schenck	Superior Community Working Group
Greg Waterman	Sun City Anthem Hiking Club
Bruce Odegaard	Sun City Anthem Hiking Club
Lynn Martin	Ranching community
George Martin	Ranching community
Rick Schonfeld	WestLand Resources, Inc.
Mark Flint	WestLand Resources, Inc./Southwest Trail Solutions
Mary Morissette	Resolution Copper
Erik Filsinger	Queen Creek Coalition
Patrick Kell	International Mountain Bicycling Association
John Godec	Godec, Randall & Associates
Debra Duerr	Godec, Randall & Associates
Bill Volger	Legends of Superior Trails (LOST)
Nancy Volger	Legends of Superior Trails (LOST)

4.2. DESIGN

The preliminary trail designs were developed by the Group stakeholders and then refined based on field reconnaissance and cultural resources identified for avoidance. The trail alignments and trailhead areas were surveyed for impacts to cultural resources. For the trail alignments, a corridor width of 10 meters to either side of the proposed travel way (20 meters total) was surveyed to ensure the conceptual plan does not conflict with cultural resources that are eligible for the National Register of Historic Places. The preliminary designs were adjusted where needed to ensure each trail alignment is constructible, consistent with USFS construction standards, sustainable, and navigable.

During field reconnaissance, trail designers identified the opportunity to segregate the two major trail use categories – motorized and non-motorized – into different sections of the trail system. The ridge line extending approximately north/south separating Telegraph Canyon and Wood Canyon serves as a natural boundary between the two use areas (**Figure 2**). One portion of the trail system, north and

east of Wood Canyon, was designed primarily for operation of motorized equipment, both two-wheeled (motorcycles) and four-wheeled (small all-terrain vehicles and larger jeeps and sport-utility vehicles). The other portion of the trail, to the west of Wood Canyon, was designed primarily for non-motorized recreation (equestrian, mountain biking, and hiking).

Physically separating the two categories of trail use meets the Groups' goals of providing a diverse range of trail types in a safe and sustainable way. There are two exceptions to this segregation, however. A single new non-motorized trail has been proposed within the lowlands of the primarily-motorized section to provide a more moderate non-motorized trail with easy access from Superior and the highways. The other exception is the presence of an existing designated motorized USFS road within the portion western portion of the Project Area that is primarily non-motorized. A short segment of new motorized trail is proposed to connect the motorized trail system through the primarily non-motorized portion of the Project Area to the existing USFS road.

Potential locations for trailhead parking areas which were also segregated for motorized and non-motorized (primarily equestrian) uses. Users of both types of trails often use trailers, so the trailhead for each type of trail was designed to provide ample room for parking and unloading. All trailheads will be located within the lowlands in the northeast of the Project Area to provide easy access to the trailheads from Superior and the highways.

All trails are designed to maximize long-term sustainability and minimize erosion with consideration given to grade, angle, slope, and clearance. The trail system design also considers existing roads, unauthorized trails, and other sources of resource degradation and/or public safety concerns within the Project Area and identifies strategies for addressing these issues. The trail system is also designed to provide a variety of trail difficulty levels ranging from novice to expert. Design standards for the two user types (motorized vs. non-motorized) are identical, with the exception that sight-line distances and turning radii will be greater on motorized trails to accommodate the greater speeds and power associated with motorcycle use.

Final trail design and construction will take into consideration the local hydrology, soil types, cultural sites, and sensitive species that are listed, proposed or candidate for listing as threatened or endangered under the Endangered Species Act (ESA) within the area of the desired trail location. Known caves within the immediate vicinity of the proposed trail routes will continued to be managed by the USFS to protect culturally significant sites and follow U.S. Fish and Wildlife Service white nose syndrome protocols for bat populations that may frequent the caves. Trail designers will also identify sources of erosion, assess the potential impacts, and ensure that water and wind will not adversely affect the intended travel way.

4.3. LAYOUT

The trail system has been laid out as a standalone recreation system for both motorized and non-motorized users in the Superior region. The trail system has been designed to deliberately limit AZNST tie-ins to already-designated locations in an effort to avoid additional unplanned pressures on AZNST usage.

The trail layout is designed to encourage the use of the proposed trail system while discouraging the use of the existing unauthorized trails and the creation of new unauthorized trails. The is accomplished through two primary approaches: signage placement and route design. First, signs will be strategically placed at trail heads to indicate the authorized paths and reinforce good trail stewardship by stressing the importance of staying on designated trails. Signs will also be placed as a deterrent, along with boulders, railings, etc., at unauthorized access points to discourage off-trail usage. Second, the trail route has been located such that turns in the trail (a common point where unauthorized trail usage occurs) will be placed adjacent to features that will serve as natural deterrents to off-trail use, such as large boulders, steep inclines or drop-offs, etc.

Three staging areas are planned on TNF lands (**Figure 3**) totaling 2.9 acres of disturbance. These staging areas are strategically located to be close to desirable recreation areas while also being accessible to passenger vehicles and close enough to Superior to encourage visitor use of the town.

Table 4 provides a summary of the of trail lengths segregated by trail type. Motorized trails include two track routes appropriate for four-wheeled vehicles and single-track routes appropriate for off-highway motorcycles. Non-motorized trails are proposed single-track routes that are intended for hikers, cyclists, and equestrians.

Table 4. New Trails Proposed on TNF Lands

Trail Type	Trail Length (miles)
Motorized (two track)*	14.7
Motorized (single track)	28.7
Non-Motorized	25.6
TOTAL	**69.0**

* Existing unauthorized two-track trails

The layout of existing trails on private land with the potential to be connected to the proposed network on TNF lands are not included in the estimated trail lengths, as private trails are not included in this plan unless an easement already exists or the land owner has agreed to grant an easement for the trail.

4.4. CONSTRUCTION

Most proposed trail construction within the lowlands of the Project Area (in the northeast portion) will consist of improvements to existing unauthorized two-track roads to reduce ongoing erosion and increase public safety. Redundant existing roads will be obliterated and reclaimed to the extent possible. The construction of one new non-motorized single-track trail and three trailhead parking areas are proposed within this section (**Figure 2**).

Typical activities associated with the construction of the new trail alignments will include shaping the thin soil layer where present and moving and/or reducing the sizes of boulders where they conflict with the intended users. Where possible, boulders and rock ledges will be incorporated into the trail alignments in accordance with the skill level of the anticipated users. Vegetation along proposed new single track alignments will be pruned to an approximate height of 10 feet and an approximate width of 6 to 8 feet to allow sufficient space for users to pass in opposite directions.

The bulk of construction will be done manually by volunteer crews, including youth, veteran, and ancestral lands crews, during the cooler months of the year. Most of the new trails will be constructed in the upland areas on top of solid rock. Manual construction activities will include shaping the thin soil layer where possible, moving boulders out of the planned trail route, and breaking rock to allow for passage where necessary. Some rocks and rock ledges will be preserved to provide a more challenging terrain for bicyclists.

Where necessary, professional operators will use mechanized equipment for trail construction. This will likely be limited primarily to the lowlands along the northern extent of the Project. In these cases (and where feasible) a SWECO trail dozer and mini excavator (or equivalent) would be used to construct the trail. Construction will proceed in phases.

The majority of new motorized trails will be for single-track (motorcycle) use only.[4] Design and construction standards will be essentially the same as for non-motorized use trails. Because of the greater speed and power associated with motorcycle use, sight-line distances, turning radii and switchback construction will all be adjusted accordingly.

4.5. MAINTENANCE

Sustainable trail design and construction are being applied from the outset to minimize trail maintenance. As a result, most of the maintenance is anticipated to consist of pruning vegetation and maintaining drainage crossings. Unusually severe weather events may require more intensive maintenance and possible trail reconstruction.

[4] Approximately 3.2 miles of existing unauthorized trails are two track.

The success of numerous volunteer groups, such as the Arizona Trail Association (which maintains the AZNST), illustrates the fact that non-profit organizations can provide ongoing maintenance for recreational trails. It is anticipated that at least one such organization will be formed to recruit, train, and manage trail stewards and to raise funds for major repair projects.

4.6. FUNDING

It is anticipated that all final design and construction costs will be provided by at least one dedicated non-profit organization with additional funding provided by other entities. Construction and maintenance work will be conducted mainly by volunteers, such as youth, veteran, and ancestral lands volunteer crews. The bulk of construction expenses will come from the development of the final design and field layout by professional contractors, and the professional crews needed for more challenging trail sections. Possible funding sources include Resolution as well as grants, donations, and special organized events.

4.7. TRAIL BENEFITS

The trail is anticipated to provide benefits to the local economy in the form of long-term sustainable recreation and ecotourism, to reduce resource degradation from unauthorized trail use, and to better employ the currently underdeveloped recreational opportunities of National Forest lands located in proximity to a major metropolitan area.

The economic impacts that outdoor recreation provide to rural communities are well documented, and it is anticipated that development of the Project will be no exception for Superior, Arizona. Because the Project contains such a diverse range of scenic terrain within a relatively small area, it has the potential to become a popular destination for the growing number of outdoor recreation enthusiasts not only from the greater Phoenix area but also from across the country. In order to encourage visitors to use the town as a starting point, the Project includes the extension of an existing trail from town to the Picketpost trailhead on the Arizona National Scenic Trail (**Figure 2**), thereby providing a direct non-motorized connection to the Project Area. It is anticipated that the local business community will promote and participate in volunteer trail construction and maintenance efforts. The phasing of Project construction will allow for existing businesses to adapt to an expanding clientele and for new businesses to take advantage of new opportunities.

Developing a planned trail with appropriate signage and design elements will reduce the impacts to soil erosion, wildlife, plant life, and riparian habitat that the area is currently experiencing from the haphazard and unauthorized trail use that is occurring due to the lack of a planned system. The plan has identified sensitive resources and designed the trail system to avoid or minimize impacts to these resources.

The Group was developed specifically to ensure the trail system plan is one that meet the interests of the current users in a sustainable way that is in line with USFS management priorities. As a result, the proposed Project provides recreation opportunities currently unavailable in this location that are of interest to potential users. Furthermore, the Project's proximity to a major metropolitan area will facilitate access to these resources to in a more deliberate and environmentally sustainable way.

The proposed plan addresses ongoing management concerns for the TNF while providing a service and recreation opportunities that are currently underdeveloped to the local and regional communities, creating long-reaching benefits to the region.

5. REFERENCES

Brown, David E., and C. Lowe. 1980. Biotic Communities of the Southwest [Map]. *General Technical Report RM-78*. Fort Collins: Reprinted (and revised) 1994 by University of Utah Press, Salt Lake City.

Ffolliott, P.F. 1999. "Central Arizona Highlands." In *History of watershed research in the Central Arizona Highlands*, edited by Jr. Baker, M.B., 1-6. Fort Collins: U.S. Forest Service, Rocky Mountain Research Station General Technical Report RMRS-GTR-29.

Minckley, W. L., and D. E. Brown. 1994. "Interior and Californian Riparian Deciduous Forests and Woodlands." In *Biotic Communities: Southwestern United States and Northwestern Mexico*, edited by D. E. Brown, 250-254. Salt Lake City: University of Utah Press.

Turner, R. M., and D.E. Brown. 1982. "Sonoran Desertscrub." In *Biotic Communities of the American Southwest – United States and Mexico*, edited by D. E. Brown, 181-221. Boyce Thompson Southwestern Arboretum.

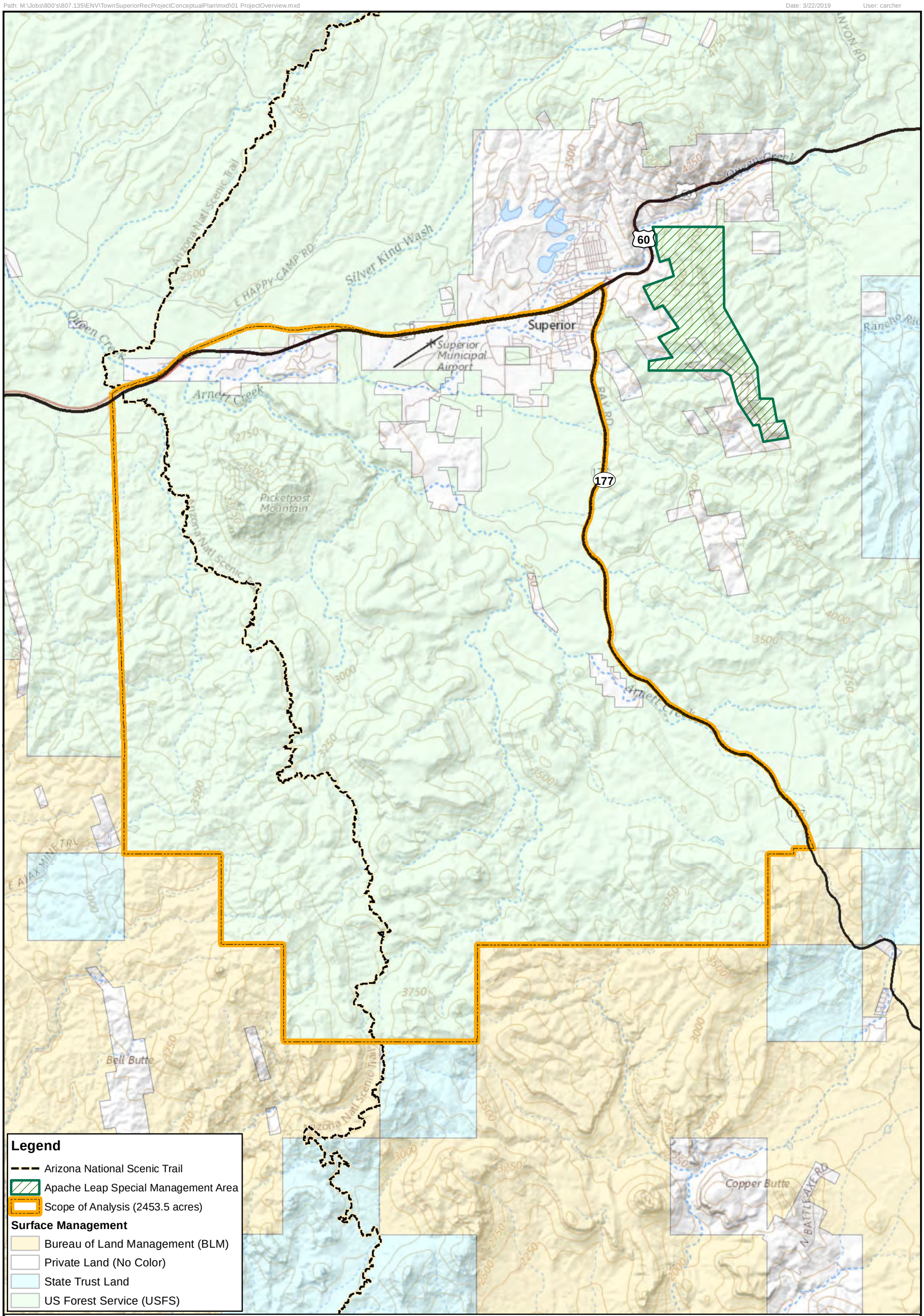
U.S. Climate Data. 2019. Climate Superior - Arizona. *U.S. Climate Data (Temperature - Precipitation - Sunshine - Snowfall)*: Your Weather Service.

U.S. Forest Service. 1985. Tonto National Forest Plan. Published by Southwest Region: U.S. Department of Agriculture. October 1985. 329 pp.

_____. 2019. Tonto National Forest. *Website*. Phoenix, Arizona: U.S. Forest Service.

Western Regional Climate Center. 2019. NOAA Cooperative Stations - Temperature and Precipitation.

FIGURES



Scope of Analysis within:
T2S, R11-13E, and T3S, R12E,
Pinal County, Arizona,
Data Source: AZ Trail Association and
Surface Management: BLM 2018, WRI modified 2018
Image Source: ArcGIS Online USGS National Map

WestLand Resources

N

0 2,500 5,000 Feet

0 1,000 2,000 Meters

RECREATION USER GROUP
SUPERIOR, AZ
Conceptual Plan

PROJECT OVERVIEW
Figure 1

Picketpost Trailhead

Proposed Trailhead/Parking Lot 1
Off-Highway Vehicle Users

Proposed Trailhead/Parking Lot 2
Equestrians and Mountain Bicyclists

Proposed Trailhead/Parking Lot 3
Equestrians and Mountain Bicyclists

Scope of Analysis within:
T2S, R11-13E, and T3S, R12E,
Pinal County, Arizona,
Mesa USGS 1:100,000 USGS Quadrangle
Data Source: Surface Management (BLM 2018, WRI Modified 2018),
Recreation User Group (RUG)
Road Classification: ArcGIS Online, USA Major Roads

WestLand Resources

N

0 1,250 2,500 Feet

0 500 1,000 Meters

Legend

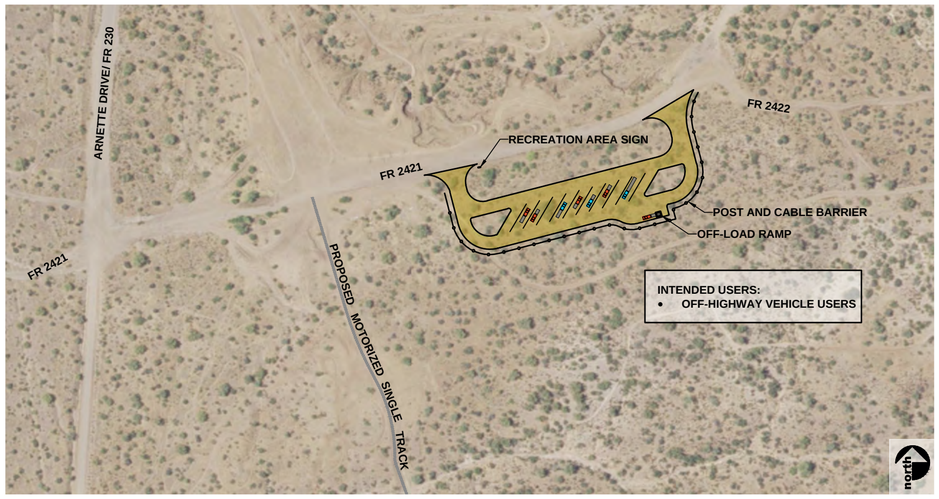
Recreation Use Trail
- Proposed Trail, Motorized (Single Track)
- Existing Forest Road, Motorized
- Proposed Road, Motorized
- Existing Trail, Non-Motorized
- Proposed Trail, Non-Motorized
- Telegraph Canyon/Wood Canyon Ridgeline

Road Classification
- Other Major Road
- Secondary Road
- Important Local Road
- Scope of Analysis (2453.5 acres)

Surface Management
- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

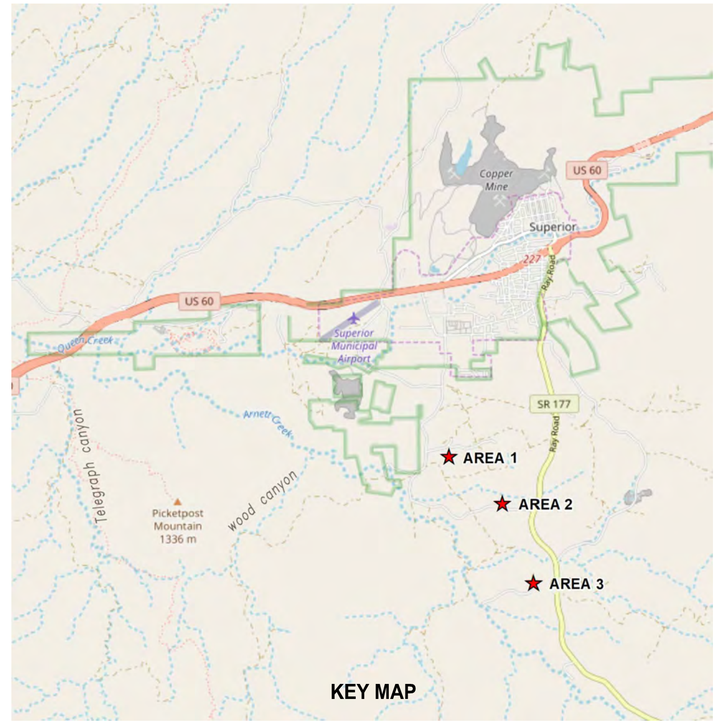
RECREATION USER GROUP
SUPERIOR, AZ
Conceptual Plan

TRAIL DESIGN
Figure 2



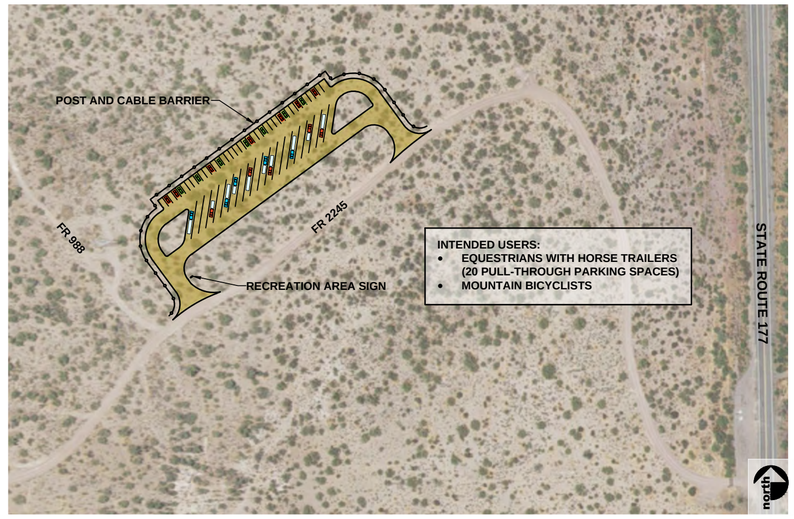
1 **TRAILHEAD PARKING AREA (FOREST ROADS 2421 & 2422) : OFF-HIGHWAY VEHICLES**

SCALE: 1" = 200'



2 **TRAILHEAD PARKING AREA (ARNETT DRIVE/ FOREST ROAD 230) : EQUESTRIAN & MOUNTAIN BICYCLIST**

SCALE: 1" = 200'



3 **TRAILHEAD PARKING AREA (FOREST ROAD 2245) : EQUESTRIAN & MOUNTAIN BICYCLIST**

SCALE: 1" = 200'

WestLand Resources Inc.
Engineering and Environmental Consultants
4001 E. Paradise Falls Drive
Tucson, Az 85712 (520) 206-9585

RECREATION USER GROUP
SUPERIOR, AZ
Conceptual Plan

TRAILHEAD PARKING AREAS

Figure 3

APPENDIX C

Updated Figures for the Biological Assessment for the Resolution Copper Project

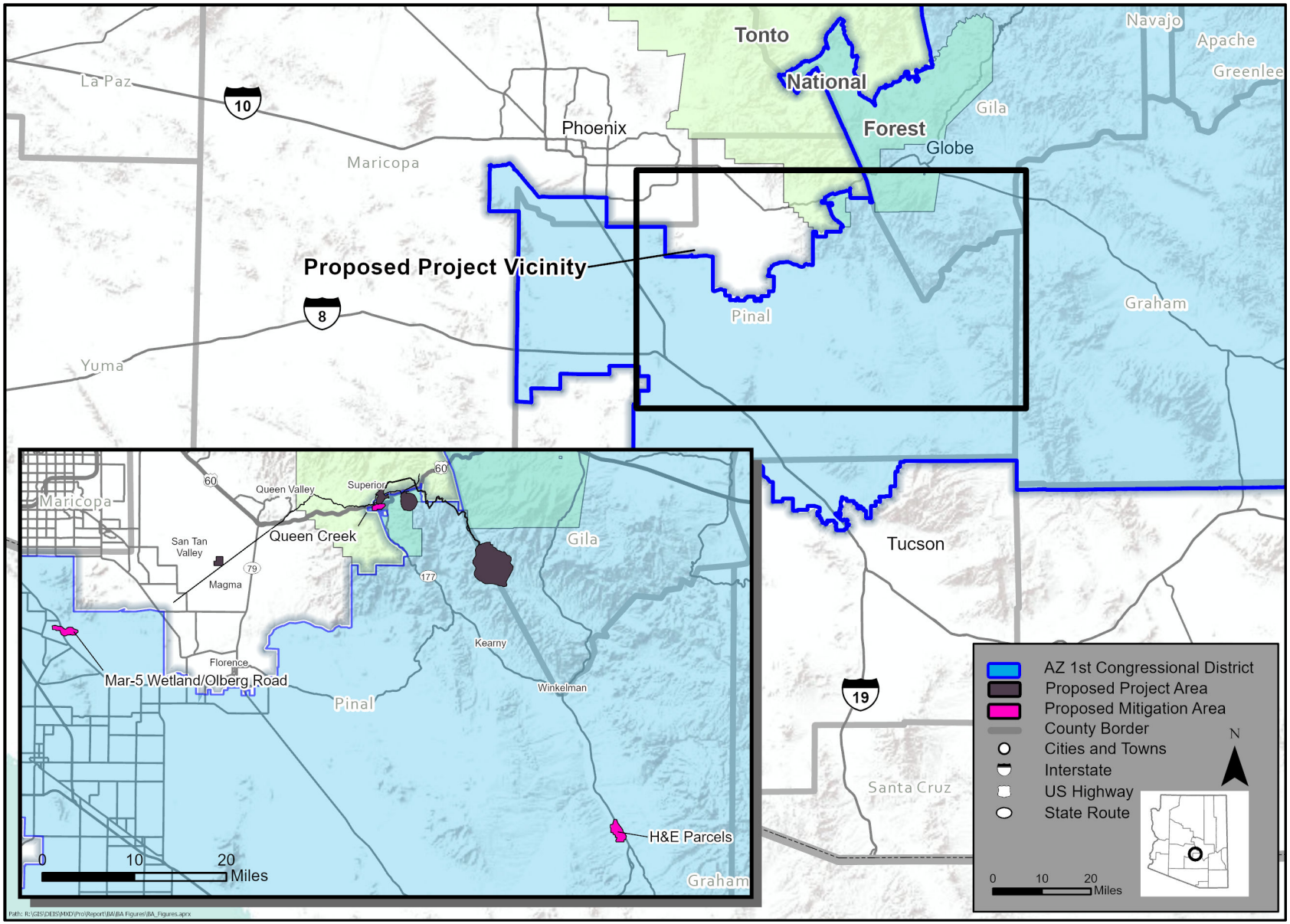


Figure 1 Resolution Copper Project vicinity map

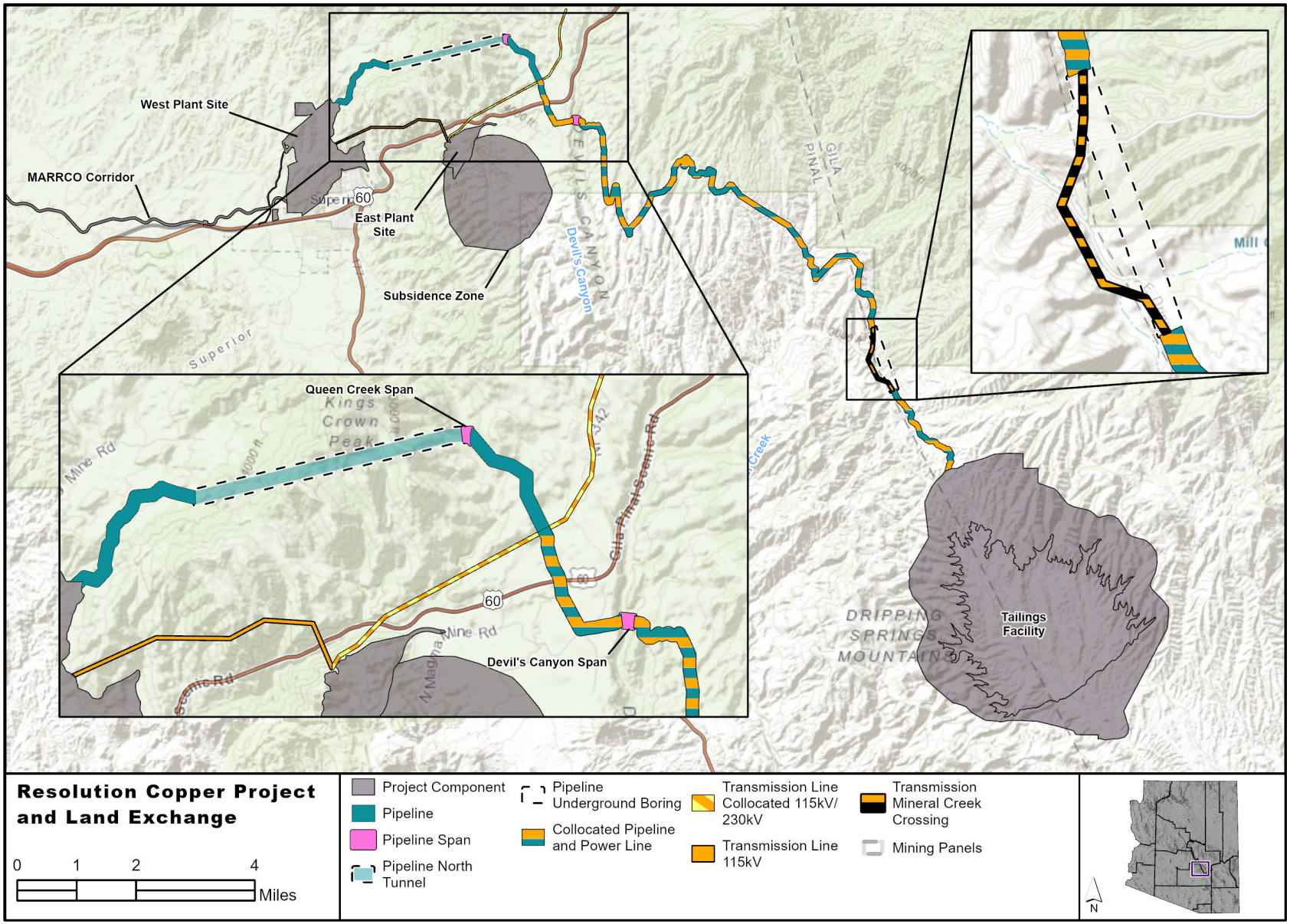


Figure 2. Proposed action components

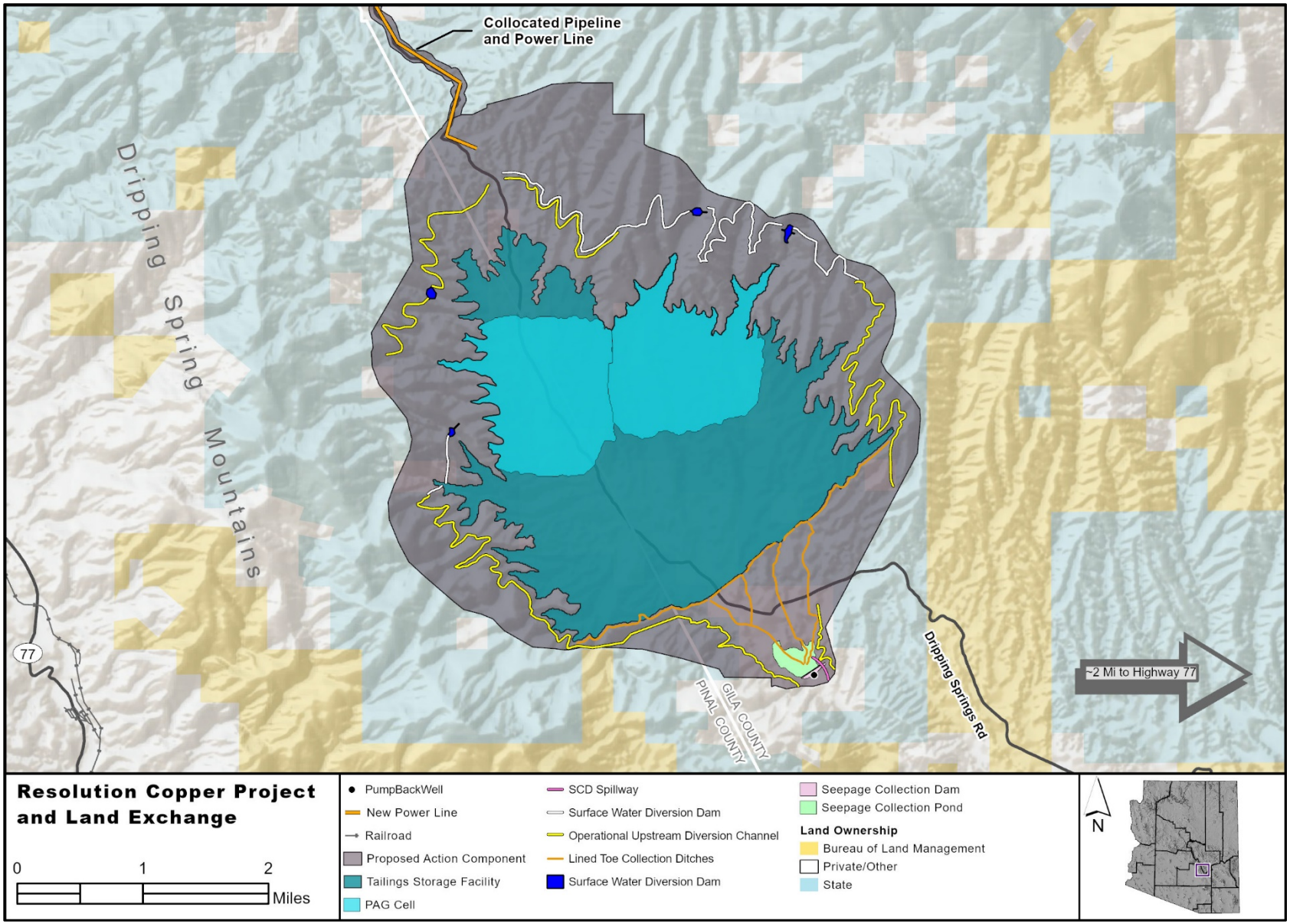


Figure 6. Proposed action tailings storage facility

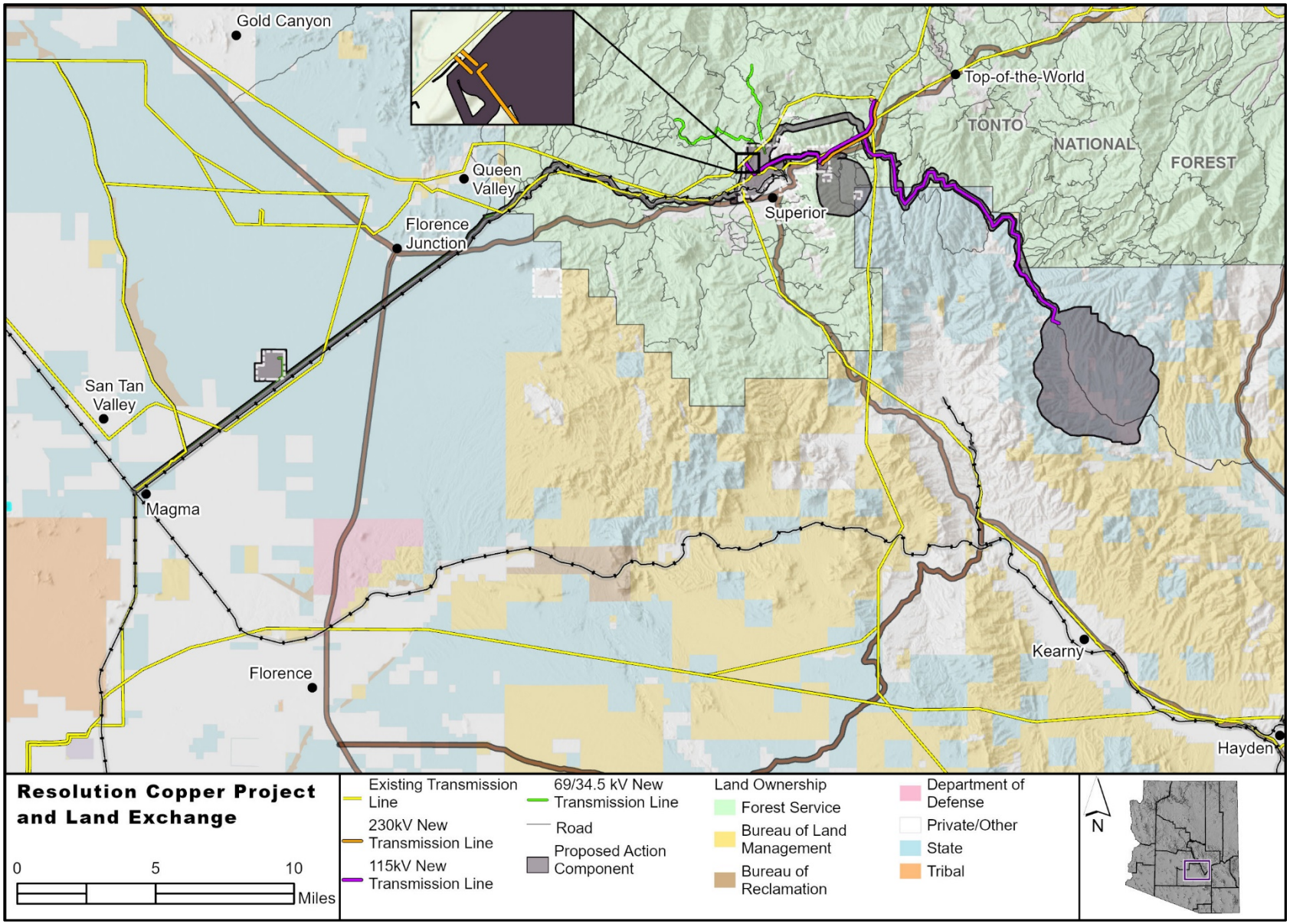


Figure 8. Proposed upgraded and new SRP transmission lines

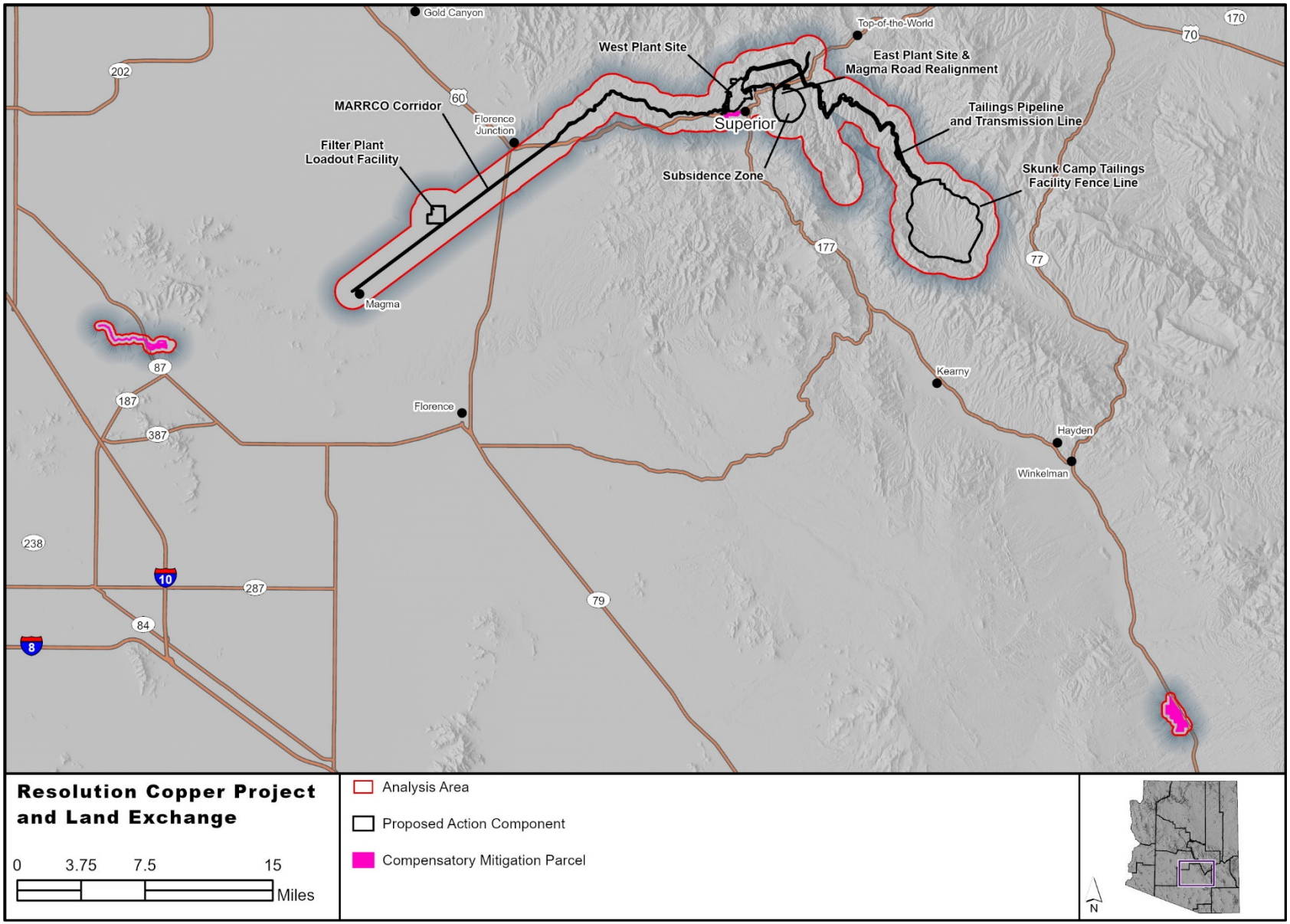


Figure 10. Resolution Copper Project action area

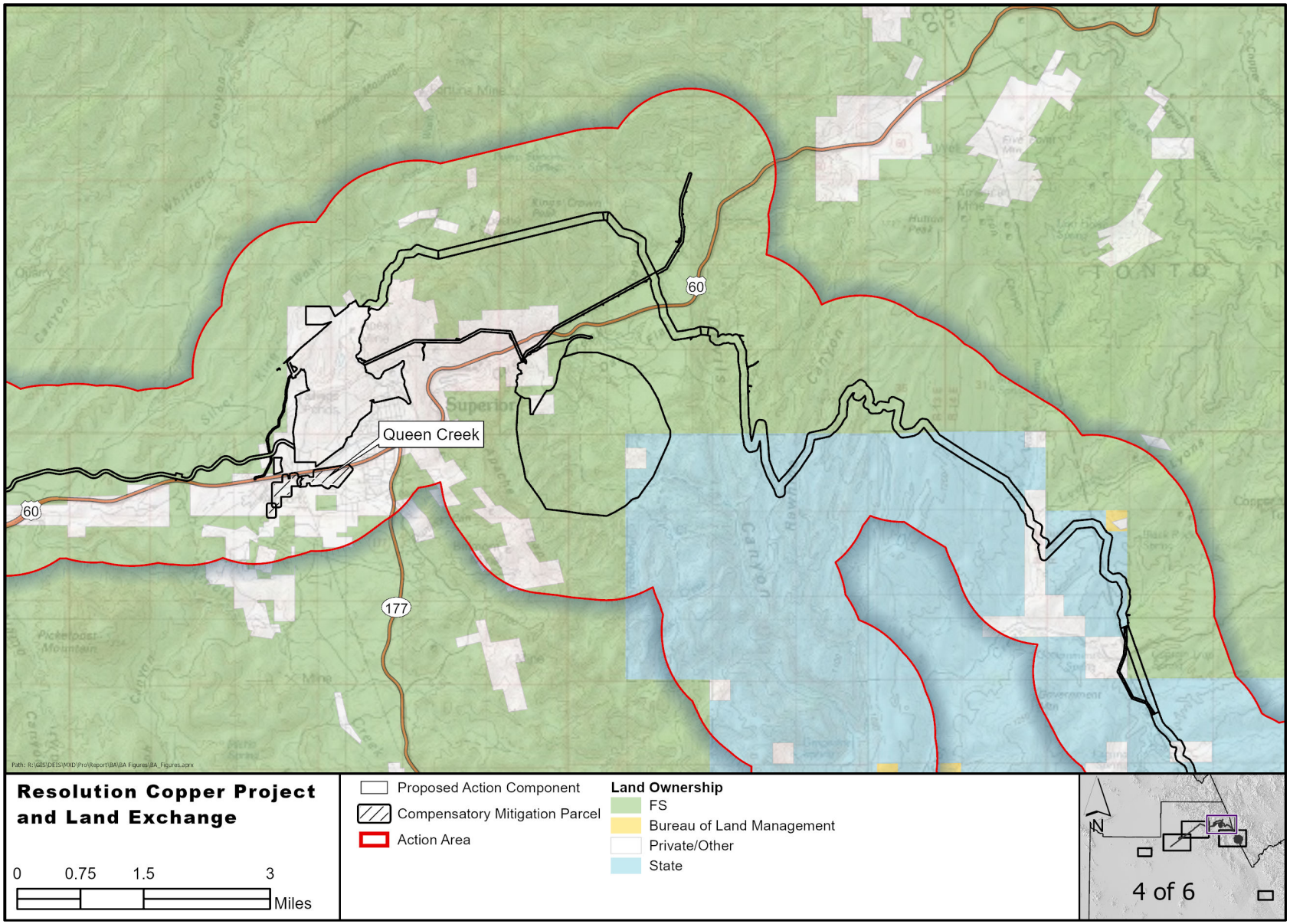


Figure 11-4. Topography with land ownership (4 of 6)

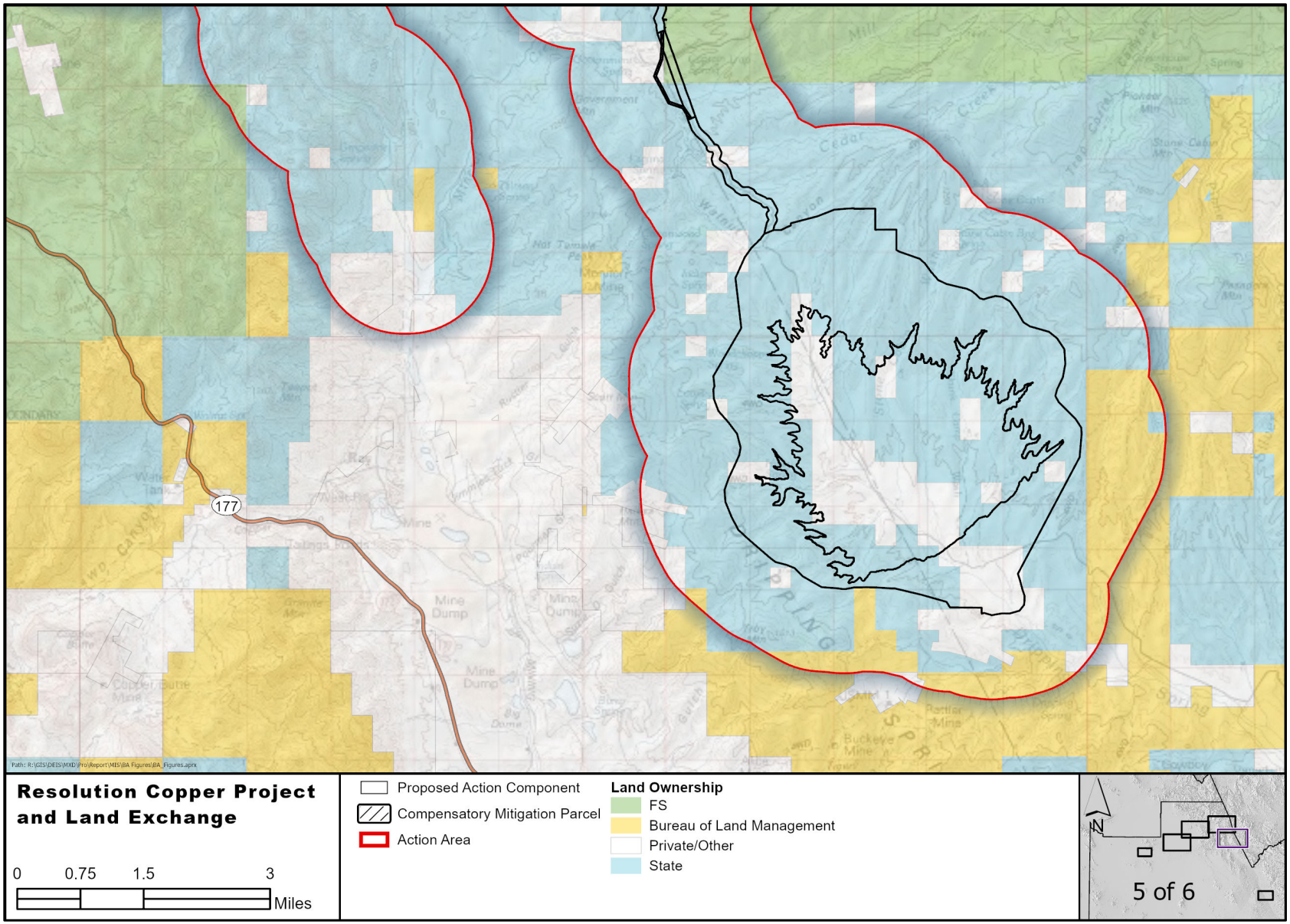


Figure 11-5. Topography with land ownership (5 of 6)

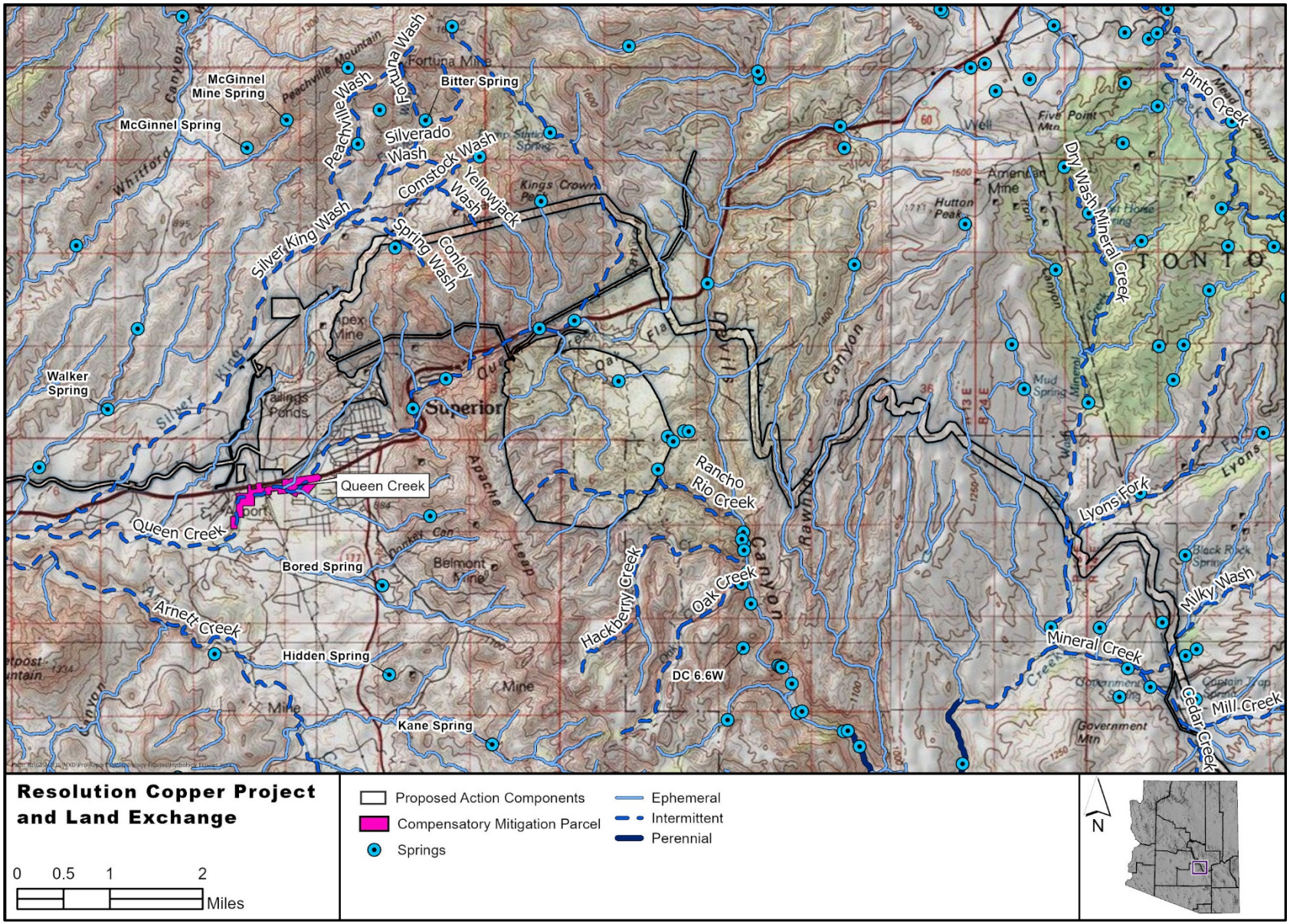


Figure 12-4. Surface water features in action area (4 of 6)

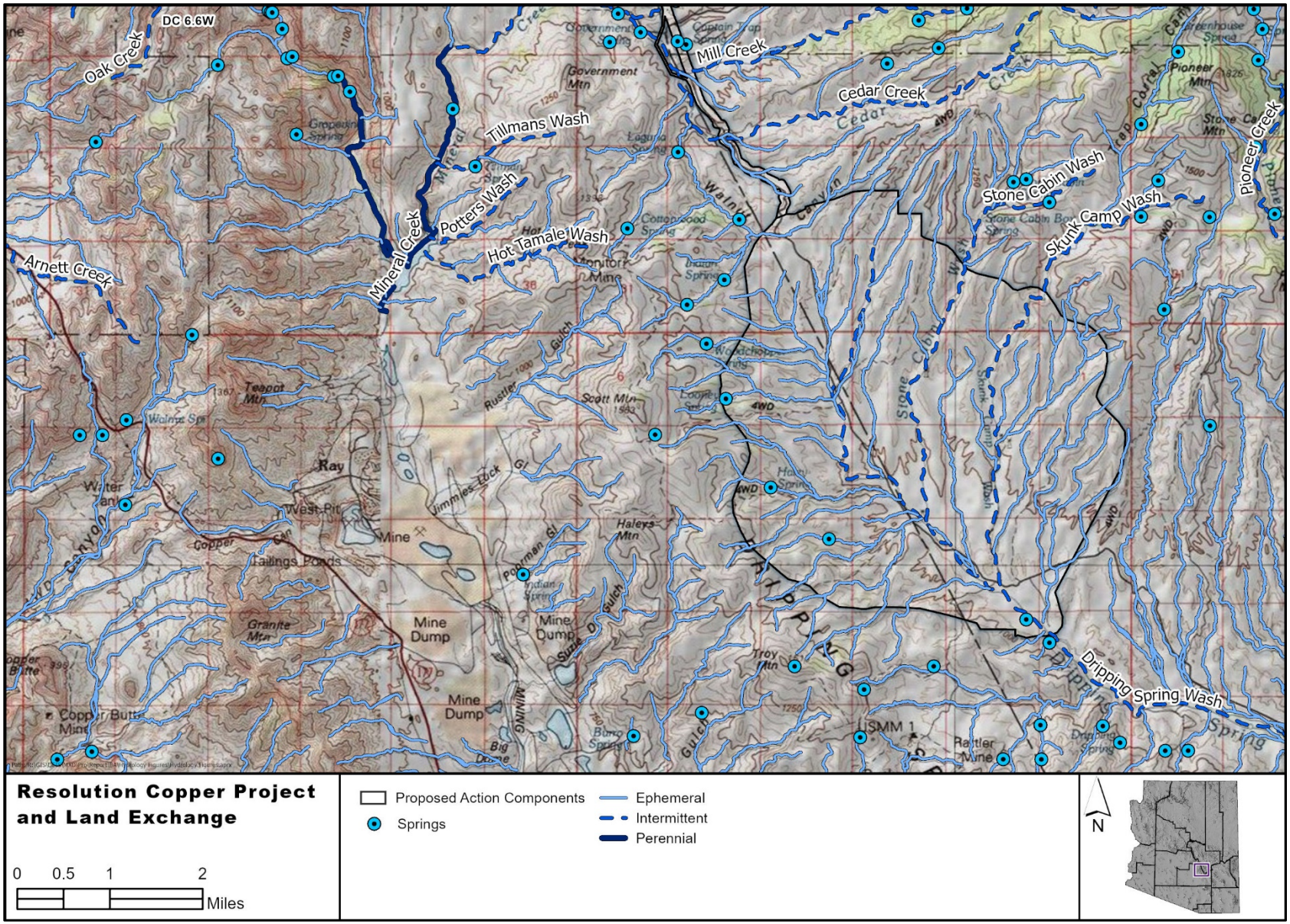


Figure 12-5. Surface water features in action area (5 of 6)

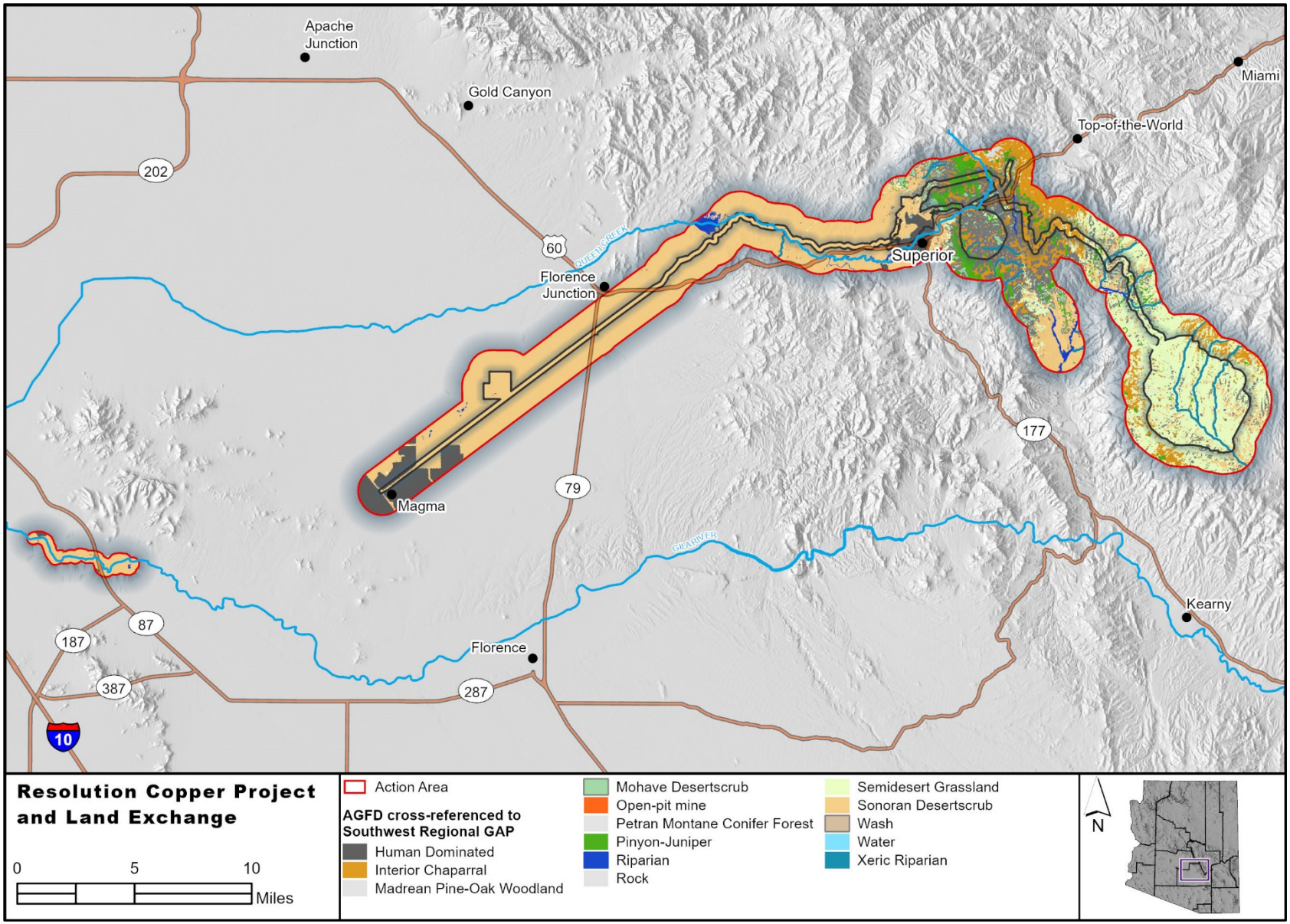


Figure 13-1. Vegetation communities in the action area (1 of 3)

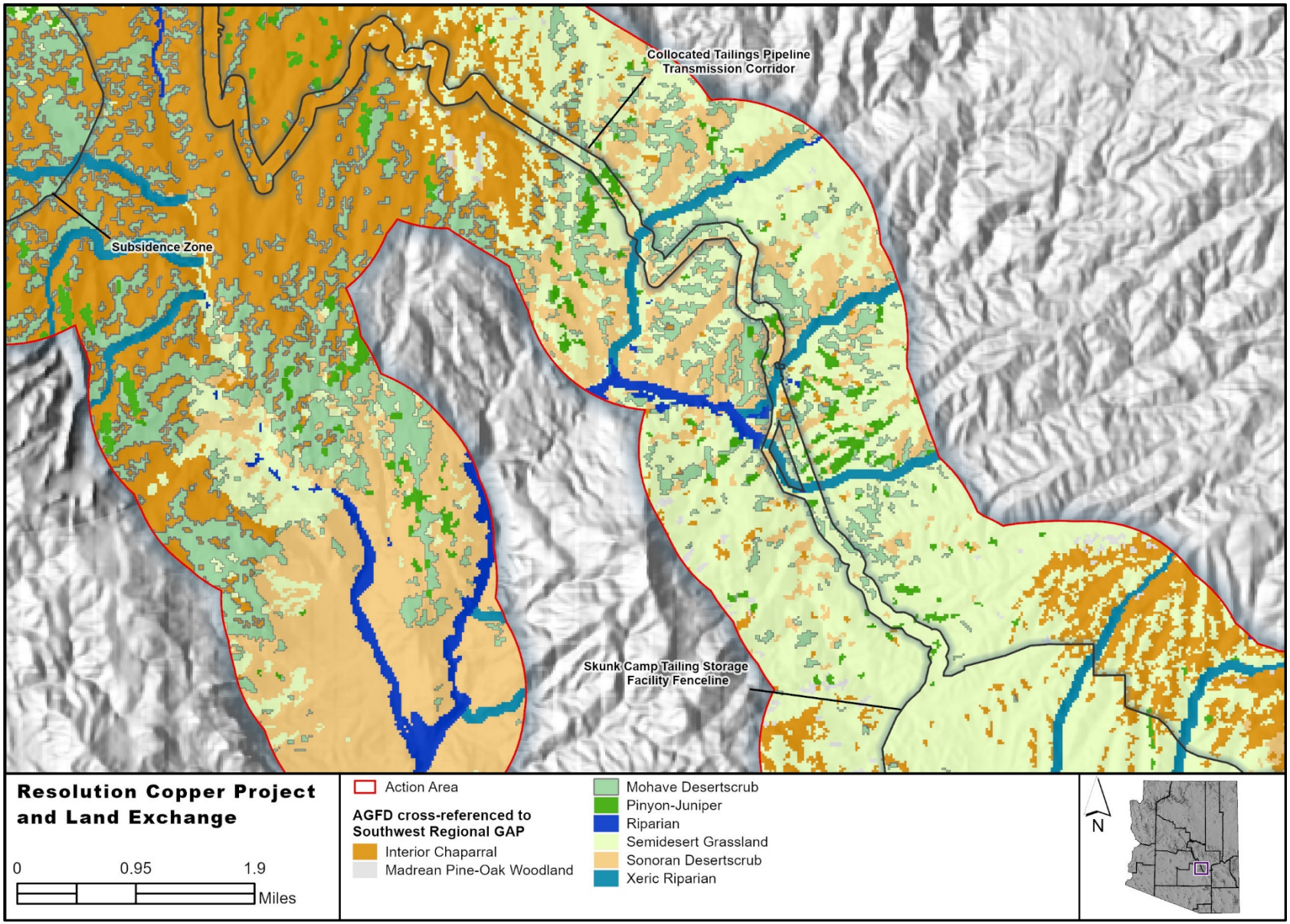


Figure 13-3. Vegetation communities in the action area (3 of 3)

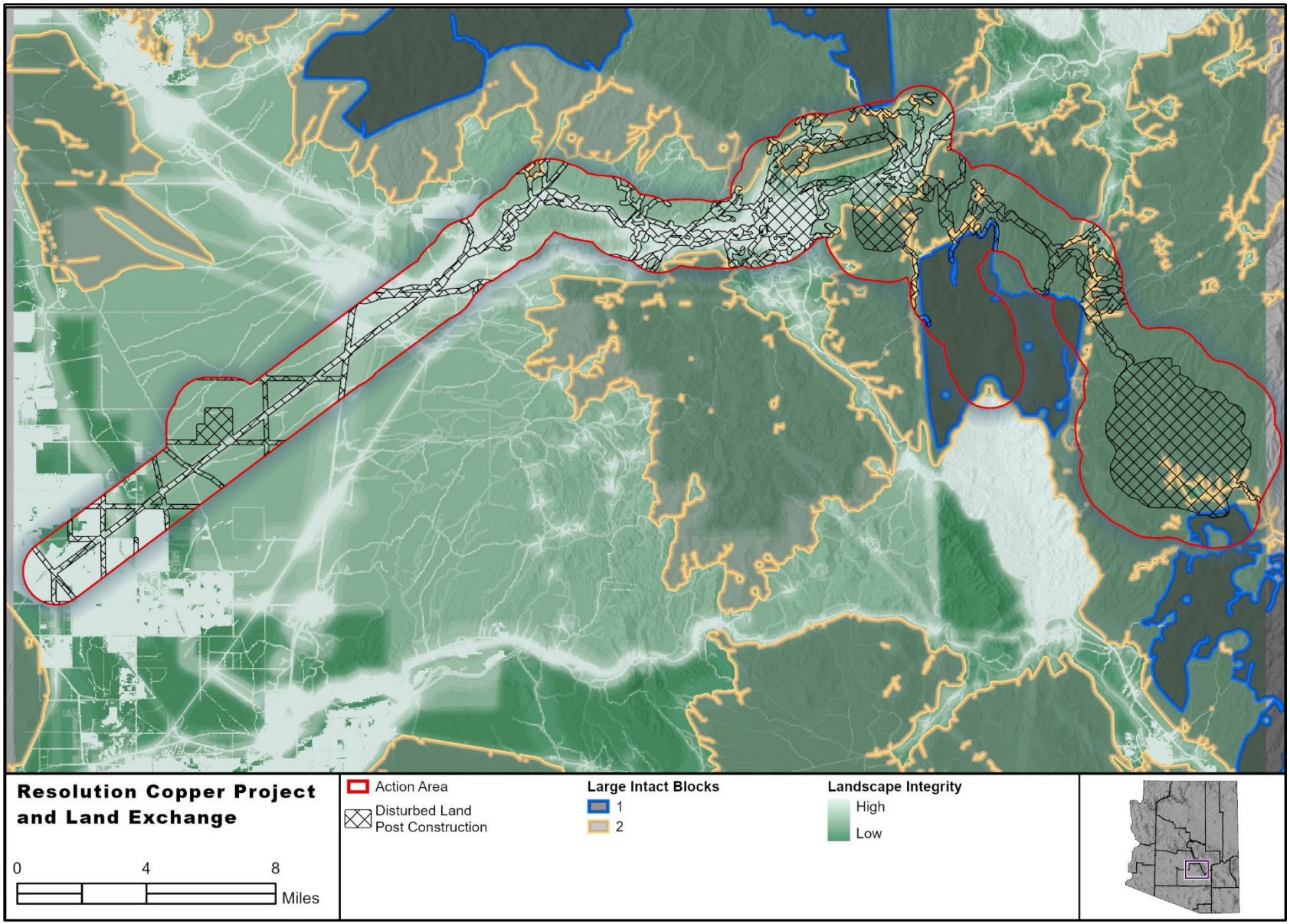


Figure 14. Existing habitat fragmentation map

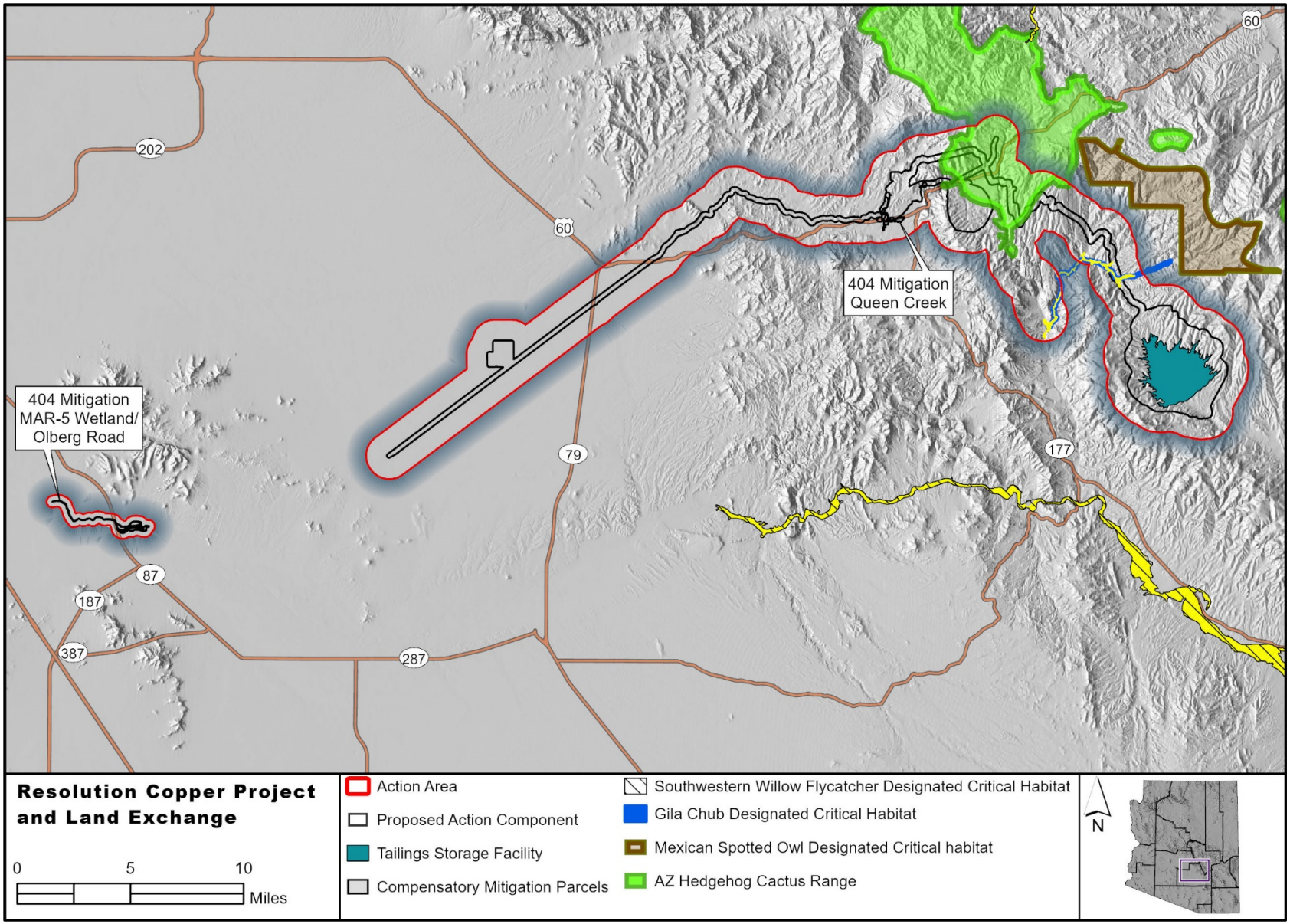


Figure 15-1. Critical habitat in project vicinity (1 of 2)

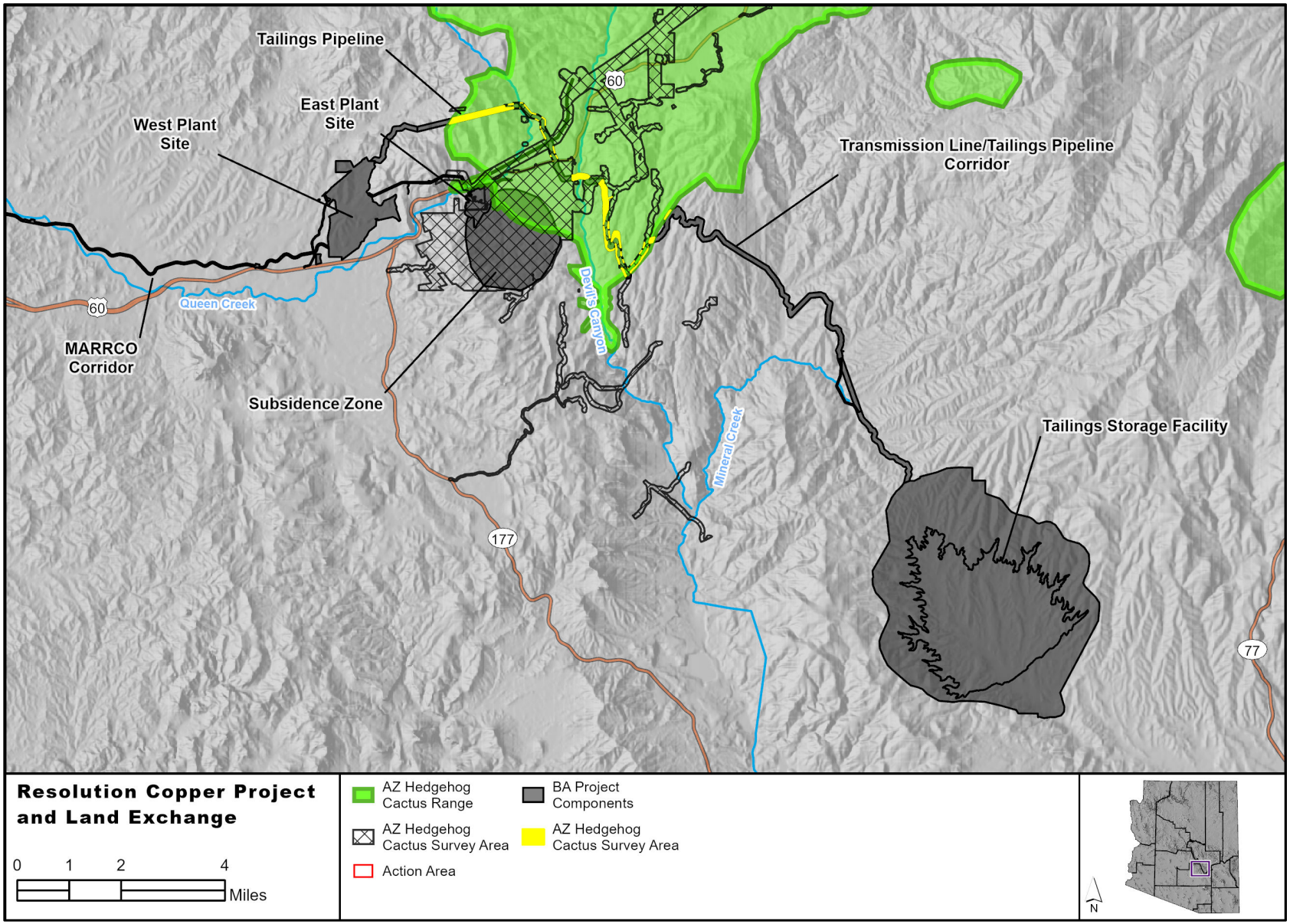


Figure 16-1. Arizona hedgehog cactus surveys

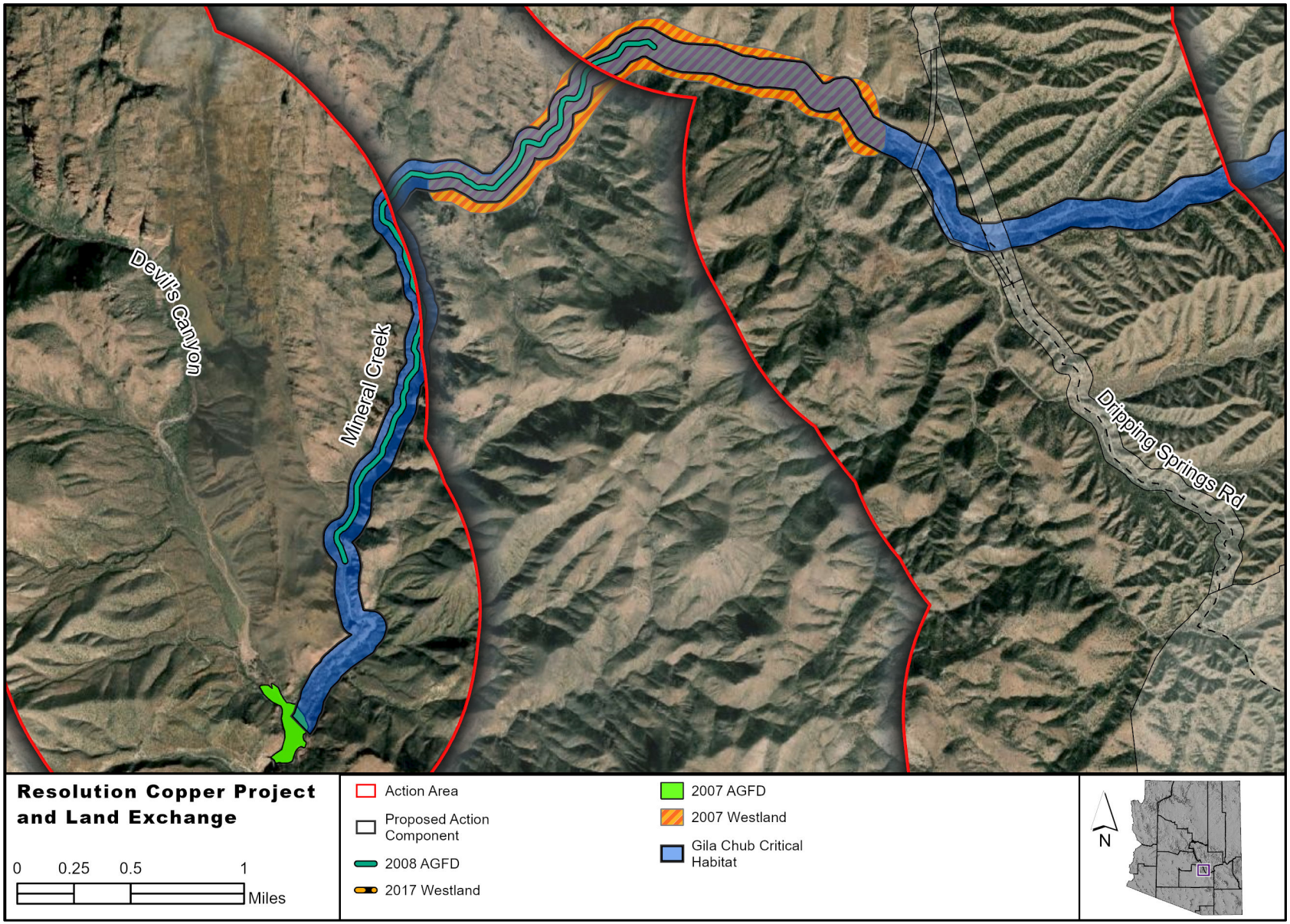


Figure 17-1. Gila chub surveys in the action area and vicinity (1 of 2)

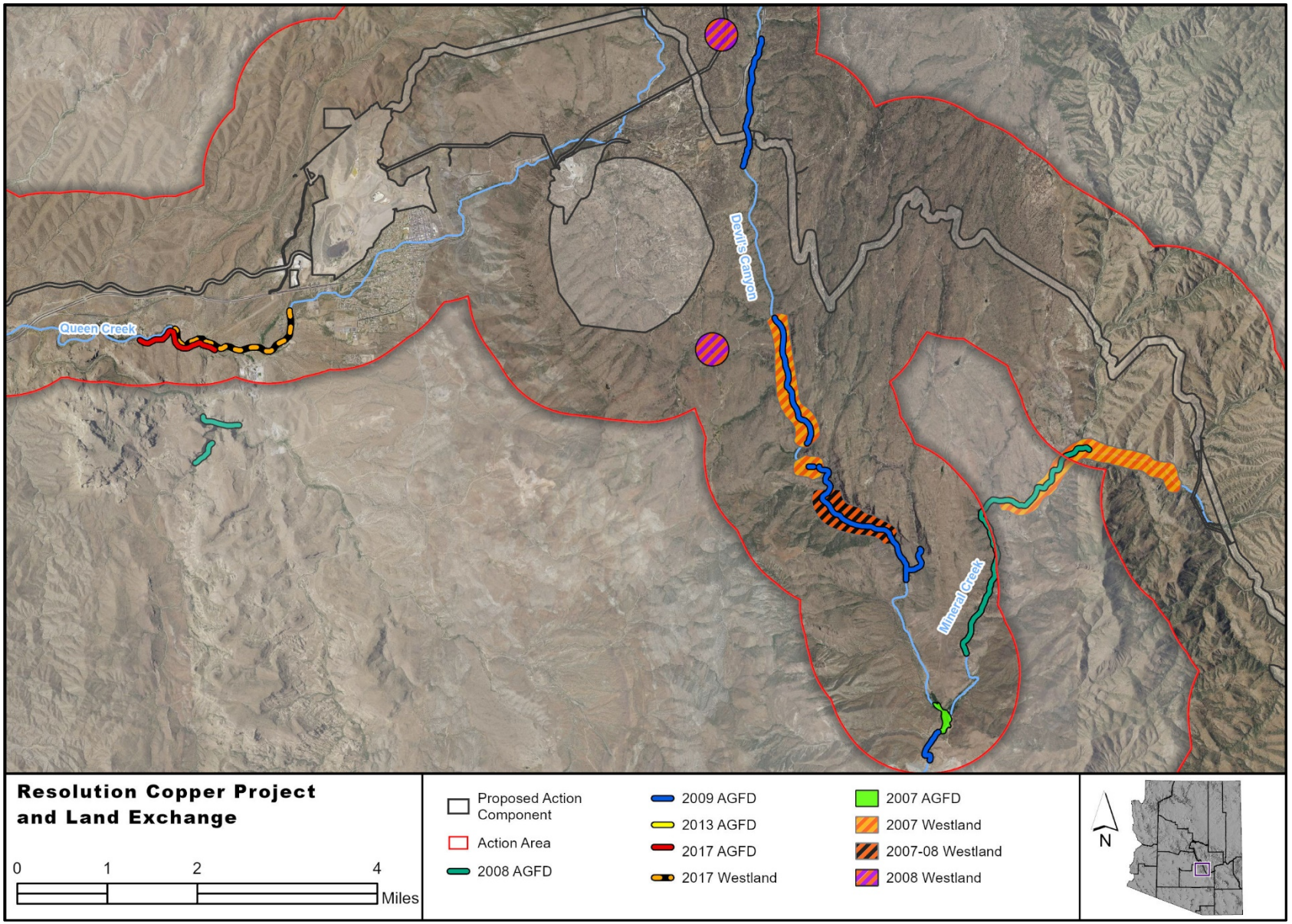


Figure 17-2. Gila chub surveys in the action area and vicinity (2 of 2)

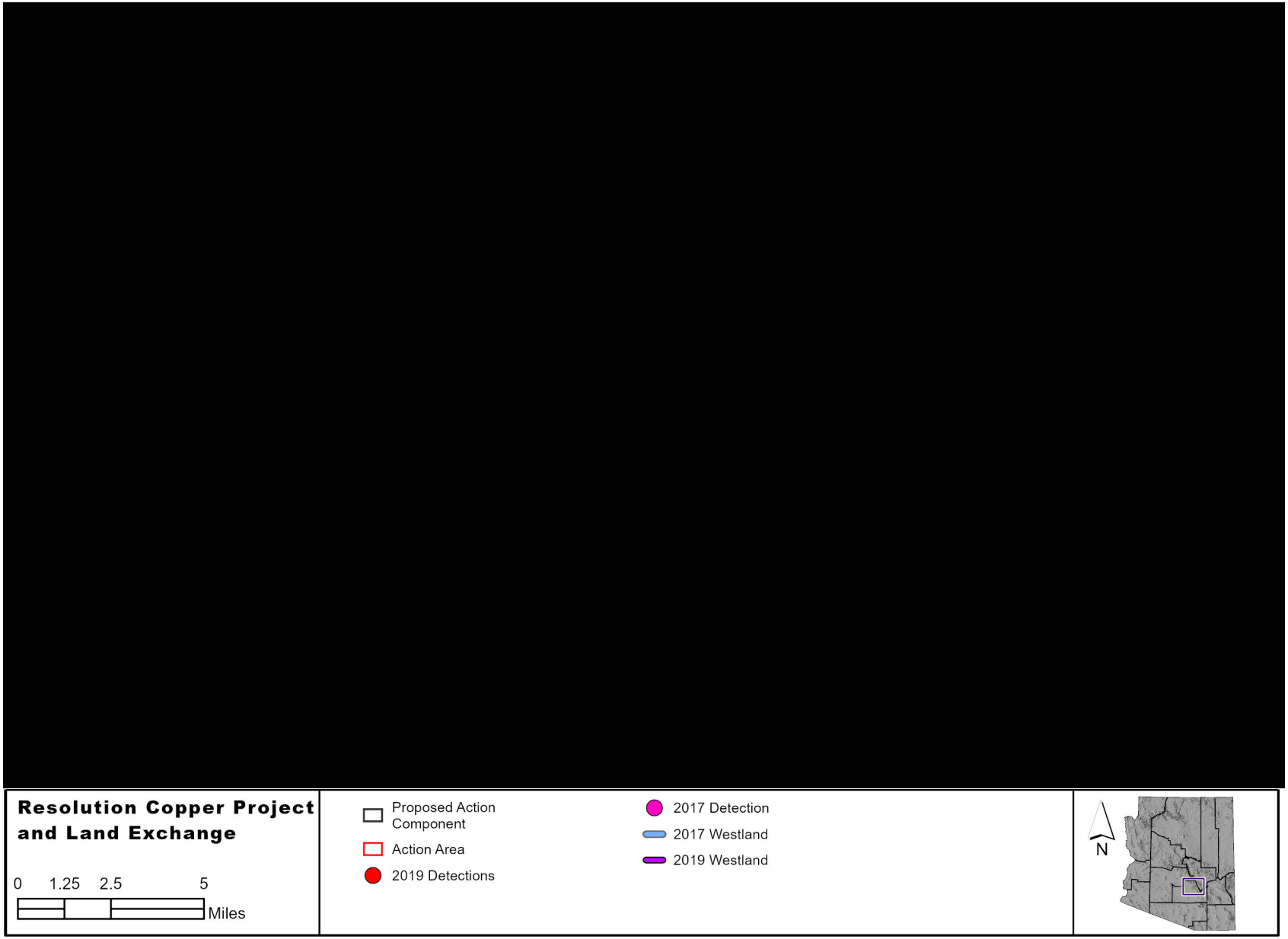


Figure 18. Southwestern willow flycatcher surveys in the project and action areas

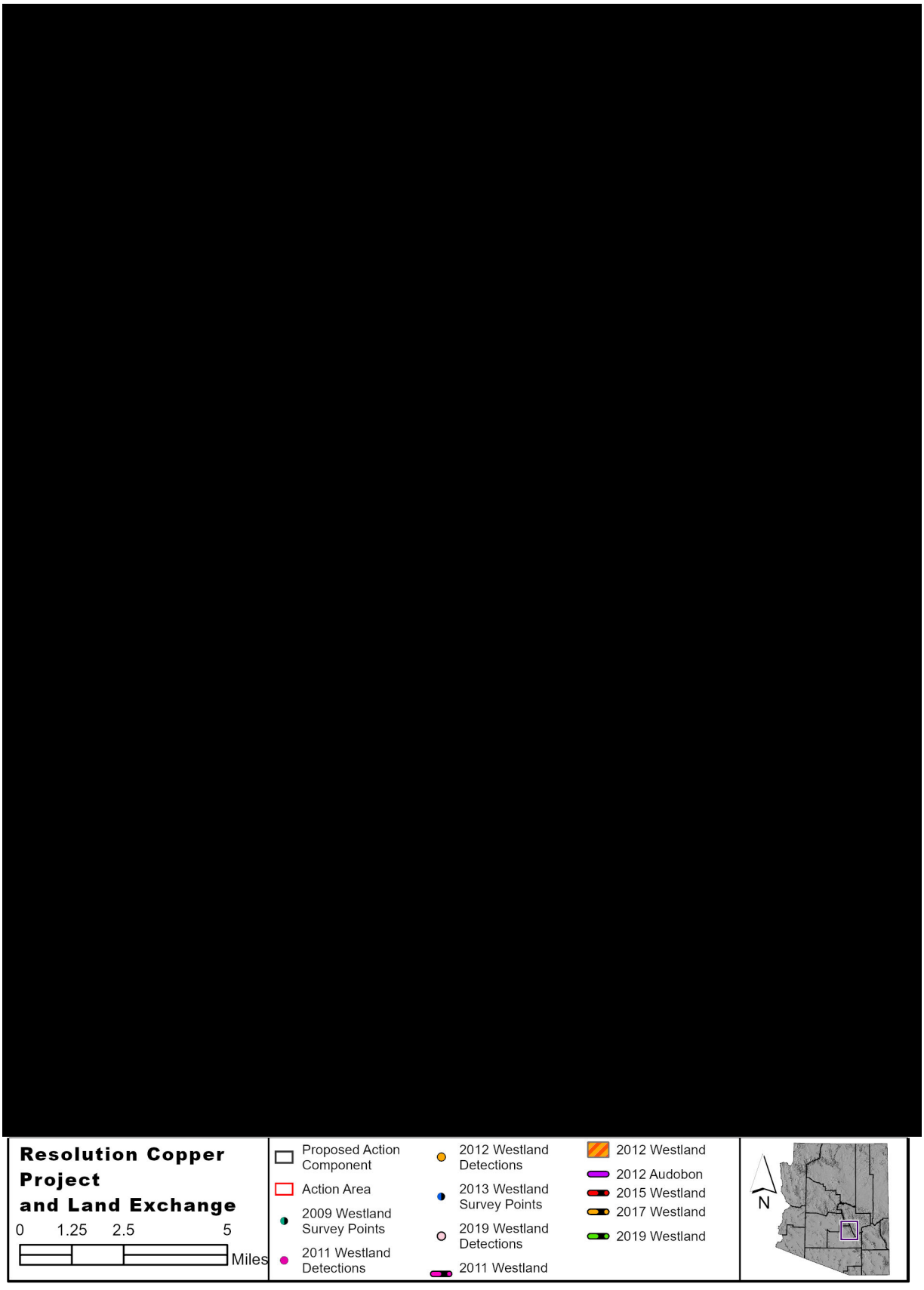


Figure 19. Yellow-billed cuckoo surveys in the action area and vicinity

APPENDIX D

Clean Water Act Section 404 Conceptual Mitigation Plan, Resolution Copper Project

CLEAN WATER ACT SECTION 404 CONCEPTUAL MITIGATION PLAN

Resolution Copper Project

Prepared for:

United States Army Corps of Engineers

On Behalf of:

RESOLUTION COPPER

102 Magma Heights – Superior, Arizona 85173

Project Number: 807.175 06 02

September 15, 2020

WestLand Resources

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ATTACHMENTS

1. INTRODUCTION

Resolution Copper Mining, LLC (Resolution, or the Applicant) has proposed the development and operation of an underground copper and molybdenum mine near Superior, Arizona (**Figure 1**). As proposed, the construction of the tailings storage facility (TSF), associated pipelines, and appurtenant infrastructure requires the discharge of fill to surface water features (**Figure 2**) that the U.S. Army Corps of Engineers (Corps) has determined (Corps File No. SPL-2016-00547) to be potentially jurisdictional waters of the United States (waters of the U.S.) pursuant to a preliminary jurisdictional determination (PJD). As these potentially jurisdictional waters of the U.S. will be impacted by discharges of dredged or fill material resulting from portions of Resolution's planned mine development, Resolution has made application for a Clean Water Act (CWA) Section 404 permit for these discharges.

In order to secure a CWA Section 404 permit, the Applicant is bound by the requirements of the Corps' and the U.S. Environmental Protection Agency's (EPA) "Final Rule for Compensatory Mitigation for Losses of Aquatic Resources" (33 C.F.R. Parts 325 and 332 and 40 C.F.R. Part 320; published in 73 Fed. Reg. 19594-19705) (Corps and EPA 2008), hereinafter referred to as the 2008 Mitigation Rule. The fundamental objective of the 2008 Mitigation Rule is to establish standardized compensatory mitigation criteria for all mitigation types to offset unavoidable impacts to waters of the U.S. authorized through the issuance of a CWA Section 404 permit. Compensatory mitigation is required for unavoidable impacts to waters of the U. S. after all appropriate and practicable avoidance and minimization has been achieved. The South Pacific Division of the Corps has developed a standard operating procedure in the form of a Mitigation Ratio-Setting Checklist (MRSC) for determining compensatory mitigation requirements.

As configured, only the development of the TSF, pipelines, and appurtenant infrastructure (collectively, the "Project" for purposes of this document) require a discharge of dredged or fill material into potential waters of the U.S. Resolution has coordinated with the Corps to identify potential mitigation opportunities for the Project. This Conceptual Mitigation Plan is presented in six sections: *Section 1* identifies the document's purpose and organization; *Section 2* introduces the Project and the overall project purpose; *Section 3* describes avoidance and minimization measures and summarizes Project impacts to potential waters of the U.S.; *Section 4* provides a description of the mitigation site selection process and outlines the specific conceptual plans for each proposed mitigation area and the expected outcome; *Section 5* summarizes the site assessment process for determining migration ratios and provides the results from application of the MRSC; and *Section 6* includes the references used in the preparation of this document. The application of mitigation credits in *Section 5* describes application of the MRSC-derived mitigation ratios to Project impacts and mitigation sites in a sequential fashion, as needed, until all of the functional impacts for each impact drainage class are mitigated. The application of mitigation to impacts in this Conceptual Mitigation Plan is intended only to demonstrate sufficient credit is available to mitigate for unavoidable impacts to waters of the U.S. from development of the Project. Actual application of the mitigation credits in the Final Mitigation

Plan may occur in a number of ways. Following review and approval (or modification, as appropriate) by the Corps of the concepts contained in this Conceptual Mitigation Plan, a final Mitigation Plan in compliance with the 2008 Mitigation Rule will be completed.

2. PROJECT DESCRIPTION AND PURPOSE

2.1. MINE DEVELOPMENT BACKGROUND

Resolution's planned mine development is located near Superior in Pinal County, Arizona (**Figure 1**) in an area commonly referred to as the Copper Triangle and specifically within the Pioneer Mining District. Mine exploration and operations have been conducted in the area since the early 1860's, when the discovery of silver led to the development of the Silver King Mine. Magma Copper Company (Magma) took over the Silver King Mine and operated it as the Magma Mine from 1912 until the operation was finally shut down in 1996. After Magma's shutdown, the Resolution ore deposit was discovered 1.2 miles south of the existing Magma Mine and 7,000 feet below the ground surface. Since 2004, Resolution has steadily worked to investigate and delineate the Resolution ore body, develop a mine design, prepare environmental and engineering studies to support the mine permitting and approvals effort, and conduct multiple community outreach efforts and public meetings to inform and involve the public as plans were developed.

Resolution proposes the development of the Resolution ore body using panel caving, a type of cave mining. The copper and molybdenum ore will be mined, undergo primary crushing underground, and then be sent to a concentrator facility to be constructed at the existing West Plant Site north of Superior. Concentrate produced at the West Plant Site will be transported offsite for additional processing, while the resulting tailings will be transported via a pipeline to the proposed Skunk Camp TSF location, approximately 3 miles east of the Asarco Ray open pit mine. Under the current proposed operating conditions and Life of Mine (LOM) planning parameters, the Resolution ore body is sufficient to support the concentrator operations for approximately 41 years. As currently configured, operations are anticipated to result in the mining of approximately 1.4 billion tons of copper and molybdenum ore and the production of approximately 1.37 billion tons of tailings. Because portions of Resolution's planned mine development occur on lands managed by the U.S. Forest Service (USFS) Tonto National Forest (TNF), the USFS is reviewing the General Plan of Operations (GPO) and associated land exchange under the National Environmental Policy Act (NEPA) and publishing an Environmental Impact Statement (EIS) for the planned mine development.

2.2. PROJECT DESCRIPTION

Although the planned locations of all mine facilities are described in the EIS, only the development of the TSF, pipelines, and auxiliary infrastructure requires a discharge of dredged or fill material into potential waters of the U.S. and associated CWA Section 404 permit. Discharge of fill for the development of these features, particularly the TSF, consists mostly of the leveling of existing topography through site grading (cut and fill) of the natural ground surface. Materials to be discharged

to potential waters of the U.S. during this process would consist primarily of native soil and rock taken from the footprint of the constructed features during the grading process. The Applicant's overall project purpose and need is to construct and operate a TSF and associated infrastructure capable of storing approximately 1.37 billion tons of tailings produced through milling copper and molybdenum ore from the Resolution ore body (plus approximately 12 million cubic yards of on-site borrow material used to construct the starter embankments), along with the pipelines and associated infrastructure needed to transport tailings to the TSF and recycled water from the TSF back to the concentrator facility. Capacity to deposit approximately 1.37 billion tons of tailings is required to allow for utilization of the Resolution ore body to the extent described in the EIS (mining of approximately 1.4 billion tons of ore).

2.3. PROJECT PURPOSE

The Applicant's overall project purpose and need is to construct and operate a TSF and associated infrastructure capable of storing approximately 1.37 billion tons of tailings produced through milling copper and molybdenum ore from the Resolution ore body (plus approximately 12 million cubic yards of on-site borrow material used to construct the starter embankments), along with the pipelines and associated infrastructure needed to transport tailings to the TSF and recycled water from the TSF back to the concentrator facility. Capacity to deposit approximately 1.37 billion tons of tailings is required to allow for utilization of the Resolution ore body to the extent described in the EIS (mining of approximately 1.4 billion tons of ore). The Applicant's basic project purpose is mine tailings storage, which is not water-dependent. However, the proposed discharge will not affect a special aquatic site, so the rebuttable presumption in 40 C.F.R. § 230.10(a)(3) is not triggered.

3. JURISDICTIONAL WATERS OF THE U.S.

3.1. AVOIDANCE AND MINIMIZATION

The development of alternatives for Resolution's proposed underground copper and molybdenum mine design included a significant effort to avoid and minimize impacts to potential waters of the U.S. to the extent practicable. Only the development of the TSF, pipelines, and auxiliary infrastructure requires a discharge of dredged or fill material into potential waters of the U.S. Numerous aspects of TSF design and construction, such as embankment type (e.g., upstream, centerline, modified centerline, and downstream embankments), management of tailings, and deposition methods (e.g., conventional thickened, high-density thickened, and filtered, or 'dry-stack'), were assessed for use at the proposed TSF locations (USFS 2019, 2020) to avoid and minimize impacts. A number of onsite mitigation measures (referred to as "applicant committed environmental protection measures") were incorporated into the Skunk Camp TSF designs to address impacts to the aquatic environment, including potential waters of the U.S., and water quality and quantity functions. The pipeline corridor from the West Plant to the TSF presented in the Draft EIS (USFS 2019) was also refined and updated based on agency and public comment. The pipeline corridor revision resulted in a reduction in overall disturbance from the pipeline of approximately 463 acres and a reduction in impacts to potentially

jurisdictional waters of the U.S. of approximately 15.3 acres. The revised pipeline alignment incorporates a span for Devils' Canyon and underground boring beneath Mill Creek and Mineral Creek, outside of the Ordinary High Water Mark of all three major drainages, and completely avoids designated critical habitat for the Gila chub (*Gila intermedia*) and proposed critical habitat for the Yellow-billed cuckoo (*Coccyzus americanus*).

Although the area beneath the footprint of the TSF and its appurtenant features will no longer contribute runoff from precipitation to downstream drainage reaches, the TSF design minimizes impacts to downstream waters of the U.S. by diverting upstream stormwater flows around the facility. Similarly, the stormwater controls, run-on diversions, and engineering controls have been designed to maintain downstream stormwater flows while minimizing the risk of contaminant discharge to downstream surface water features. The full range of alternatives analyzed in the development of the proposed design of the Project is described in the 404(b)(1) Alternatives Analysis (WestLand 2020a) and EIS (USFS 2019, 2020) prepared for the Project.

3.2. JURISDICTIONAL IMPACTS

Table 1 summarizes the unavoidable impacts to potential waters of the U.S. that would result from construction of the alternative identified as the Least Environmentally Damaging Practicable Alternative (LEDPA) in the alternatives analysis: the Skunk Camp TSF Alternative. This alternative is also analyzed as Alternative 6 in the EIS prepared by the USFS (USFS 2020). Under the Skunk Camp TSF Alternative (**Figure 2**), the total amount of permanently impacted, or 'lost,' potential waters of the U.S. from development of the Project was determined to be 172.62 acres (**Figure 3**). These impacts include 129.24 acres are anticipated to be direct permanent impacts resulting from construction of the TSF and 43.38 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions (**Figure 4**). Impacts from the pipeline (**Figure 5**) include a maximum estimated 15.70 acres of largely temporary impacts from the buried pipeline and associated access road. The final location of the pipeline within the analyzed 500-foot corridor will be micro-sited prior to construction and will disturb an estimated 200 feet within the 500 foot corridor. The estimate of 15.70 acres conservatively assumes that all the potential waters of the U.S. within the 500-foot corridor are temporarily impacted. As these impacts from the development of the pipeline are temporary, no mitigation for these impacts are proposed in the Conceptual Mitigation Plan.

Table 1. Impacts to Potential Waters of the U.S. from the Project

Project Component	Type of Impact	Impacts to Potential Waters of the U.S. (Acres)
TSF	Direct Impacts - Permanent	129.24
TSF	Indirect Impacts - Permanent	43.38
Pipeline	Direct Impacts - Temporary	15.70

Impacts to potentially jurisdictional waters of the U.S. from development of the Project are not expected to occur until approximately 10 years after authorization of the Project. As a component of reducing the risk and uncertainty related to compensatory mitigation success, Resolution anticipates initiating compensatory mitigation actions several years in advance of the construction of the TSF and the associated impacts to potentially jurisdictional waters of the U.S. Initiating mitigation in advance of impacts to potential waters of the U.S. also removes any aspect of temporal loss of aquatic function associated with impacted surface water features. These factors are considered in the discussion of mitigation actions below and in the calculation of final mitigation ratios in the MRSC.

Potential waters of the U.S. identified within the TSF footprint and pipeline corridor are dominated by both confined and braided ephemeral channels with functions and values typical of desert ephemeral systems. Non-ephemeral drainages within the pipeline corridor, including Devil's Canyon and Mineral Creek, will not be impacted by the project. No jurisdictional special aquatic sites (e.g., wetlands) or seeps and springs are located within the footprint of this TSF or the pipeline corridor.

The area of the proposed Skunk Camp TSF is relatively undisturbed with ongoing local ranching activities. As stated above, potential waters of the U.S. identified within the TSF footprint are dominated by both confined and braided ephemeral channels. Some minor alteration of these ephemeral channels has occurred through the construction of corrals and stock tanks related to the ranching activity (**Figure 2**). As part of the development of the MRSC (**Attachment A**), the drainages within the Skunk Camp TSF site were grouped into three different classes based on physical parameters that affect their hydrologic, chemical, and biotic function as assessed in Step 2. These classes, Classes A, B, and C are described below and shown in **Figure 6**.

Impact Class A: Class A washes consist of low-gradient, braided (multi-thread) ephemeral drainages within broad, relatively unrestricted floodplains. Class A washes are located lower in the watershed, and in the area of the Skunk Camp TSF are located mainly at lower elevations in the central portion of the site (**Figure 6**). Class A washes in this area include the lower portions of Dripping Spring Wash, Stone Cabin Wash, and Skunk Camp Wash. Xeroriparian vegetation is common and widespread along the banks and floodplain terraces of Class A washes but is generally absent in the low-flow channels. Sediment in the active channels of Class A washes is typically soft and is characterized by a well-sorted mixture composed primarily of sand, silt, and gravel. The TSF and its appurtenant features impact approximately 86.94 acres of Class A drainages.

Impact Class B: Class B washes are located higher upgradient in the local watershed and consist of low- to moderate-gradient, typically single-thread, ephemeral drainages. The active channels of Class B washes are generally confined within well-defined, relatively narrow floodplains. Class B washes are located throughout the area of the Skunk Camp TSF, with most are directly tributary to the Class A washes (**Figure 6**). Vegetation along Class B washes typically includes narrow bands of xeroriparian vegetation along the banks. Vegetation may be present within the low-flow channel as well. Sediment in the active channels of Class B washes may be well-or poorly sorted, and typically includes sand,

gravel, and cobbles. The TSF and its appurtenant features impact approximately 39.98 acres of Class B drainages.

Impact Class C: Class C washes are located in the headwaters of the local watershed and consist of moderate- to high-gradient single-thread ephemeral drainages. The active channels of Class C washes are typically confined within well-defined, very narrow floodplains. Class C washes represent the upper-most headwater tributaries in the area of the Skunk Camp TSF (**Figure 6**). Vegetation along Class C washes typically includes narrow bands of xeroriparian vegetation along the bed and banks. Upland species may be present in the low-flow channel. The substrate in the active channels of Class C washes may be well-or poorly sorted, and typically includes gravel, cobbles, and boulders. Cut banks are common in these drainages and the channel bed may be scoured to bedrock in some areas. The TSF and its appurtenant features impact approximately 45.70 acres of Class C drainages.

The total amount of permanently impacted, or 'lost,' potential waters of the U.S. from development of the Project was determined to be 172.62 acres. These impacts include 129.2 acres which are anticipated to be direct permanent impacts resulting from construction of the TSF and 43.4 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions (**Figure 4**). As the impacts from the development of the pipeline are temporary, no mitigation for these impacts are proposed in the Conceptual Mitigation Plan. These impacts, separated by drainage class, are shown in **Table 2**.

Table 2. Impacts from the Project by Drainage Class

Drainage Class	Type of Impact	Impacts to Potential Waters of the U.S. (Acres)
Class A	Direct Impacts	60.75
	Indirect Impacts	26.19
Class B	Direct Impacts	32.28
	Indirect Impacts	7.70
Class C	Direct Impacts	36.21
	Indirect Impacts	9.49

4. MITIGATION SITE SELECTION

4.1. SITE SELECTION OVERVIEW

The 2008 Mitigation Rule identifies general classes of compensatory mitigation, as well as clear preference among these classes, specifically noting that Mitigation Banking and then in-lieu-fee (ILF) Mitigation are preferred over applicant-sponsored on-site or off-site mitigation. As a general matter, in-kind mitigation is also preferred over out-of-kind mitigation. Resolution considered these general classes of compensatory mitigation from a watershed perspective in the selection of proposed mitigation sites and the development of the draft Conceptual Mitigation Plan.

The Project is located within the Middle Gila River subbasin, defined as Hydrologic Unit Code (HUC 8) 15050100. In accordance with the Corps' Final 2015 Regional Compensatory Mitigation and Monitoring Guidelines (2015), Resolution evaluated mitigation opportunities, based on the above hierarchy, within the Project watershed and adjacent watersheds. WestLand is not aware of any watershed planning efforts for the HUC 6 or HUC 8 watersheds within which the Project is located that identify specific restoration goals for aquatic resources. There are currently no Mitigation Banks established in Arizona and no approved ILF Mitigation projects in this watershed HUC 8 subbasin. Resolution had initially proposed the use of the Arizona Game and Fish Department (AGFD) Lower San Pedro River Wildlife Area (LSPRWA) ILF project within the adjacent Lower San Pedro HUC 8 watershed subbasin (HUC 15050203), which has been used as mitigation for other projects located in the Middle Gila River HUC 8 watershed (WestLand 2018). All advanced credits available for purchase through the LSPRWA ILF project have been sold or obligated for sale, however, and the Corps and EPA have requested that the additional 650 credits anticipated from five future phases of development of the ILF not be considered in the Conceptual Mitigation Plan for the Project at this time. Given the lengthy mine construction period described in *Section 3.2*, Resolution anticipates that additional credits would become available and may be considered and incorporated in the future.

Based on the above, Resolution has identified three permittee-responsible mitigation sites, all offsite mitigation opportunities. Given that the footprint of the practicable TSF alternative contains ephemeral drainage channels and will be operated as part of an active copper mine, little opportunity exists for the development of onsite mitigation for unavoidable impacts to waters of the U.S.

4.2. MITIGATION SITE DESCRIPTION

The three permittee-responsible mitigation sites identified are the MAR-5/ORRS Mitigation Site, the Queen Creek Mitigation Site, and the H&E Farm Mitigation Site (**Figure 7**). The relative ecological benefits of each mitigation opportunity are discussed in the Conceptual Mitigation Plan for the Project and summarized here. Discussion of the benefits of these sites is based on WestLand's recent experience working within the framework of the 2008 Mitigation Rule on similar mitigation projects (WestLand 2017, 2018), following Corps guidelines (Corps 2015), and field investigations and analysis. Fulfillment of mitigation at each site would provide regional conservation benefits, though none of the proposed mitigation measures will create xeroriparian habitat similar to the habitat that will be lost or impacted by the Project. Mitigation activities proposed at these sites include preservation, enhancement, and restoration of high-value mesoriparian and hydroriparian habitats, which, although out-of-kind, are rarer within the regional landscape and have higher productivity and wildlife values (Lowery, Stingelin, and Hofer 2016).

The Corps (2017a) defines *compensatory mitigation* as "the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved." *Restoration* is defined (Corps 2017a) as "the manipulation of the physical, chemical, or biological characteristics of a site

with the goal of returning natural/historic functions to a former or degraded aquatic resource. For the purpose of tracking net gains in aquatic resource area, restoration is divided into two categories: reestablishment and rehabilitation." *Re-establishmen*t "results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions," while *Rehabilitation* "results in a gain in aquatic resource function but does not result in a gain in aquatic resource area." *Establishment* is "the manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site" and "results in a gain in aquatic resource area and functions." *Enhancement* is "the manipulation of the physical, chemical, or biological characteristics of an aquatic resource to heighten, intensify, or improve a specific aquatic resource function(s)…may also lead to a decline in other aquatic resource function(s)…[and] does not result in a gain in aquatic resource area (Corps 2017a)."

4.2.1. MAR-5/ORRS Mitigation Site

The Gila River Indian Community (GRIC, the Community) MAR-5 Recharge Project is a 5-year pilot study designed to evaluate the effectiveness of recharging a portion of the GRIC allotment of Central Arizona Project (CAP) water into the Gila River, on the Community's lands (**Figure 7**). Over the 5-year pilot study, CAP water was discharged at a single turnout near the Olberg Road Bridge in GRIC District 3. Baseline data collection was conducted at the site in 2015 prior to the initiation of discharge of CAP water. The pre-discharge vegetation of the area was described (WestLand 2019) as a sparse collection of upland woody shrubs with desert forbs and Bermudagrass (*Cynodon dactylon*), along with the nonnative, invasive tamarisk (*Tamarix* spp.). Resolution first began discussions with the Corps about potential use of the site as CWA compensatory mitigation in 2014. The pre-impact mitigation was intended to reduce temporal losses of aquatic function from Project impacts to potential waters of the U.S. and minimize mitigation risk and uncertainty. In 2017, the Sacramento District of the Corps' South Pacific Division formalized guidance (Corps 2017b) on an Advance Permittee-Responsible Mitigation (APRM) process very similar to that undertaken at the MAR-5 Restoration Area. Resolution and the Corps have coordinated between 2014 and the present to evaluate and document the establishment of the riparian community at the MAR-5 Restoration Area and the associated functional lift in accordance with the 2008 Mitigation Rule.

The instream discharge, initiated in August 2015, established an approximately 123-acre wetted area at the GRIC MAR-5 site (**Figure 8**) and associated riparian vegetation community, and it is anticipated that continued discharges would provide additional sustained and significant ecological lift as riparian habitat in this area continues to develop. Data collected in 2017 (WestLand 2019) show a five-fold increase in total vegetation volume and a six-fold increase in total herbaceous cover, and at the end of the pilot study the site was populated with desirable riparian species including cattails (*Typha* spp.) and Goodding's willow (*Salix gooddingii*). Tamarisk density at the site also increased substantially and the GRIC Department of Environmental Quality has identified a large tamarisk thicket directly upstream, the 23-acre Olberg Road Restoration Site (ORRS), that is likely a major seed source contributing to the tamarisk colonization and proliferation at the GRIC MAR-5 site.

Given the proximity of MAR-5 and ORRS and the clear ecological linkage between the two locations, the areas are considered together as the MAR-5/ORRS Mitigation Site in the Conceptual Mitigation Plan. The conceptual mitigation strategy for the ORRS consists of exotic tree species (principally tamarisk) removal and control, combined with native plant species reseeding. Mitigation activities at MAR-5 consist of the continued discharge of CAP allotment into the river, as well as exotic tree species control combined with seeding of native plant species. Exotic tree species removal and control combined with seeding of native plant species at both MAR-5 and ORRS would allow for the restoration, enhancement, and maintenance of a riparian habitat dominated by native tree species and would eliminate a large, local source of exotic tree species seed from that section of the Gila River. The Corps places a high value on restoration projects (33 CFR 332.3(a)(2)), and the MAR-5/ORRS Mitigation Site represents a significant restoration opportunity on one of Arizona's largest river systems and it is within the same Middle Gila HUC 8 subbasin as the Project. Additionally, the Community has indicated that the continued recharge at the site would restore a cultural resource (surface flows in the Gila River) that has significant traditional value to the Community. **Table 3** provides a brief summary of the proposed mitigation within the MAR-5/ORRS Mitigation Site. The specific types of compensatory mitigation provided by the MAR-5/ORRS Mitigation Site include establishment, rehabilitation, and enhancement (Corps 2017a).

Table 3. Mitigation Areas within the MAR-5/ORRS Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
MAR-5 Restoration Area	123.0	The MAR-5 Restoration Area is located within the active channel of the Gila River. Discharge of CAP water into the channel has established a riparian vegetation community along the 123-acre wetted area. Continued discharge of this allotment will continue establishment of this riparian community. Exotic species removal and control and seeding of native species will improve the functions of this restored riparian community.
ORRS Area	23.0	The ORRS Area is located within the Gila River channel immediately upgradient of the MAR-5 Restoration Area and is a major seed source for tamarisk growing within the MAR-5 Restoration Area. Exotic species removal and control and seeding of native species will rehabilitate the existing riparian community and enhance the functions of the MAR-5 Restoration Area.

4.2.2. Queen Creek Mitigation Site

The Queen Creek Mitigation Site is approximately 79 acres in size and includes a 1.8-mile-long reach of Queen Creek near Superior, Arizona (**Figure 7**). The 79-acre Queen Creek Mitigation Site includes lands owned by Resolution and BHP Mineral Resources, Inc. (BHP). This reach of Queen Creek is ephemeral with a large, well-defined, single to multi-threaded, low-gradient channel and a mainly xeroriparian vegetation community composed of mature, medium-stature catclaw acacia (*Acacia greggii*), velvet mesquite (*Prosopis velutina*) shrubs, and medium-stature creosote (*Larrea tridentata*). Immediately downgradient of the proposed mitigation site, Queen Creek receives treated effluent from the Superior Wastewater Treatment Plant (SWWTP) and the Imerys Perlite USA, Inc. mine, forming an effluent

dependent water with more mesoriparian vegetation. Anthropogenic disturbances are present throughout the site including debris piles, unauthorized trails, and roads.

Conceptual mitigation elements for the site consist of actions intended to enhance the ecological condition of this reach, including the removal of tamarisk to allow native riparian vegetation to return to its historic composition and structure and promote more natural stream functions (**Figure 9**). Additionally, a site protection instrument would be established to restrict future development of the site and provide protected riparian and wildlife habitat. The Corps has requested that, although the site protection instrument will cover the entire 79-acre site, mitigation credit for the Queen Creek Mitigation Site be limited to an approximately 33-acre area that includes the Queen Creek channel and the riparian corridor of the channel. Within this xeroriparian corridor, limited removal of sparsely populated tamarisk and other invasive species would occur, followed by planting and seeding of native plant species. Select man-made debris would be removed while avoiding disturbance to existing mature woody vegetation; seeding of native plant species would follow. The Queen Creek project would be accessible and highly visible from Superior (**Figure 9**), allowing a local community affected by the Project to be a major beneficiary of the mitigation. **Table 4** provides a brief summary of the proposed mitigation within the Queen Creek Mitigation Site. The specific type of compensatory mitigation provided by the Queen Creek Mitigation Site is enhancement (Corps 2017a).

Table 4. Mitigation Areas within the Queen Creek Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
Queen Creek Enhancement Area	33.0	The Queen Creek Enhancement Area includes the channel of an approximately 1.8-mile-long reach Queen Creek. Exotic species removal and control, seeding of native species, and removal of select anthropogenic disturbances without additional disturbance of mature vegetation will enhance the functions of the riparian community associated with this reach.

4.2.3. H&E Farm Mitigation Site

The H&E Farm Mitigation Site is an approximately 500-acre site located along the Lower San Pedro River, approximately 3.5 miles northwest of the town of Mammoth in Pinal County, Arizona (**Figure 7**). The property is comprised entirely of private lands managed by The Nature Conservancy (TNC) and includes an approximately 2-mile-long low-gradient, braided intermittent reach of the San Pedro River. The river floodplain and terrace to the east of the river is comprised of former agricultural fields currently used for cattle grazing and associated ranching activities. Existing vegetation within the historic agricultural fields is sparse and consists of small to medium-statured mesquite and graythorn (*Ziziphus obtusifolia*). Vegetation along the active channel at the H&E Farm Mitigation Site consists of narrow, dense stands of mesoriparian and xeroriparian trees and shrubs. Species include large-statured mesquite (*Prosopis* sp.) and tamarisk, with a few individual cottonwoods (*Populus* sp.) and interspersed patches of singlewhorl burrobush (*Ambrosia monogyra*).

The H&E Farm Mitigation Site contains two proposed mitigation areas, the 300-acre H&E Terrace Reestablishment Area and the 15-acre H&E Wetland Reestablishment Area (**Figure 10**). CWA mitigation activities proposed for the H&E Farm Mitigation Site include removal of agricultural ditch and berm systems in the historic fields, reestablishment of some ephemeral drainage channels on the eastern floodplain terrace, reestablishment of the natural alluvial fan and floodplain terrace structure, and restoration of their associated vegetation (**Figure 10**). This earthwork, reestablishment, and revegetation will reconnect uplands to the east of the river with the mainstem of the San Pedro River and return aquatic functions to this portion of the floodplain. Minimal earthwork and planting of native riparian trees and shrubs is proposed within the former agricultural fields to enhance the adjacent wetland features, reestablish former wetland areas, and restore a more native vegetation community. These efforts are intended to mirror the previous mitigation strategies implemented by TNC and Arizona Department of Water Resources (ADWR) in 2011, as well as ongoing CWA mitigation at the LSPRWA ILF, which is contiguous with the western and northern boundaries of the H&E Farm Mitigation Site (**Figure 10**). **Table 5** provides a brief summary of the proposed mitigation within the H&E Farm Mitigation Site. The specific types of compensatory mitigation provided by the H&E Farm Mitigation Site include reestablishment and enhancement (Corps 2017a).

Table 5. Mitigation Areas within the H&E Farm Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
H&E Terrace Reestablishment Area	300.0	The H&E Terrace Reestablishment Area consists of historic agricultural fields occupying the former floodplain, floodplain terrace, and alluvial fan of the San Pedro River within the eastern half of the mitigation site. Mitigation activities proposed within this area include removal of agricultural ditch and berm systems, reestablishment of some ephemeral drainage channels on the floodplain terrace, reestablishment of the natural alluvial fan and terrace structure, and restoration of these features associated vegetation. Minimal planting of native trees and shrubs is proposed within the river floodplain to enhance this vegetation community.
H&E Wetland Reestablishment Area	15.0	The H&E Wetland Reestablishment Area includes an area of historic agricultural fields immediately adjacent to existing wetlands in the San Pedro River channel. Minimal earthwork and planting of native riparian trees and shrubs is proposed adjacent to existing wetlands to enhance the wetland features present, reestablish former wetland areas, and restore a more native vegetation community.

5. SITE ASSESSMENT AND DETERMINATION OF MITIGATION RATIOS

The South Pacific Division of the Corps has developed the *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) for determining compensatory mitigation requirements for the processing of CWA Section 404 permits. The substantive component of this procedure is completion of Attachment 12501.1-SPD, the MRSC. The completed MRSC is intended to provide a ratio determining the amount of acreage necessary as compensatory mitigation to offset the acreage of authorized impacts, in compliance with the 2008 Mitigation Rule. Completion of the MRSC

comprises a 10-step process that includes a functional analysis of impacted waters of the U.S. and proposed mitigation parcels, establishes baseline mitigation ratios, and authorizes adjustment of those ratios based on specified criteria.

The 10 steps for the completion of the MRSC are:

Step 1. Identification and Classification of Aquatic Resources
Step 2. Qualitative Impact-Mitigation Comparison
Step 3. Quantitative Impact-Mitigation Comparison
Step 4. Mitigation Site Location
Step 5. Net Loss of Aquatic Resource Surface Area
Step 6. Type Conversion
Step 7. Risk and Uncertainty
Step 8. Temporal Loss
Step 9. Final Mitigation Ratio
Step 10. Final Compensatory Mitigation Summary

As Step 2 of this process, the functions of the aquatic features at both the impact and mitigation sites are compared to assess those aquatic functions and values lost if the Project is permitted compared to those aquatic functions and values gained through mitigation activities. Evaluation of these functions was based on available data, published literature, aerial photography, field observations, and field data collected from both the impact and proposed mitigation sites. This effort also included use of the *California Rapid Assessment Method (CRAM) Episodic Riverine Field Book, version 2.0* (CWMW 2018), which was specifically developed to assess the functionality of ephemeral drainages based on relationships between condition and function. CRAM is used in California to assess the function of ephemeral aquatic features in comparison to normally functioning reference features of the same class and similar flow regime. Although not designed or currently approved for use as a stand-alone qualitative impact-mitigation comparison method, metrics from CRAM were incorporated in the Step 2 qualitative functional assessment. Given the nature of the proposed mitigation sites, this assessment requires a functional comparison of services provided by relatively small ephemeral drainage systems to services provided by much larger intermittent or perennial systems (e.g., the Gila River) and associated riparian habitat. The assessment is not intended to make a value judgement between these systems; rather, the assessment fulfills the purposes of the MRSC to provide a comparative assessment of the functionality of the systems at the impact and mitigation sites and to develop a mitigation ratio that will ensure there is no net loss of aquatic functions and values.

Functional assessment of the Skunk Camp TSF impact site included field data collection and evaluation of a representative sample of the ephemeral drainages within the property, selected based on physical parameters, such as underlying geology, slope and landscape position, that can affect their hydrologic, chemical, and biotic functions. The functional losses assessed result from direct impacts to ephemeral channel areas within the Project footprint and indirect permanent impacts anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features,

including the seepage controls and stormwater diversions. The three mitigation sites occupy highly valuable and rare areas adjacent to the major mainstem drainages of the Gila River, Queen Creek, and San Pedro River watersheds and the proposed mitigation actions will help restore, enhance, and maintain natural functions and associated riparian buffers along these larger waterbodies. The resources and functions present at the three mitigation sites were classified and evaluated by mitigation area, where such areas were defined by existing physical characteristics and by the specific primary mitigation actions proposed. Defined mitigation areas within the three mitigation sites include areas of establishment, establishment, rehabilitation, and enhancement activities. Functional scoring of each mitigation area consisted primarily of an evaluation of the functional gain that the area would provide upon achievement of mitigation success. The functional or ecological 'lift' provided by the mitigation activities is presented as the difference between the current baseline functions of the mitigation site and the functional value anticipated under post-mitigation conditions.

The MRSC document included as **Attachment A** describes the methods used for the application of these 10 steps to determine the final mitigation ratios and acreages in this analysis, and provides the results of applying the MRSC to the calculation of compensatory mitigation required for the proposed impacts to potential waters of the U.S. from development of the Project. The final ratios determine the amount of acreage credits that are generated by each mitigation area when compared to each impacted drainage class. Step 9 of the MRSC is the calculation of final mitigation scoring ratios from Steps 2-8 in the MRSC. The final mitigation ratios comparing each impact class to each mitigation area were compiled and are summarized in **Table 6**. The *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) instructions state that where a qualitative comparison is used for the functional assessment in Step 2, final mitigation ratios may not be less than 1:1. Therefore, ratios shown in **Table 6** as less than 1:1 are applied as a ratio of 1:1 in **Table 7**.

Table 6. Final Mitigation Ratios Per Impacted Drainage Class and Mitigation Area

Mitigation Site Areas	Skunk Camp TSF Impact Site		
	Impact Class A Ratio	Impact Class B Ratio	Impact Class C Ratio
MAR-5/ORRS Mitigation Site			
MAR-5 Restoration Area	1.25:1	0.88:1	0.50:1
ORRS Area	2.75:1	2.60:1	1:1
Queen Creek Mitigation Site			
Queen Creek Enhancement Area	4.70:1	4.20:1	4.20:1
H&E Farm Mitigation Site			
H&E Terrace Reestablishment Area	1.39:1	0.83:1	0.67:1
H&E Wetland Reestablishment Area	0.63:1	0.30:1	0.22:1

In Step 10, the total acres of impacted area by drainage class are applied to the number of mitigation credits provided by mitigation site, based on the final mitigation ratios. **Table 7** summarizes the application of the MRSC-derived mitigation ratios to the mitigation sites in a sequential fashion. The completed MRSC worksheets, showing the steps described above, are an appendix to the MRSC document provided as **Attachment A**. Mitigation credits were applied to the higher functionally scoring Class A impacts first, then to the lower scoring Class B and Class C. The application of mitigation credit areas began with the MAR-5/ORRS Mitigation Site areas and moved sequentially through the mitigation areas of the Queen Creek Mitigation Site and the H&E Farm Mitigation Site, as needed, until all of the functional impacts for each drainage class were mitigated. Application of the mitigation credits in this fashion was based solely on the order of discussion of the mitigation sites in this document. Actual application of the mitigation credits in the Final Mitigation Plan may occur in a number of ways. The application of mitigation to impacts in this Conceptual Mitigation Plan is intended to demonstrate sufficient credit is available to mitigate for unavoidable impacts to waters of the U.S. from development of the Project.

Table 7. Final Mitigation Credits Applied by Impact Drainage Class and Mitigation Site/Area

Impact Drainage Class	Impact Acres	Mitigation Site/Area	Mitigation Acres Available	Mitigation Ratio	Mitigation Acres Used	Mitigation Credits Provided	Remaining Impact Acres
Impact Class A	86.94	MAR-5 Restoration Area	123.00	1.25:1	108.68	86.94	0.00
		ORRS Area	23.00	2.75:1	0.00	0.00	0.00
		Queen Creek Enhancement Area	33.00	4.70:1	0.00	0.00	0.00
		H&E Terrace Reestablishment Area	300.00	1.39:1	0.00	0.00	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00
Impact Class B	39.98	MAR-5 Restoration Area	14.32	1:1	14.32	14.32	25.66
		ORRS Area	23.00	2.60:1	23.00	8.84	16.82
		Queen Creek Enhancement Area	33.00	4.20:1	33.00	7.85	8.97
		H&E Terrace Reestablishment Area	300.00	1:1	8.97	8.97	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00
Impact Class C	45.70	MAR-5 Restoration Area	0.00	1:1	0.00	0.00	0.00
		ORRS Area	0.00	1:1	0.00	0.00	0.00
		Queen Creek Enhancement Area	0.00	4.20:1	0.00	0.00	0.00
		H&E Terrace Reestablishment Area	300.00	1:1	45.70	45.70	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00

6. REFERENCES

California Wetlands Monitoring Workgroup (CWMW). 2018. California Rapid Assessment Method (CRAM), Episodic Riverine Field Book, Version 2.0. August 2018.

Lowery, Shawn F., Angela Stingelin, and Charles Hofer. 2016. Conceptual Plan, January 2016, In-Lieu Fee Restoration Project Site Wetland Restoration and Monitoring at the Lower San Pedro River Wildlife Area, Pinal County, Arizona. Phoenix: Arizona Game and Fish Department.

U.S. Army Corps of Engineers. 2015. Final 2015 Regional Compensatory Mitigation and Monitoring Guidelines. U.S. Army Corps of Engineers - South Pacific Division. January 12, 2015. 70.

_____. 2017a. 12501-SPD Regulatory Program Standard Operating Procedure For Determination Of Mitigation Ratios. U.S. Army Corps of Engineers - South Pacific Division. January 11, 2017.

_____. 2017b. Guidelines for Preparation of Advance Permittee-Responsible Mitigation Proposals. U.S. Army Corps of Engineers - Sacramento District. May 8, 2017.

U.S. Army Corps of Engineers, and U.S. Environmental Protection Agency. 2008. Compensatory Mitigation for Losses of Aquatic Resources; Final Rule. *Federal Register*. April 10, 2008. 19594-19705.

U.S. Forest Service. 2019. Resolution Copper Project Draft Environmental Impact Statement. U.S. Department of Agriculture.

_____. 2020. Resolution Copper Project Final Environmental Impact Statement. U.S. Department of Agriculture.

WestLand Resources, Inc. 2017. Clean Water Act Section 404 Conceptual Mitigation Plan Lone Star Ore Body Development Project. *Prepared for U.S. Army Corps of Engineers on Behalf of Freeport-McMoRan Safford Inc.* Tucson, Arizona: WestLand Resources, Inc. February 3, 2017.

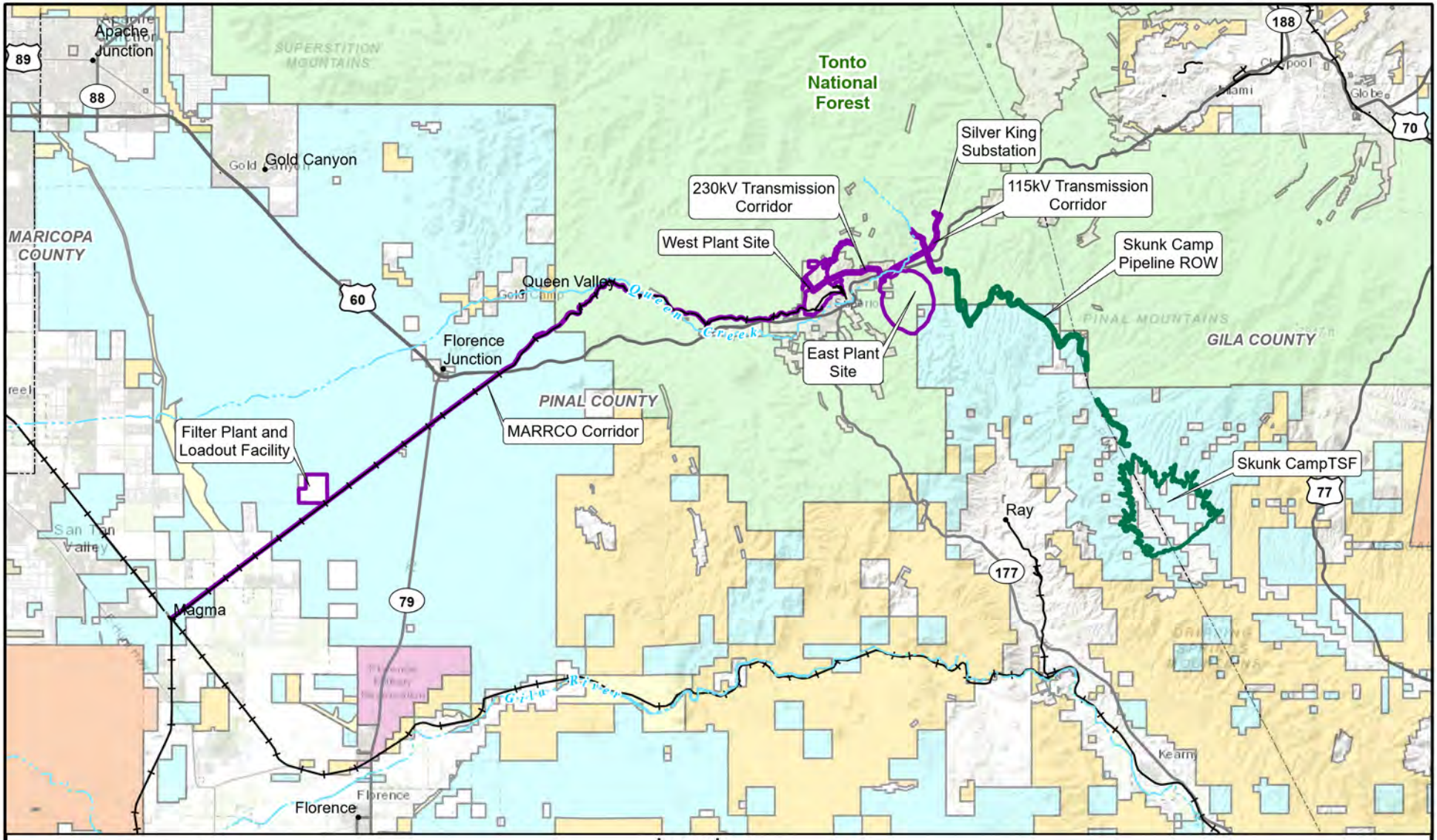
_____. 2018. Ripsey Wash Tailings Storage Facility Revised Clean Water Act Section 404 Conceptual Mitigation Plan. *Prepared for ASARCO LLC - Ray Operations*. Tucson, Arizona: WestLand Resources, Inc. February 1, 2018.

_____. 2019. Gila River Indian Community MAR-5 2017 Vegetation Monitoring Report. *Prepared for Resolution Copper*. Tucson, Arizona: WestLand Resources, Inc. May 2019.

_____. 2020a. DRAFT Clean Water Act 404(b)(1) Alternatives Analysis. *Prepared for U.S. Army Corps of Engineers on behalf of Resolution Copper*. Tucson, Arizona: WestLand Resources, Inc. July 2020.

_____. 2020b. DRAFT Resolution Copper Project Mitigation Ratio-Setting Checklist. *Prepared for U.S. Army Corps of Engineers on behalf of Resolution Copper*. Tucson, Arizona: WestLand Resources, Inc. July 2020.

FIGURES



Legend

Pinal and Gila Counties, Arizona,
Data Source: BLM 2019, WRI Modified 2019, ALRIS, SWCA, and USFS
Image Source: ArcGIS Online, World Topo Map

N

0 2.5 5 Miles

0 4 8 Kilometers

WestLand Resources

- Skunk Camp TSF Alternative
- GPO Mine Element

Surface Management

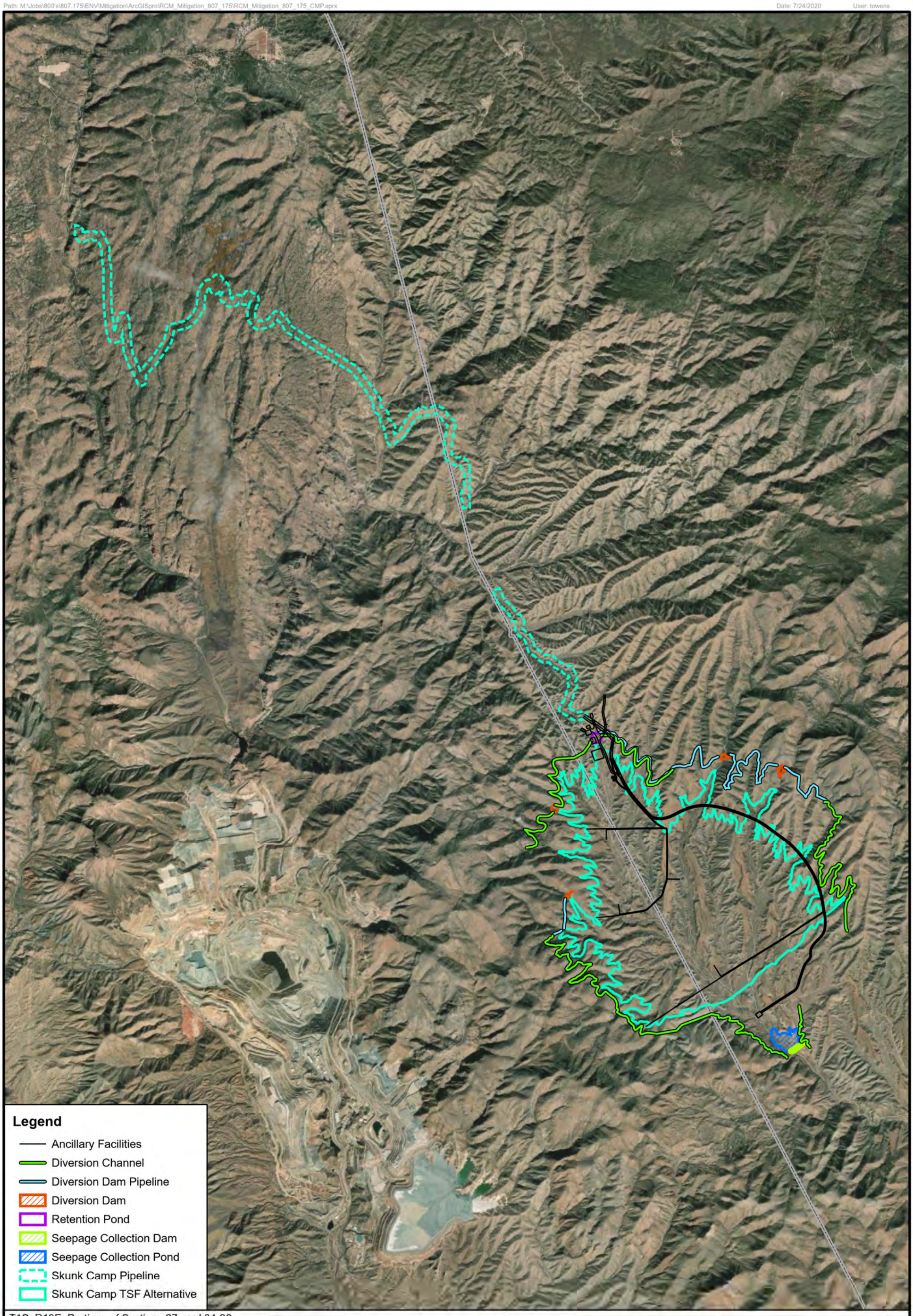
- Bureau of Land Management (BLM)
- Bureau of Reclamation
- County
- Indian Lands
- Local or State Parks
- Military
- Other
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

OVERVIEW OF PROPOSED MINING OPERATION

Figure 1



T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF ALTERNATIVE
AERIAL OVERVIEW

Figure 2

Path: M:\Jobs\800's\807.175\ENV\Mitigation\ArcGISpro\RCM_Mitigation_807_175\RCM_Mitigation_807_175_CMP.aprx Date: 7/24/2020 User: towens

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

N

0 3,000 6,000 Feet

0 1,500 3,000 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF ALTERNATIVE
IMPACTS TO THE AQUATIC ECOSYSTEM

Figure 3

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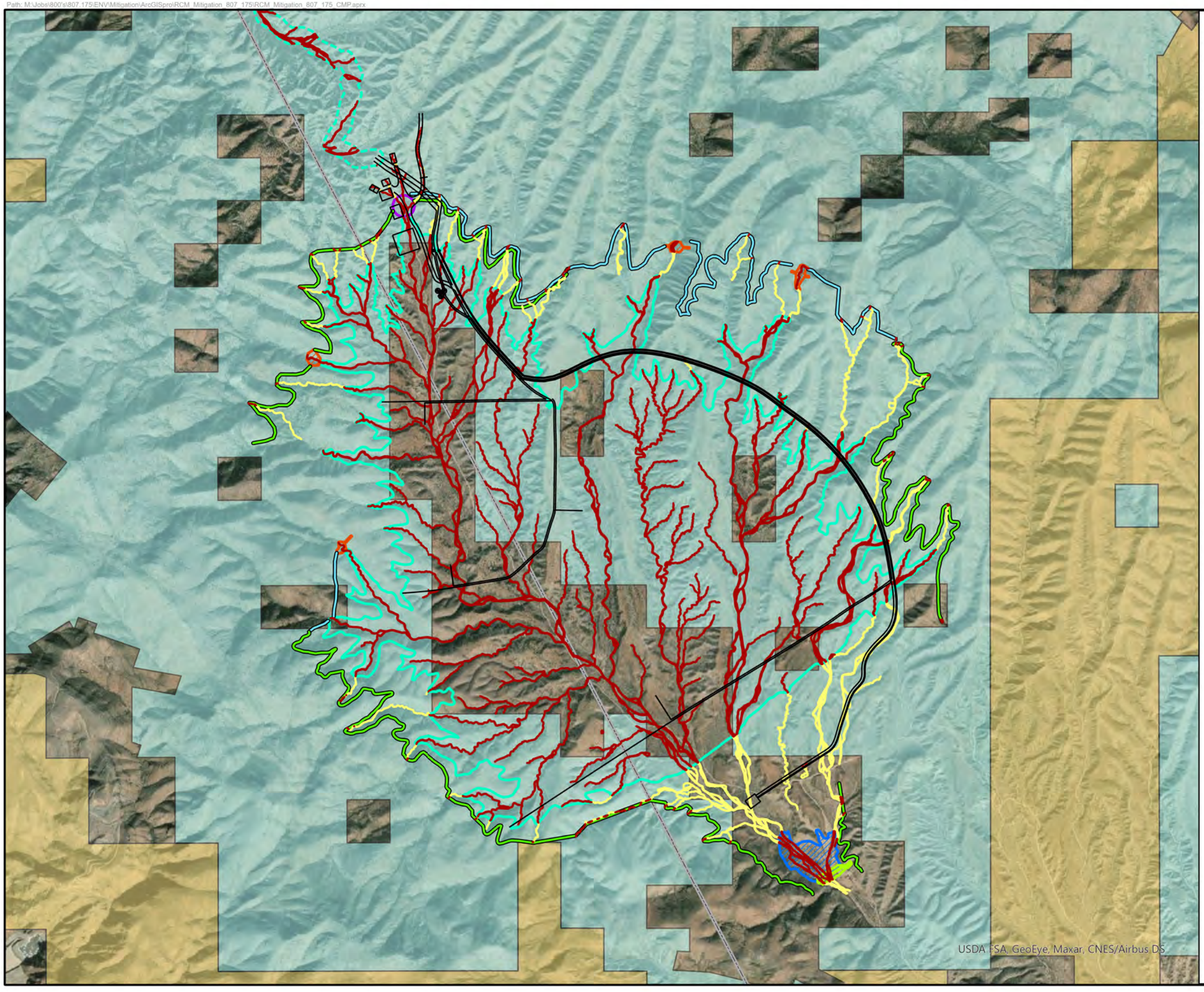

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land

N

0 1,500 3,000 Feet

0 750 1,500 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF DIRECT AND INDIRECT IMPACTS

Figure 4

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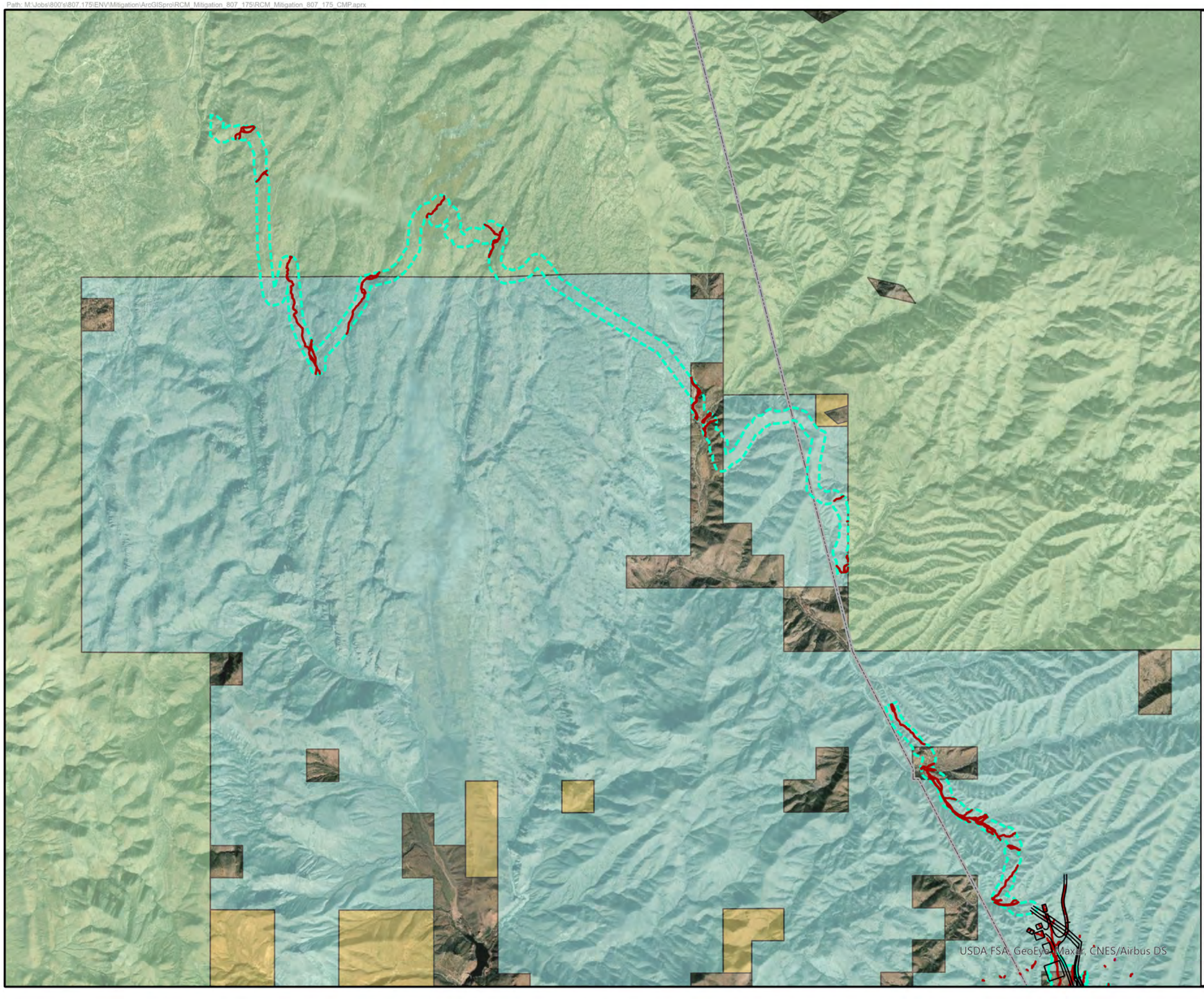

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
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T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Skunk Camp Direct OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

Note: Most OHWM impacts in the pipeline corridor are temporary and this analysis conservatively assumes all OHWM will be impacted.

N

0 2,000 4,000 Feet

0 1,000 2,000 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF PIPELINE DIRECT IMPACTS

Figure 5

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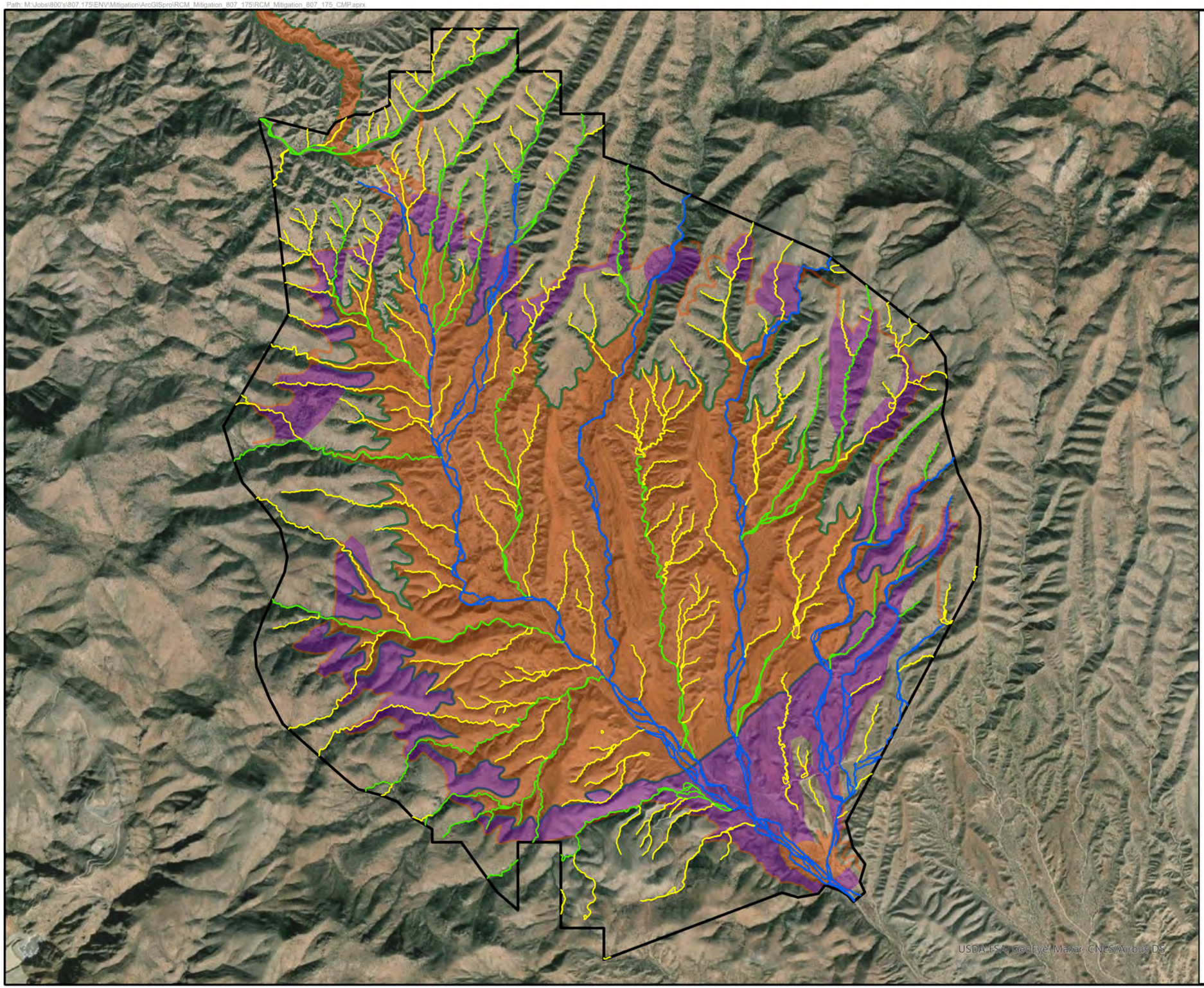

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018

Legend

- Skunk Camp Analysis Area
- Skunk Camp Direct Impact Area
- Skunk Camp Indirect Impact Area
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Skunk Camp OHWM Drainage Class

- Class A
- Class B
- Class C

N

0 1,500 3,000 Feet

0 750 1,500 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

SKUNK CAMP TSF IMPACT DRAINAGE CLASSES

Figure 6

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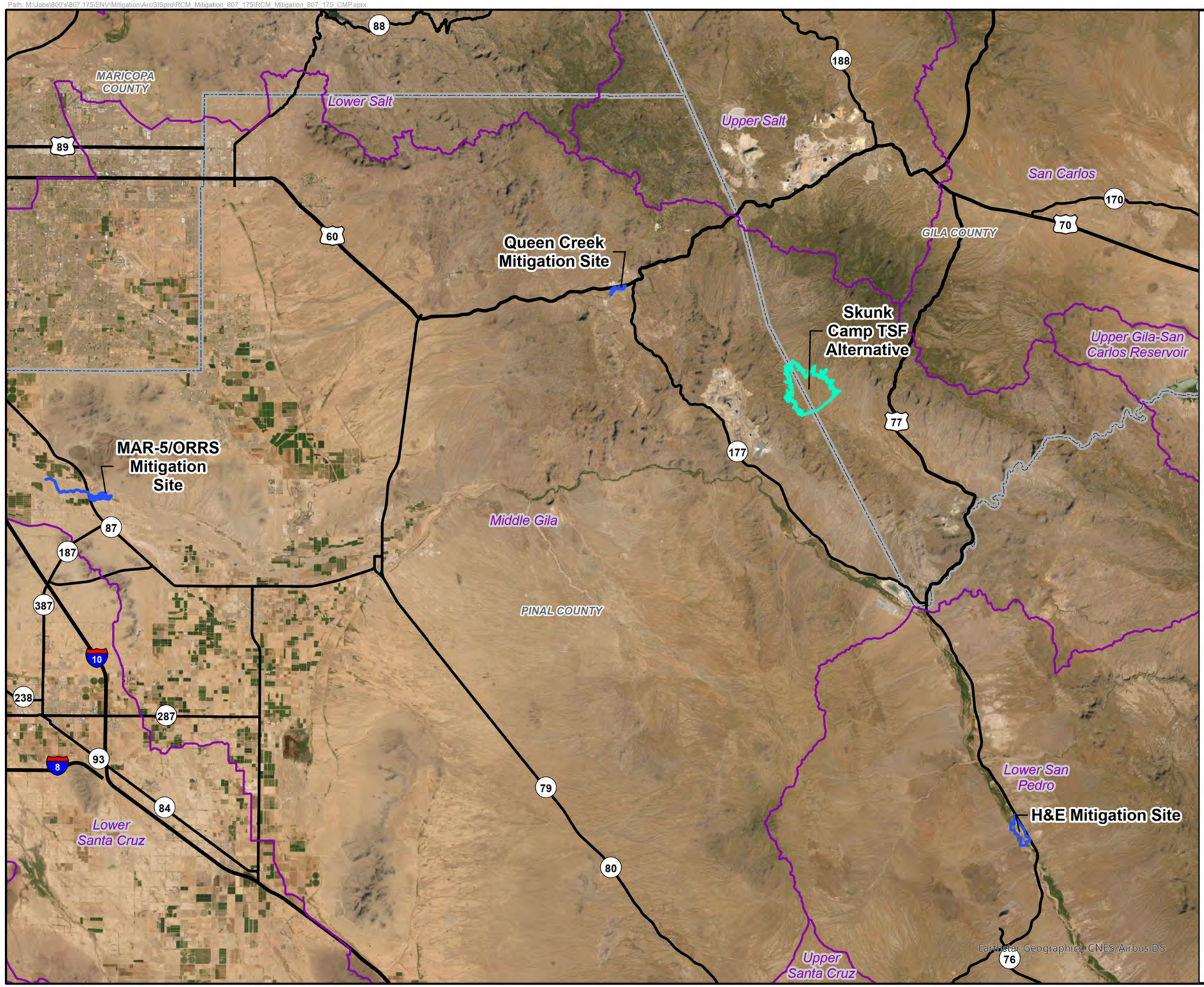

Portions of T2S R12-14E, T4S R6-7E, T6S R20E, T7S R16E, and T8S R16E,
Pinal, Graham, and Gila Counties, Arizona,
Image Source: Maxar 2018

Legend

- Mitigation Boundaries
- Skunk Camp TSF Alternative
- USGS HUC 8

N

0 4 8 Miles

0 8 16 Kilometers

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

MITIGATION SITES AERIAL OVERVIEW

Figure 7

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T4S, R6E, Portions of Sections 8-14,
Pinal County, Arizona,
Image Source: Maxar 6/19/2018

WestLand Resources

N

0 750 1,500 Feet

0 250 500 Meters

Legend

- MAR-5/ORRS Mitigation Site
- MAR-5 Restoration Area
- ORRS Area

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

MAR-5/ORRS MITIGATION SITE

Figure 8

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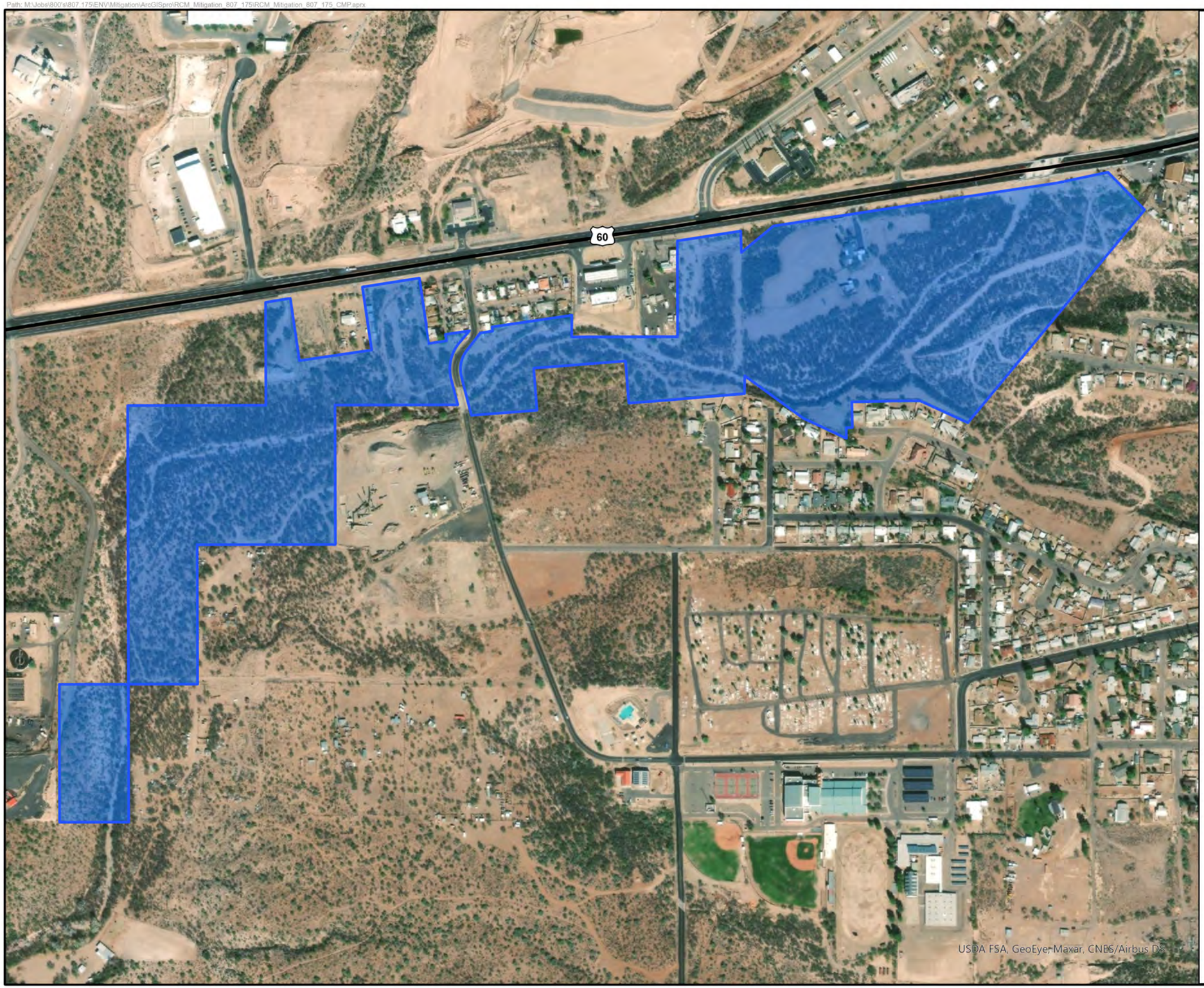

T2S, R12E, Portions of Sections 3 and 4,
Pinal County, Arizona,
Image Source: Maxar 2/6/2018

Legend

- Queen Creek Enhancement Area
- Queen Creek Mitigation Site

N

0 250 500 Feet

0 100 200 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

QUEEN CREEK MITIGATION SITE

Figure 9

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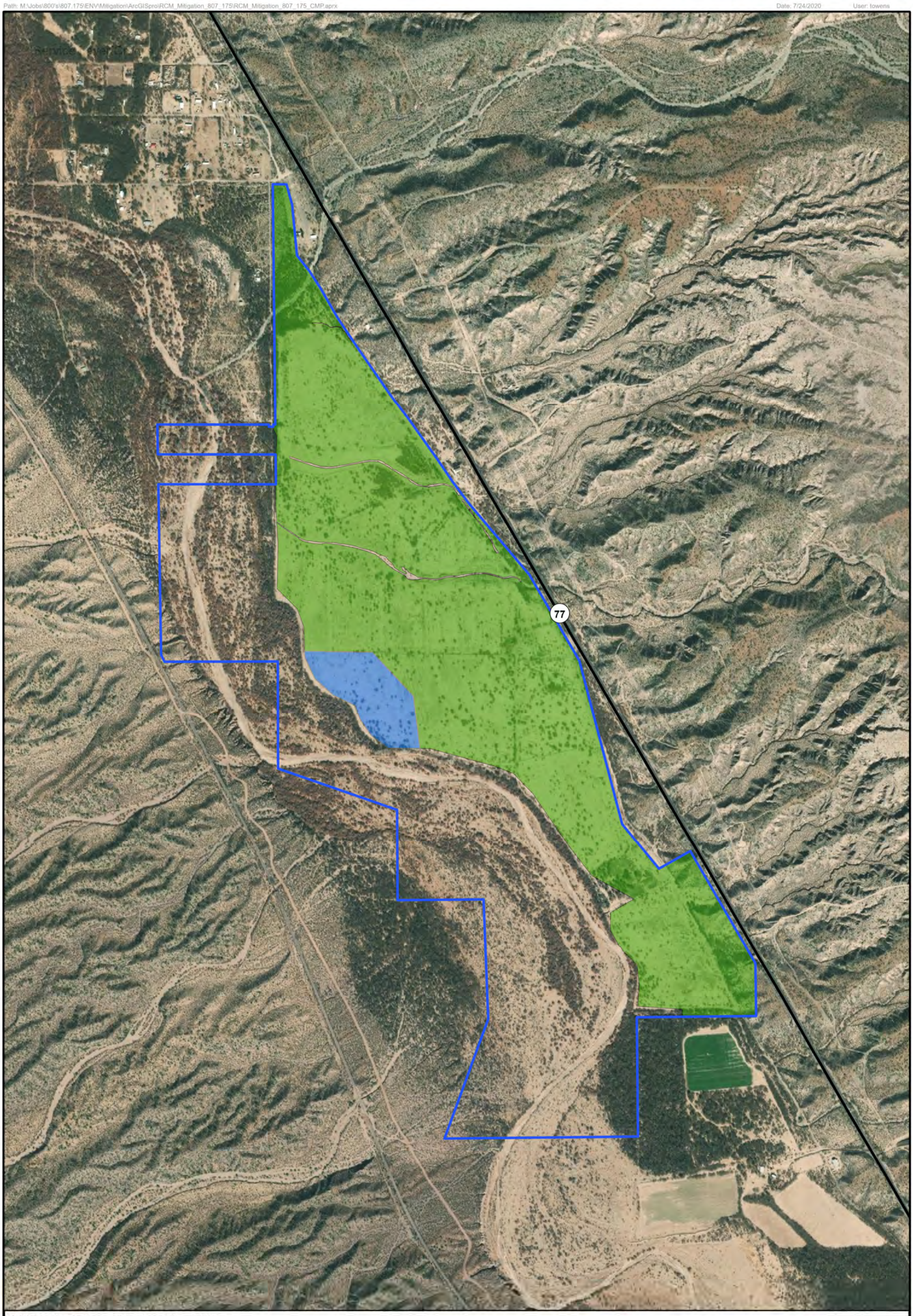

T7S, R16E, Portions of Sections 35 and 36,
T8S, R16E, Portion of Section 1,
Pinal County, Arizona,
Image Source: Maxar 1/31/2018

Legend

- H&E Farm Mitigation Site
- H&E Terrace Reestablishment Area
- H&E Wetland Reestablishment Area

N

0 500 1,000 Feet

0 250 500 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Conceptual Mitigation Plan

H&E FARM MITIGATION SITE

Figure 10

ATTACHMENT A

Resolution Copper Project Mitigation Ratio-Setting Checklist

RESOLUTION COPPER PROJECT
MITIGATION RATIO-SETTING CHECKLIST

Prepared for: U.S. Army Corps of Engineers *on behalf of* Resolution Copper

Prepared by: WestLand Resources, Inc.

Date: September 15, 2020

Project No.: 807.175 06 01

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1. DOCUMENT PURPOSE AND ORGANIZATION

Resolution Copper Mining, LLC (Resolution, or the Applicant) has proposed the development and operation of an underground copper and molybdenum mine near Superior, Arizona (**Figure 1**). As proposed, the construction of the tailings storage facility (TSF), associated pipelines, and appurtenant infrastructure requires the discharge of fill to surface water features (**Figure 2**) that the U.S. Army Corps of Engineers (Corps) has determined (Corps File No. SPL-2016-00547) to be potentially jurisdictional waters of the United States (waters of the U.S.) pursuant to a preliminary jurisdictional determination (PJD). As these potentially jurisdictional waters of the U.S. will be impacted by discharges of dredged or fill material resulting from portions of Resolution's planned mine development, Resolution has made application for a Clean Water Act (CWA) Section 404 permit for these discharges.

In order to secure a CWA Section 404 permit, the Applicant is bound by the requirements of the Corps' and the U.S. Environmental Protection Agency's (EPA) "Final Rule for Compensatory Mitigation for Losses of Aquatic Resources" (33 C.F.R. Parts 325 and 332 and 40 C.F.R. Part 320; published in 73 Fed. Reg. 19594-19705) (Corps and EPA 2008), hereinafter referred to as the 2008 Mitigation Rule. The fundamental objective of the 2008 Mitigation Rule is to establish standardized compensatory mitigation criteria for all mitigation types to offset unavoidable impacts to waters of the U.S. authorized through the issuance of a CWA Section 404 permit. Compensatory mitigation is required after all efforts to avoid and minimize impacts have been achieved and impacts to waters of the U.S. would still occur. The South Pacific Division of the Corps has developed a standard operating procedure in the form of a Mitigation Ratio-Setting Checklist (MRSC) for determining compensatory mitigation requirements.

As configured, only the development of the TSF, pipelines, and appurtenant infrastructure (collectively, the "Project" for purposes of this document) requires a discharge of dredged or fill material into potential waters of the U.S. Resolution has coordinated with the Corps to identify potential mitigation opportunities for the Project. This MRSC report has been prepared to support the Conceptual Mitigation Plan (WestLand 2020b) for the Project and is an attachment to that document. Detailed description of the Project and overall project purpose, impacts to potential waters of the U.S., and the mitigation site selection process are included in the Conceptual Mitigation Plan (WestLand 2020b). This MRSC report is presented in five sections: *Section 1* provides the document purpose and organization; *Section 2* summarizes Project impacts to potential waters of the U.S.; *Section 3* identifies the proposed mitigation sites; and *Section 4* describes the mitigation sites and actions, defines the methods used for determining final mitigation ratios and acreages in this analysis, and provides the results of applying the checklist. *Section 5* lists the references used in developing the report. Following review and approval (or modification, as appropriate) by the Corps of the concepts contained in the Conceptual Mitigation Plan, a final Mitigation Plan in compliance with the 2008 Mitigation Rule will be completed.

2. JURISDICTIONAL IMPACTS FROM THE PROJECT

The development of alternatives for Resolution's proposed underground copper and molybdenum mine design included a significant effort to avoid and minimize impacts to potential waters of the U.S. to the extent practicable. Only the development of the TSF, pipelines, and auxiliary infrastructure requires a discharge of dredged or fill material into potential waters of the U.S. A number of onsite mitigation measures (referred to as "applicant committed environmental protection measures") were incorporated into the TSF designs to address impacts to the aquatic environment, including potential waters of the U.S., and water quality and quantity functions (WestLand 2020b). The full range of alternatives analyzed in the development of the proposed design of the Project is described in the 404(b)(1) Alternatives Analysis (WestLand 2020a) prepared for the Project.

Table 1 summarizes the unavoidable impacts to the aquatic ecosystem that would result from construction of the alternative identified as the Least Environmentally Damaging Practicable Alternative (LEDPA) in that analysis: the Skunk Camp TSF Alternative. This alternative is also analyzed as Alternative 6 in the EIS prepared by the USFS (USFS 2020). Under the Skunk Camp TSF Alternative (**Figure 2**), the total amount of permanently impacted, or 'lost,' potential waters of the U.S. from development of the Project was determined to be 172.62 acres (**Figure 3**). These impacts include 129.24 acres are anticipated to be direct permanent impacts resulting from construction of the TSF and 43.38 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions (**Figure 4**). Impacts from the pipeline (**Figure 5**) include a maximum estimated 15.7 acres of largely temporary impacts from the buried pipeline and associated access road. The final location of the pipeline within the analyzed corridor is still being refined and this estimate of 15.7 acres conservatively assumes that all the potential waters of the U.S. within the corridor are temporarily impacted. As these impacts from the development of the pipeline are temporary, no mitigation for these impacts are proposed in the Conceptual Mitigation Plan.

Potential waters of the U.S. identified within the TSF footprint and pipeline corridor are dominated by both confined and braided ephemeral channels with functions and values typical of desert ephemeral systems. Non-ephemeral drainages within the pipeline corridor, including Devil's Canyon and Mineral Creek, will not be impacted by the project. No jurisdictional special aquatic sites (e.g., wetlands) or seeps and springs are located within the footprint of this TSF or the pipeline corridor. None of the components of this Project alternative would adversely affect any special aquatic sites, including wetlands.

Table 1. Impacts to Potential Waters of the U.S. from the Project

Project Component	Type of Impact	Impacts to Potential Waters of the U.S. (Acres)
TSF	Direct Impacts - Permanent	129.24
TSF	Indirect Impacts - Permanent	43.38
Pipeline	Direct Impacts - Temporary	15.70

3. MITIGATION SITE SELECTION

The 2008 Mitigation Rule identifies general classes of compensatory mitigation, as well as clear preference among these classes, specifically noting that Mitigation Banking and then in-lieu-fee (ILF) Mitigation are preferred over applicant-sponsored on-site or off-site mitigation. As a general matter, in-kind mitigation is also preferred over out-of-kind mitigation. Resolution considered these general classes of compensatory mitigation from a watershed perspective in the selection of proposed mitigation sites and the development of the draft Conceptual Mitigation Plan.

The Project is located within the Middle Gila River subbasin, defined as Hydrologic Unit Code (HUC 8) 15050100. In accordance with the Corps' Final 2015 Regional Compensatory Mitigation and Monitoring Guidelines (2015), Resolution evaluated mitigation opportunities, based on the above hierarchy, within the Project watershed and adjacent watersheds. WestLand is not aware of any watershed planning efforts for the HUC 6 or HUC 8 watersheds within which the Project is located that identify specific restoration goals for aquatic resources. There are currently no Mitigation Banks established in Arizona and no approved ILF Mitigation projects in this watershed HUC 8 subbasin. Resolution had initially proposed the use of the Arizona Game and Fish Department (AGFD) Lower San Pedro River Wildlife Area (LSPRWA) ILF project within the adjacent Lower San Pedro HUC 8 watershed subbasin (HUC 15050203), which has been used as mitigation for other projects located in the Middle Gila River HUC 8 watershed (WestLand 2018). All advanced credits available for purchase through the LSPRWA ILF project have been sold or obligated for sale, however, and the Corps and EPA have requested that the additional 650 credits anticipated from five future phases of development of the ILF not be considered in the Conceptual Mitigation Plan for the Project at this time. Given the lengthy mine construction period, Resolution anticipates that additional credits would become available and may be considered and incorporated in the future.

As the footprint of the practicable TSF alternative contains ephemeral drainage channels and will be operated as part of an active copper mine, little opportunity exists for the development of onsite mitigation for unavoidable impacts to waters of the U.S. Therefore, Resolution has identified three permittee-responsible mitigation sites, all offsite mitigation opportunities: the MAR-5/ORRS Mitigation Site, the Queen Creek Mitigation Site, and the H&E Farm Mitigation Site (**Figure 6**). The relative ecological benefits of each mitigation opportunity are discussed in the Conceptual Mitigation Plan (WestLand 2020b) for the Project and summarized in *Section 4.1.2* of this MRSC document. Discussion of the benefits of these sites is based on WestLand's recent experience working within the framework of the 2008 Mitigation Rule on similar mitigation projects (WestLand 2017, 2018) and following Corps guidelines (Corps 2015). Fulfillment of mitigation at each site would provide regional conservation benefits, though none of the proposed mitigation measures will create xeroriparian habitat similar to the habitat that will be lost or impacted by the Project. Mitigation activities proposed at these sites include preservation, enhancement, and restoration of high-value mesoriparian and hydroriparian habitats, which, although out-of-kind, are rarer within the regional landscape and have higher productivity and wildlife values (Lowery, Stingelin, and Hofer 2016).

4. MRSC METHODS AND RESULTS

The South Pacific Division of the Corps has developed the *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) for determining compensatory mitigation requirements for the processing of CWA Section 404 permits. The substantive component of this procedure is completion of Attachment 12501.1-SPD, the MRSC. The completed MRSC is intended to provide a ratio determining the amount of acreage necessary as compensatory mitigation to offset the acreage of authorized impacts, in compliance with the 2008 Mitigation Rule. Completion of the MRSC comprises a 10-step process that includes a functional analysis of impacted waters of the U.S. and proposed mitigation parcels, establishes baseline mitigation ratios, and authorizes adjustment of those ratios based on specified criteria.

The 10 steps for the completion of the MRSC are:

Step 1. Identification and Classification of Aquatic Resources
Step 2. Qualitative Impact-Mitigation Comparison
Step 3. Quantitative Impact-Mitigation Comparison
Step 4. Mitigation Site Location
Step 5. Net Loss of Aquatic Resource Surface Area
Step 6. Type Conversion
Step 7. Risk and Uncertainty
Step 8. Temporal Loss
Step 9. Final Mitigation Ratio
Step 10. Final Compensatory Mitigation Summary

The following section of this document describes the methods used for the application of these steps to determine the final mitigation ratios and acreages in this analysis, and provides the results of applying the MRSC to the calculation of compensatory mitigation required for the proposed impacts to potential waters of the U.S. from development of the Project.

4.1. IDENTIFICATION AND CLASSIFICATION OF AQUATIC RESOURCES (STEP 1)

Step 1 within the MRSC is the identification and classification of the aquatic resources present at and functions provided by the impact site and the proposed mitigation site.

4.1.1. Skunk Camp TSF Alternative Drainage Impact Classes

The drainages within the Skunk Camp TSF site were grouped into three different classes based on physical parameters that affect their hydrologic, chemical, and biotic function as assessed in Step 2. These classes, Classes A, B, and C are described below and shown in **Figure 7**.

Impact Class A: Class A washes consist of low-gradient, braided (multi-thread) ephemeral drainages within broad, relatively unrestricted floodplains. Class A washes are located lower in the local watershed and include the lower portions of Dripping Spring Wash, Stone Cabin Wash, and Skunk Camp Wash. The TSF and its appurtenant features impact approximately 86.94 acres of Class A drainages.

Impact Class B: Class B washes are located higher upgradient in the local watershed and consist of low- to moderate-gradient, typically single-thread, ephemeral drainages. Class B washes are located throughout the area of the Skunk Camp TSF, with most directly tributary to the Class A washes (**Figure 7**). The TSF and its appurtenant features impact approximately 39.98 acres of Class B drainages.

Impact Class C: Class C washes are located in the headwaters of the local watershed and consist of moderate- to high-gradient single-thread ephemeral drainages. Class C washes represent the upper-most headwater tributaries in the area of the Skunk Camp TSF (**Figure 7**). The TSF and its appurtenant features impact approximately 45.70 acres of Class C drainages.

The total amount of permanently impacted, or 'lost,' potential waters of the U.S. from development of the Project was determined to be 172.62 acres. These impacts include 129.2 acres which are anticipated to be direct permanent impacts resulting from construction of the TSF and 43.4 acres of indirect permanent impacts are anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions (**Figure 7**). As the impacts from the development of the pipeline are temporary, no mitigation for these impacts are proposed in the Conceptual Mitigation Plan. These impacts, separated by drainage class, are shown in **Table 2**.

Table 2. Impacts from the Project by Drainage Class

Drainage Class	Type of Impact	Impacts to Waters of the U.S. (Acres)
Class A	Direct Impacts	60.75
	Indirect Impacts	26.19
Class B	Direct Impacts	32.28
	Indirect Impacts	7.70
Class C	Direct Impacts	36.21
	Indirect Impacts	9.49

4.1.2. Mitigation Site Areas

The proposed mitigation areas at the three mitigation sites, the MAR-5/ORRS Mitigation Site, the Queen Creek Mitigation Site, and the H&E Farm Mitigation Site, are described below and shown in **Figures 8**, **9**, and **10**.

MAR-5/ORRS Mitigation Site: The MAR-5/ORRS Mitigation Site contains two proposed mitigation areas, the 123-acre MAR-5 Restoration Area and the 23-acre Olberg Road Restoration Site (ORRS) Area (**Figure 8**). Brief descriptions of the proposed mitigation areas are provided in **Table 3**. The specific types of compensatory mitigation provided by the MAR-5/ORRS Mitigation Site include establishment, rehabilitation, and enhancement (Corps 2017).

Table 3. Mitigation Areas within the MAR-5/ORRS Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
MAR-5 Restoration Area	123.0	The MAR-5 Restoration Area is located within the active channel of the Gila River. Discharge of Central Arizona Project water into the channel has established a riparian vegetation community along the 123-acre wetted area. Continued discharge of this allotment will continue establishment of this riparian community. Exotic species removal and control and seeding of native species will improve the functions of this restored riparian community.
ORRS Area	23.0	The ORRS Area is located within the Gila River channel immediately upgradient of the MAR-5 Restoration Area and is a major seed source for tamarisk growing within the MAR-5 Restoration Area. Exotic species removal and control and seeding of native species will rehabilitate the existing riparian community and enhance the functions of the MAR-5 Restoration Area.

Queen Creek Mitigation Site: The 79-acre Queen Creek Mitigation Site includes one proposed mitigation area: the Queen Creek Enhancement Area (**Figure 9**). The Corps has requested that, although the site protection instrument will cover the entire 79-acre Queen Creek Mitigation Site, mitigation credit for the site be limited to an approximately 33-acre area that includes the Queen Creek channel and the riparian corridor of the channel. A brief description of the proposed mitigation area is provided in **Table 4**. The specific type of compensatory mitigation provided by the Queen Creek Mitigation Site is enhancement (Corps 2017).

Table 4. Mitigation Areas within the Queen Creek Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
Queen Creek Enhancement Area	33.0	The Queen Creek Enhancement Area includes the channel of an approximately 1.2-mile-long reach Queen Creek. Exotic species removal and control, seeding of native species, and removal of select anthropogenic disturbances without additional disturbance of mature vegetation will enhance the functions of the riparian community associated with this reach.

H&E Farm Mitigation Site: The H&E Farm Mitigation Site contains two proposed mitigation areas, the 300-acre H&E Terrace Reestablishment Area and the 15-acre H&E Wetland Reestablishment Area (**Figure 10**). Brief descriptions of the proposed mitigation areas are provided in **Table 5**. The

specific types of compensatory mitigation provided by the H&E Farm Mitigation Site include reestablishment and enhancement (Corps 2017).

Table 5. Mitigation Areas within the H&E Farm Mitigation Site

Mitigation Area	Acreage	Description of Area and Proposed Mitigation
H&E Terrace Reestablishment Area	300.0	The H&E Terrace Reestablishment Area consists of historic agricultural fields occupying the former floodplain, floodplain terrace, and alluvial fan of the San Pedro River within the eastern half of the mitigation site. Mitigation activities proposed within this area include removal of agricultural ditch and berm systems, reestablishment of some ephemeral drainage channels on the floodplain terrace, reestablishment of the natural alluvial fan and terrace structure, and restoration of these features associated vegetation. Minimal planting of native trees and shrubs is proposed within the river floodplain to enhance this vegetation community.
H&E Wetland Reestablishment Area	15.0	The H&E Wetland Reestablishment Area includes an area of historic agricultural fields immediately adjacent to existing wetlands in the San Pedro River channel. Minimal earthwork and planting of native riparian trees and shrubs is proposed adjacent to existing wetlands to enhance the wetland features present, reestablish former wetland areas, and restore a more native vegetation community.

4.2. QUALITATIVE IMPACT-MITIGATION COMPARISON (STEP 2)

Step 2 of the MRSC is a qualitative comparison between the functions of potential waters of the U.S. that will be impacted by the proposed Project and the functional gain from the proposed mitigation actions. Eleven hydrologic, chemical, and biotic functions were developed for this purpose (**Table 6**).

Table 6. Functions Evaluated for TSF Impacted Drainages

Evaluated Functions
HYDROLOGIC FUNCTIONS
Hydrologic Connectivity
Subsurface Flow and Groundwater Recharge
Energy Dissipation
Sediment Transport/Regulation
CHEMICAL FUNCTIONS
Elements, Compounds, and Particulate Cycling
Organic Carbon Export/Sequestration
BIOTIC FUNCTIONS
Aquatic Invertebrate Fauna
Presence of Fish and Fish Habitat Structure
Riparian/Wetland Vegetation Structure
Age Class Distribution of Wooded Riparian or Wetland Vegetation
Native/Non-native Plant Species

These functions are consistent with those identified in the South Pacific Division's *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) based on WestLand's recent experience working within the framework of the 2008 Mitigation Rule on similar mitigation projects (WestLand 2017, 2018). Scoring for these 11 functions was conducted based on available data, published literature, field data collected on potential waters of the U.S., general field observations, and aerial photography. The functions of each resource were scored qualitatively on a six-category numeric scale, as follows: 0 = none, 1 = low, 2 = low-moderate, 3 = moderate, 4 = moderate-high, and 5 = high function.

The functions of the aquatic features at both the impact and mitigation sites are compared in Step 2 to assess those aquatic functions and values lost if the Project is permitted compared to those aquatic functions and values gained through mitigation activities. Given the nature of the proposed mitigation sites, this assessment requires a functional comparison of services provided by relatively small ephemeral drainage systems to services provided by much larger intermittent or perennial systems (e.g., the Gila River) and associated riparian habitat. The assessment is not intended to make a value judgement between these systems; rather, the assessment fulfills the purposes of the MRSC to provide a comparative assessment of the functionality of the systems at the impact and mitigation sites and to develop a mitigation ratio that will ensure there is no net loss of aquatic functions and values.

Functional assessment of the Skunk Camp TSF impact site included field data collection and evaluation of a representative sample of the ephemeral drainages within the property, selected based on physical parameters, such as underlying geology, slope and landscape position, that can affect their hydrologic, chemical, and biotic functions. The functional losses assessed result from direct impacts to ephemeral channel areas within the Project footprint and indirect permanent impacts anticipated from the 'dewatering' of ephemeral drainages downgradient of portions of the TSF and its appurtenant features, including the seepage controls and stormwater diversions. The three mitigation sites occupy highly valuable and rare areas adjacent to the major mainstem drainages of the Gila River, Queen Creek, and San Pedro River watersheds and the proposed mitigation actions will help restore, enhance, and maintain natural functions and associated riparian buffers along these larger waterbodies. The resources and functions present at the three mitigation sites were classified and evaluated by mitigation area, where such areas were defined by existing physical characteristics and by the specific primary mitigation actions proposed. Defined mitigation areas within the three mitigation sites include areas of establishment, reestablishment, rehabilitation, and enhancement activities (**Figures 8**, **9**, and **10**) as described in *Section 4.1*. Functional scoring of each mitigation area consisted primarily of an evaluation of the functional gain that the area would provide upon achievement of mitigation success. The functional or ecological 'lift' provided by the mitigation activities is presented as the difference between the current baseline functions of the mitigation site and the functional value anticipated under post-mitigation conditions.

4.2.1. Function Definition and Scoring Methods

Definitions of each function and explanation of the scoring methods are provided below:

4.2.1.1. Hydrologic Functions

Hydrologic Connectivity: Hydrologic connectivity scoring assesses the connectivity between surface waters to downstream receiving waters through both surface and shallow subsurface flow.

Scoring for this category was based on the ability of a defined drainage class or mitigation area to transmit either perennial or ephemeral flows from an upstream source to the downstream receiving water. Any impedance in a channel would slow the flow rate of water whether that impedance was artificial, such as a roadbed or railroad, or natural, such as a broad, flat channel with a deep sand and gravel bed. A "5" or "high" score would be given to a system that transmits virtually all water from its upstream source to the downstream receiving water. A "1" or "low" score would be given to a system that transmits comparatively little water from its upstream source to the downstream receiving water.

Subsurface Flow and Groundwater Recharge: Subsurface flow and groundwater recharge scoring assesses the potential for surface water to infiltrate into the channel bed and continue to move either vertically to recharge local or regional groundwater aquifers or laterally to support riparian vegetation and contribute to material cycling.

Scoring for this function was based on the permanence and volume of flow through the feature, coupled with the impedance of the channel. A "1" or "low" score would be given to a low-order ephemeral stream with compact bed soils; shallow bedrock, impenetrable horizons, or high clay content; and sparse xeroriparian buffer. A "5" or "high" score would be given to a large perennial stream with a silt or gravel bed substrate; meso-, hydroriparian, or wetland vegetation buffer; and, deep low-impedance soils promoting infiltration and hyporheic exchange through the streambed.

Energy Dissipation: Energy dissipation scoring assesses the ability of the watershed to dissipate the high energy of floodwaters leading to slower velocities, reduced potential for erosion, enhanced groundwater recharge, and support of riparian vegetation.

Scoring for this function was based on three parameters: the relative sinuosity of the channel, the roughness and gradient of the channel, and the ability of the adjacent floodplain to hold and attenuate flood flows. A "1" or "low" score would be given to a relatively straight, high-gradient stream with a sandy bottom or a constrained buffer and floodplain with minimal riparian vegetation. A "5" or "high" score would be given to a highly sinuous or braided low gradient channel with cobbles, woody vegetation, and/or debris within the channel; and an accessible floodplain with a well-developed riparian buffer.

Sediment Transport/Regulation: Sediment transport and regulation scoring assesses the ability of the features to regulate the transport of sediment downstream and the ability to minimize excessive sediment loss and gains.

Scoring for this function was based on a qualitative evaluation of the channel geometry, the ability of upstream and lateral features to provide sediment to the system, and the ability of the system to attenuate sediment loads. A "1" or "low" score would be given to feature with little ability to either provide sediment to the system and/or attenuate sediment loads, such as high-gradient, bedrock-dominated drainage systems. A "5" or "high" score would be given to a feature with strong abilities in these areas, such as features with deep alluvial beds or wide floodplains that provide sediment sources and storage.

4.2.1.2. Chemical Functions

Elements, Compounds, and Particulate Cycling: Elements, compounds, and particulate cycling scores assess the ability of a stream class to regulate the transport of elements, compounds, and particulates. This function includes the capacity to reduce harmful pulses of nitrogen and phosphorus to downstream waters. Riparian vegetation aids in the sequestration of nutrients that can be released during flood events and through subsurface movement. Riparian vegetation is also a critical component in the denitrification process, which can prevent excessive nitrogen levels that lead to eutrophication and hypoxia.

The cycling of elements, compounds, and particulates was evaluated using channel width, upland and riparian vegetation volume and composition, stream gradient, and bed characteristics. A lower score was given to a high-gradient, low-order headwater stream with reduced or degraded riparian buffer and/or excessive chemical input. A higher score would be given to a higher order stream with a healthy riparian buffer, active hyporheic zone, and features that have the ability to retard excessive nutrient pulses through capture and storage (such as roughness, sinuosity, or vegetation).

Organic Carbon Export/Sequestration: Organic carbon export and/or sequestration evaluate(s) the production, retention, and transport of organic nutrients through the riparian system. Riparian vegetation is capable of producing and exporting significantly higher amounts of organic carbon than typical desert upland vegetation.

Scoring for this function considers channel geometry, frequency of flow, stream connectivity, stream and riparian area substrates, and riparian buffer width, density, and species composition. A lower score would be given to a narrow ephemeral stream with little to no connectivity and a minimal riparian buffer. A higher score would be given to a wide perennial stream with a well-defined riparian buffer, dense vegetation, and healthy soils that could generate large amounts of organic material for sequestration or export.

4.2.1.3. Biotic Functions

Aquatic Invertebrate Fauna: Aquatic invertebrate fauna scoring assesses the presence of aquatic invertebrate fauna within the water features. This score is also an indication of the extent of prey base available to higher order species, including aquatic-feeding amphibians, reptiles, and fish.

Scoring for this metric is based on the number of aquatic invertebrate orders that are estimated to be present within impact areas and mitigation sites. If no invertebrates are present, a score of "0" or "none" was given to the site. Scoring was then determined by the estimated average number of taxonomic orders present within a site, with one order scoring "1" or "low" and five or more orders scoring "5" or "high."

Presence of Fish and Fish Habitat Structure: Scoring of this function assesses the presence and diversity of fish and the presence and quality of fish habitat based on methods outlined in Stacey et al. (2006).

A score of "none" was given for systems supporting no fish. A score of "1" or "low" was given for the presence of non-native fish only, while a score of "moderate" was given for the presence of both native and non-native species. A "5" or "high" score would be given for sites that have native species only.

Fish habitat structure is an aggregate of three factors, including the presence of riffles and pools, the amount of underbank cover, and the amount of woody debris within the channel. The presence of riffles and pools was scored based on estimated area containing pools with a score of "0" or "none" for a lack of pools up to a score of "5" or "high" for pools that are present along at least 50 percent of the feature. Underbank cover was scored in the same manner. Large woody debris was a qualitative evaluation of the amount of large woody debris within each drainage class. The three rankings were considered and a composite score between "0" and "5" was assigned based on the combination of conditions noted within each impacted drainage class or mitigation site.

Riparian/Wetland Vegetation Structure: Riparian/wetland vegetative structure scoring evaluates the volume, density, and structure of vegetation within the riparian areas. The extent and density of riparian vegetation directly affects the ability of the riparian area to perform many of the functions in this analysis. The volume, density, and structure of riparian vegetation is also important in determining the overall quality of the riparian ecosystem.

For this function, the qualitatively estimated volume, density, and structure of riparian vegetation, where present, were considered within the impact areas, both instream and within riparian and upland habitat. For the mitigation areas, the likely presence of riparian vegetation, as well as the volume, density, and structure of that vegetation, at the completion of successful mitigation was estimated based on similar riparian settings. The scoring categories were given numeric values corresponding to the estimated characteristics of riparian vegetation on a similar six-category numeric scale to that used in the qualitative assessment for the other 10 functions. A score of "1" or "low" would be given to areas generally lacking riparian vegetation, lacking vertical structural complexity of the riparian community, and lacking

horizontal interspersion. A "5" or "high" score would be given for sites with abundant wetland and riparian vegetation possessing a high degree of both vertical and horizontal structural complexity.

Age-Class Distribution of Woody Riparian or Wetland Vegetation: This function ranks the age-class distribution structure of woody vegetation. A robust age-class distribution provides diverse habitat niches and demonstrates the health and permanency of the riparian and/or wetland community present at the site.

Scoring for this function was based on the estimated age classes of shrubs and trees, and included seedling, sapling, mature, and senescent. If one class is present, the feature is scored "1" or "low"; if two classes are present, "2" or "low-moderate"; three classes, "3" or "moderate"; and all four classes, "4" or "moderate-high". A "5" or "high" score was given if all four classes were present along with wetland vegetation. For restoration activities, estimates were based on anticipated growth and recruitment levels in each area upon achievement of mitigation success.

Native/Non-native Woody Vegetation Species: Native/non-native woody vegetation species scoring provides a qualitative evaluation of the proportion of non-native woody species in the community. Non-native vegetation can have detrimental impacts on other plant and animal species, and it can alter soil and chemical functions and compositions.

A "5" or "high" score is given for classes or areas with an estimated cover of less than five percent non-native species, and a "1" or low score indicates greater than 50 percent estimated cover of non-native species. For the mitigation site, estimates were based on anticipated conditions in each area upon achievement of mitigation success.

4.2.2. Qualitative Comparison Functional Scores

The functional losses assessed entail impacts to ephemeral channel area within the footprint of the Project. The areas of each proposed mitigation activity within each of the three proposed mitigation sites were assessed for their ability to provide functional gain through the enhancement, reestablishment, restoration, and active management activities. **Table 7** provides the functional scoring of the three classes of potential waters of the U.S. that would be impacted by the Project and the functional scoring within the mitigation areas of the three proposed mitigation sites upon achievement of mitigation success. A full description of the scoring rationale for the three classes of ephemeral drainages and the mitigation areas of the three proposed mitigation sites is attached as **Appendix A**.

Table 7. Functional Assessment Scoring for Impacted Drainage Classes and Mitigation Areas*

Assessed Functions	Skunk Camp TSF Impact Site			MAR-5/ORRS Mitigation Site		Queen Creek Mitigation Site	H&E Farm Mitigation Site	
	Impact Class A	Impact Class B	Impact Class C	MAR-5 Restoration Area	ORRS Area	Queen Creek Enhancement Area	H&E Terrace Reestablishment Area	H&E Wetland Reestablishment Area
Hydrologic Functions								
Hydrologic Connectivity	5	4	2	4	4	5	4	5
Subsurface Flow/Groundwater Recharge	4	3	2	5	2	4	3	4
Energy Dissipation	5	3	2	4	4	5	3	3
Sediment Transport/Regulation	5	3	2	4	4	5	4	4
Chemical Functions								
Elements, Compounds, and Particulate Cycling	4	3	2	4	3	4	4	4
Organic Carbon Export/Sequestration	4	2	1	4	3	4	3	4
Biotic Functions								
Aquatic Invertebrate Fauna	1	1	1	3	4	2	2	4
Presence of Fish and Fish Habitat Structure	0	0	0	2	2	0	0	1
Riparian/Wetland Vegetation Structure	4	3	3	4	3	4	2	4
Age-Class Distribution of Woody Riparian or Wetland Vegetation	4	3	3	4	3	4	3	4
Native/Non-Native Vegetation Species	5	5	5	4	4	5	4	4

* Impact drainage classes shown on **Figure 7** and mitigation areas shown on **Figures 8**, **9**, and **10**.

The scores provided by the functional assessment are used to develop the mitigation baseline ratios for use in the MRSC worksheet included as Attachment 12501.6-SPD of the *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017). Comparison of each impacted drainage class to each mitigation area of the three mitigation sites calculates the adjustment from the starting 1:1 mitigation to impact ratio, were a given mitigation area used to mitigate for a given impact. Mitigation provided for impacts can be higher or lower depending on the relative quality of the mitigation function compared to the quality of the impacted function. The ratios calculated from the complete list of comparisons are provided in **Table 8**.

Table 8. Comparative Mitigation Baseline Ratios for MRSC Step 2

Mitigation Site Areas	Skunk Camp TSF Impact Site		
	Impact Class A Ratio	Impact Class B Ratio	Impact Class C Ratio
MAR-5/ORRS Mitigation Site			
MAR-5 Restoration Area	2.50:1	1.75:1	1:1
ORRS Area	2.75:1	2.60:1	1:1
Queen Creek Mitigation Site			
Queen Creek Enhancement Area	4.50:1	4:1	4:1
H&E Farm Mitigation Site			
H&E Terrace Reestablishment Area	2.50:1	1.50:1	1.20:1
H&E Wetland Reestablishment Area	1.75:1	1:1.50	1:2.75

4.3. QUANTITATIVE IMPACT-MITIGATION COMPARISON (STEP 3)

Steps 2 and 3 of the MRSC are mutually exclusive and provide a comparison of the impact and mitigation sites based on a set of defined functional values. Step 2 is qualitative comparison (used in this analysis and described above) and Step 3 is a quantitative comparison. In order to proceed using Step 3, the MRSC requires an accepted method for conducting the assessment quantitatively. In most cases, this requires a published, peer-reviewed assessment manual that is appropriate for the region and the aquatic functions present within all considered sites. Currently, there is no Corps-approved assessment method accepted for use in Arizona. Therefore, this analysis uses the qualitative assessment in Step 2 and omits Step 3.

4.4. MITIGATION SITE LOCATION (STEP 4)

Step 4 of the MRSC is a ratio adjustment based on the location of a mitigation site with respect to the impact site. This is generally determined based on whether both sites are located within the same watershed as defined by the appropriate HUC. Although there is no defined standard HUC level for use in completing the MRSC, HUC 8 or HUC 10 designations are typically considered appropriate.

The Project is located within the Middle Gila River HUC 8 (15050100) subbasin. Both the MAR-5/ORRS Mitigation Site and the Queen Creek Mitigation Site are also located in the Middle Gila River HUC 8 (15050100) subbasin and no penalty for mitigation site location is applied for these sites. The H&E Farm Mitigation Site is located within the adjacent Lower San Pedro HUC 8 (15050203) subbasin and, although it is proximal to and has a direct hydrologic connection with the reach of the Gila River directly downgradient of the impact site (**Figure 6**), an adjustment of +1 for mitigation site location is applied for this site.

4.5. NET LOSS OF AQUATIC RESOURCE SURFACE AREA (STEP 5)

Per the MRSC instructions, credit can only be given for this step if establishment or reestablishment of aquatic features is to be completed by proposed mitigation actions. Net loss of aquatic resources is scored with a modification of +0 for establishment or reestablishment mitigation and +1 for all remaining mitigation types.

Aquatic resource reestablishment has already occurred as a result of water discharge within the MAR-5 Restoration Area and no penalty for net loss of aquatic resource surface area is applied for this site. No aquatic resource establishment is proposed within the ORRS Mitigation Site or the Queen Creek Mitigation Site. Therefore, an adjustment of +1 is added to the mitigation ratio for these mitigation areas. Aquatic resource reestablishment is proposed within both mitigation areas at the H&E Farm Mitigation Site. Therefore, no penalty for net loss of aquatic resource surface area is applied for this site.

4.6. TYPE CONVERSION (STEP 6)

Out-of-kind mitigation can result in an increase to the mitigation ratio if the mitigation site presents lower quality or less valuable habitat. However, if it is determined that the mitigation site has or will have a rare, unique, or valuable resource type for the determined watershed, a decrease of the mitigation ratio could be applied. Scoring for this category can range from +4 for out-of-kind habitat that is common to -4 for restoration or conversion of rare and valuable habitat. The scoring for this category compares the impact sites and the mitigation sites by assessing the rarity of the stream or habitat type and the overall functional benefit to the watershed.

Development of the Skunk Camp TSF Alternative is expected to result in the permanent impact to and loss of 172.62 acres of ephemeral drainages. This alternative would not adversely impact any special aquatic sites, including wetlands. The three defined classes of impacted drainages, Classes A, B, and C consist only of ephemeral desert washes with relatively sparse xeroriparian or upland vegetation and temporary flow regimes. While these features play an important role in desert ecology, they are more common and provide less functional value when compared to the riparian areas offered by the proposed mitigation sites.

The mitigation areas of the MAR-5/ORRS Mitigation Site provide opportunities for rehabilitation, enhancement, and long-term management along a stretch of the Gila River. Upon achievement of the mitigation success criteria, the MAR-5 Restoration Area and the ORRS Area would provide dense riparian habitat that is both rare and important within Arizona. The discharge of Central Arizona Project water into the Gila River channel has already established a riparian vegetation community along this reach. Due to the rare and regionally significant habitat rehabilitated and enhanced by these mitigation areas, a ratio adjustment of -3 is applied.

The Enhancement Area of the Queen Creek Mitigation Site provides opportunities for enhancement, preservation, and long-term management along Queen Creek. This reach of Queen Creek provides mature xeroriparian habitat. Exotic species removal and control, seeding of native species, and removal of select anthropogenic disturbances without additional disturbance of mature vegetation will enhance the functions of the riparian community associated with this reach. This community is most similar to that found along the largest drainages in the Skunk Camp Impact Area but is also more common that more mesic riparian areas. A ratio adjustment of -1.5 is applied for the Queen Creek Enhancement Area.

The mitigation areas of the H&E Farm Mitigation Site provide opportunities for reestablishment of some ephemeral drainage channels on the floodplain terrace, reestablishment of the natural alluvial fan and terrace structure, and restoration of associated vegetation. Upon achievement of the mitigation success criteria, the H&E Terrace Reestablishment Area would provide dense, mesquite-dominated, riparian habitat that is currently both rare and important within Arizona. Earthwork and planting of native riparian trees and shrubs in the H&E Wetland Reestablishment Area would reestablish former wetland areas, enhance the existing wetlands along the San Pedro River channel, and restore a more native vegetation community. The rarity of wetland features within Arizona, as well as their location in proximity to other river restoration projects like the LSPRWA ILF, makes this mitigation regionally significant. Due to these factors, a ratio adjustment of -2.5 is applied for the H&E Terrace Reestablishment Area and a ratio adjustment of -3.5 is applied for the H&E Wetland Reestablishment Area.

4.7. RISK AND UNCERTAINTY (STEP 7)

Risk and uncertainty are assessed so that the mitigation ratio reflects the uncertainty inherent in some mitigation activities. Factors that are considered include: 1) permittee-responsible mitigation; 2) mitigation site did not formerly support targeted aquatic resources; 3) difficult-to-replace resources (see 33 CFR 332.3(e)(3) and (f)(2)); 4) modified hydrology (e.g., high-flow bypass); 5) artificial hydrology (e.g., pumped water source); 6) structures requiring long-term maintenance (e.g., outfalls, drop structures, weirs, bank stabilization structures); 7) planned vegetation maintenance (e.g., mowing, land-clearing, fuel modification activities); 8) shallow, buried structures (e.g., riprap, clay liners), and 9) absence of long-term preservation mechanism. Each element of risk is scored from +0.1 to +0.3 based on the amount of uncertainty.

The mitigation actions at the MAR-5 Restoration Area include the establishment of riparian vegetation that has already occurred and, therefore, has proven successful. This suggests the management of exotic species and the establishment of native riparian vegetation through active management also has a high probability of success. The restoration does, however, presently require artificial hydrology, includes planned vegetation maintenance, and is permittee-responsible mitigation. The ratio adjustment for these factors of the MAR-5 Restoration Area is +1. The mitigation actions at the ORRS Area include planned vegetation maintenance and are permittee-responsible but lack the need for artificial hydrology. The ratio adjustment for these factors of the ORRS Area is +1. Until long-term site protection has been addressed, the Corps has requested that an additional +1 be added to the risk and uncertainty variable for this site. When long-term site protection has been addressed to the Corps' satisfaction, this additional +1 modifier for both sites will be removed.

The mitigation actions within the Enhancement Area of the Queen Creek Mitigation Site include planned vegetation maintenance and are permittee-responsible, but these actions are limited in area. Therefore, a ratio adjustment of +0.7 was applied to these actions.

The mitigation actions at both areas of the H&E Farm Mitigation Site involve planned vegetation management, utilize water control structures requiring long-term management, and are, at present, permittee-responsible mitigation. Vegetation reestablishment in the H&E Terrace Reestablishment Area may involve some artificial hydrology to ensure planting success. Given the existing site characteristics, vegetation and wetland reestablishment in the H&E Wetland Reestablishment Area would not require artificial hydrology but does involve wetlands, a difficult-to-replace resource. Based on these factors, a ratio adjustment of +0.7 is applied to both areas of the H&E Farm Mitigation Site.

4.8. TEMPORAL LOSS (STEP 8)

Temporal loss is associated with mitigation activities that begin after impacts are made and considers the amount of time it takes for a mitigation activity to reach a full, functional potential. Ratio adjustments are applied based on the amount of time required for the planting, establishment, and growth of vegetation. The temporal adjustment to the mitigation ratio is .05 per month and generally assumes a 20-month period (adjustment of +1) for herbaceous growth, a 40-month period (adjustment of +2) for woody shrubs, and a 60-month, or 5-year, period (adjustment of +3) for tree species.

The mitigation actions at both areas of the MAR-5/ORRS Mitigation Site include the establishment of tree species. The establishment of trees within the MAR-5 Restoration Area has, however, already occurred and therefore no ratio adjustment is applied in this step. Additionally, the impacts to potential waters of the U.S. from the development of the TSF will not occur for up to 10 years after issuance of the permit. As such, the proposed establishment of tree species within the ORRS Area of the MAR-5/ORRS Mitigation Site, the Queen Creek Mitigation Site, and the H&E Farm Mitigation Site will not involve a temporal loss of function between the initiation of the impact and the completion of the

mitigation establishment. Therefore, no ratio adjustment is applied to these mitigation areas for this step.

4.9. FINAL MITIGATION RATIO (STEP 9)

The final ratios determine the amount of acreage credits that are generated by each mitigation area when compared to each impacted drainage class. Step 9 of the MRSC is the calculation of final mitigation scoring ratios from Steps 2-8 in the MRSC. The final mitigation ratios comparing each impact class to each mitigation area were compiled and are summarized in **Table 9**. The *Standard Operating Procedure for the Determination of Mitigation Ratios* (Corps 2017) instructions state that where a qualitative comparison is used for the functional assessment in Step 2, final mitigation ratios may not be less than 1:1. Therefore, ratios shown in **Table 9** as less than 1:1 are applied as a ratio of 1:1 in **Table 10**.

Table 9. Final Mitigation Ratios Per Impacted Drainage Class and Mitigation Area

Mitigation Site Areas	Skunk Camp TSF Impact Site		
	Impact Class A Ratio	Impact Class B Ratio	Impact Class C Ratio
MAR-5/ORRS Mitigation Site			
MAR-5 Restoration Area	1.25:1	0.88:1	0.50:1
ORRS Area	2.75:1	2.60:1	1:1
Queen Creek Mitigation Site			
Queen Creek Enhancement Area	4.70:1	4.20:1	4.20:1
H&E Farm Mitigation Site			
H&E Terrace Reestablishment Area	1.39:1	0.83:1	0.67:1
H&E Wetland Reestablishment Area	0.63:1	0.30:1	0.22:1

4.10. FINAL COMPENSATORY MITIGATION SUMMARY (STEP 10)

In Step 10, the total acres of impacted area by drainage class are applied to the number of mitigation credits provided by mitigation site, based on the final mitigation ratios. **Table 10** summarizes the application of the MRSC-derived mitigation ratios to the mitigation sites in a sequential fashion. The completed MRSC worksheets, showing the steps described above, are provided as **Appendix B**. Mitigation credits were applied to the higher functionally scoring Class A impacts first, then to the lower scoring Class B and Class C. The application of mitigation credit areas began with the MAR-5/ORRS Mitigation Site areas and moved sequentially through the mitigation areas of the Queen Creek Mitigation Site and the H&E Farm Mitigation Site, as needed, until all of the functional impacts for each drainage class were mitigated. Application of the mitigation credits in this fashion was based solely on the order of discussion of the mitigation sites in this document. Actual application of the mitigation

credits in the Final Mitigation Plan may occur in a number of ways. The application of mitigation to impacts in this MRSC document is intended to demonstrate sufficient credit is available to mitigate for unavoidable impacts to waters of the U.S. from development of the Project.

Table 10. Final Mitigation Credits Applied by Impact Drainage Class and Mitigation Site/Area

Impact Drainage Class	Impact Acres	Mitigation Site/Area	Mitigation Acres Available	Mitigation Ratio	Mitigation Acres Used	Mitigation Credits Provided	Remaining Impact Acres
Impact Class A	86.94	MAR-5 Restoration Area	123.00	1.25:1	108.68	86.94	0.00
		ORRS Area	23.00	2.75:1	0.00	0.00	0.00
		Queen Creek Enhancement Area	33.00	4.70:1	0.00	0.00	0.00
		H&E Terrace Reestablishment Area	300.00	1.39:1	0.00	0.00	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00
Impact Class B	39.98	MAR-5 Restoration Area	14.32	1:1	14.32	14.32	25.66
		ORRS Area	23.00	2.60:1	23.00	8.84	16.82
		Queen Creek Enhancement Area	33.00	4.20:1	33.00	7.85	8.97
		H&E Terrace Reestablishment Area	300.00	1:1	8.97	8.97	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00
Impact Class C	45.70	MAR-5 Restoration Area	0.00	1:1	0.00	0.00	0.00
		ORRS Area	0.00	1:1	0.00	0.00	0.00
		Queen Creek Enhancement Area	0.00	4.20:1	0.00	0.00	0.00
		H&E Terrace Reestablishment Area	291.03	1:1	45.70	45.70	0.00
		H&E Wetland Reestablishment Area	15.00	1:1	0.00	0.00	0.00

5. REFERENCES

California Wetlands Monitoring Workgroup (CWMW). 2018. California Rapid Assessment Method (CRAM), Episodic Riverine Field Book, Version 2.0. August 2018.

Lowery, Shawn F., Angela Stingelin, and Charles Hofer. 2016. Conceptual Plan, January 2016, In-Lieu Fee Restoration Project Site Wetland Restoration and Monitoring at the Lower San Pedro River Wildlife Area, Pinal County, Arizona. Phoenix: Arizona Game and Fish Department.

Stacey, Peter B., Allison L. Jones, Jim C. Catlin, Don Duff, Lawrence E. Stevens, and Chad Gourley. 2006. User's Guide for the Rapid Assessment of the Functional Condition of Stream-riparian Ecosystems in the American Southwest. Wild Utah Project.

U.S. Army Corps of Engineers. 2015. Final 2015 Regional Compensatory Mitigation and Monitoring Guidelines. U.S. Army Corps of Engineers - South Pacific Division. January 12, 2015. 70.

_____. 2017. 12501-SPD Regulatory Program Standard Operating Procedure For Determination Of Mitigation Ratios U.S. Army Corps of Engineers - South Pacific Division. January 11, 2017.

U.S. Army Corps of Engineers, and U.S. Environmental Protection Agency. 2008. Compensatory Mitigation for Losses of Aquatic Resources; Final Rule. *Federal Register*. April 10, 2008. 19594-19705.

U.S. Forest Service. 2019. Resolution Copper Project Draft Environmental Impact Statement. U.S. Department of Agriculture.

_____. 2020. Resolution Copper Project Final Environmental Impact Statement. U.S. Department of Agriculture.

WestLand Resources, Inc. 2017. Clean Water Act Section 404 Conceptual Mitigation Plan Lone Star Ore Body Development Project. *Prepared for U.S. Army Corps of Engineers on Behalf of Freeport-McMoRan Safford Inc.* Tucson, Arizona: WestLand Resources, Inc. February 3, 2017.

_____. 2018. Ripsey Wash Tailings Storage Facility Revised Clean Water Act Section 404 Conceptual Mitigation Plan. *Prepared for ASARCO LLC - Ray Operations*. Tucson, Arizona: WestLand Resources, Inc. February 1, 2018.

_____. 2020a. DRAFT Clean Water Act 404(b)(1) Alternatives Analysis. *Prepared for U.S. Army Corps of Engineers on behalf of Resolution Copper*. Tucson, Arizona: WestLand Resources, Inc. July 2020.

_____. 2020b. DRAFT Clean Water Act Section 404 Conceptual Mitigation Plan: Resolution Copper Project. *Prepared for U.S. Army Corps of Engineers on behalf of Resolution Copper*. Tucson, Arizona: WestLand Resources, Inc. July 2020.

FIGURES

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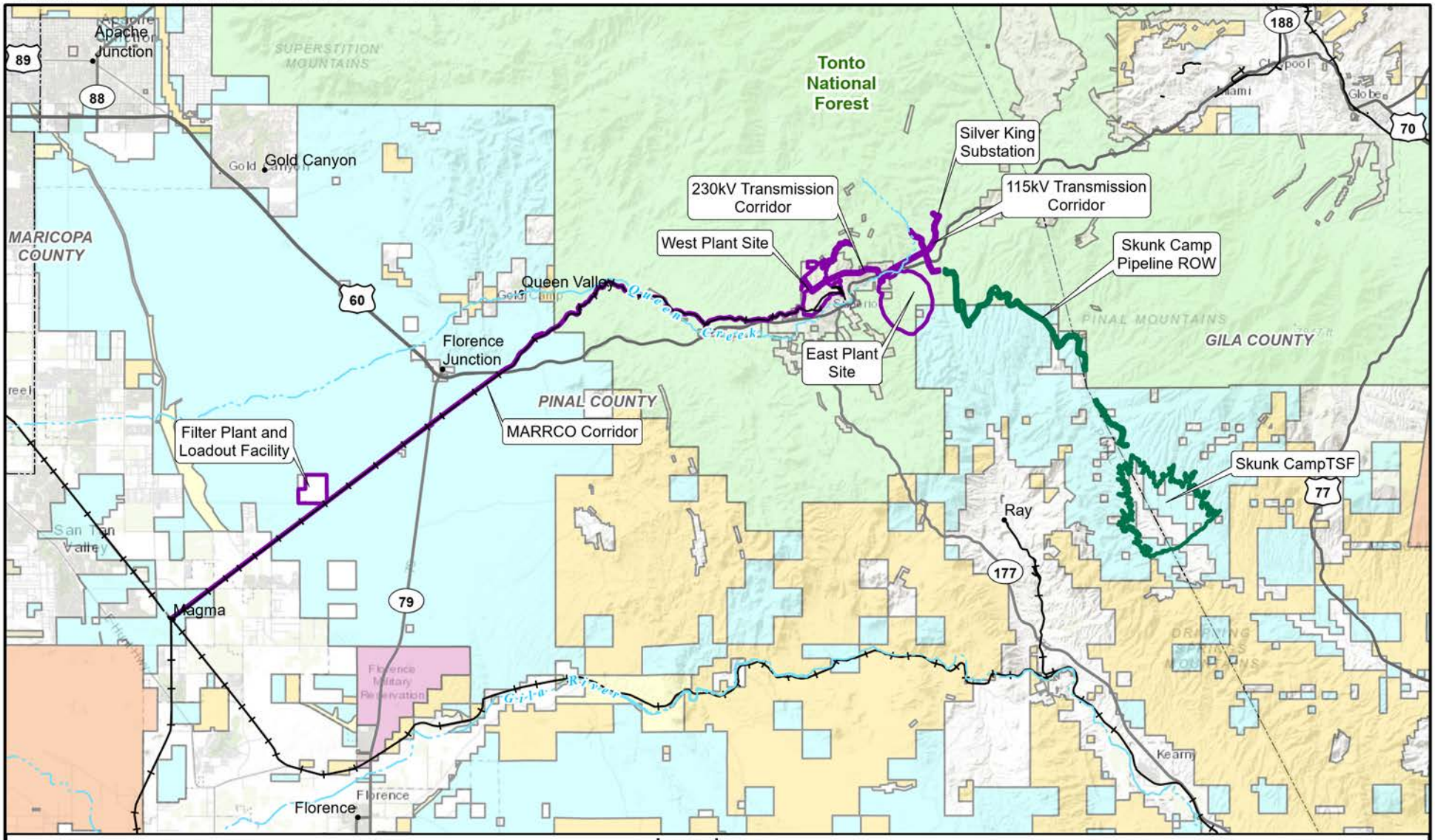


Legend

Pinal and Gila Counties, Arizona,
Data Source: BLM 2019, WRI Modified 2019, ALRIS, SWCA, and USFS
Image Source: ArcGIS Online, World Topo Map

N
0 2.5 5 Miles
0 4 8 Kilometers

WestLand Resources

- Skunk Camp TSF Alternative
- GPO Mine Element

Surface Management

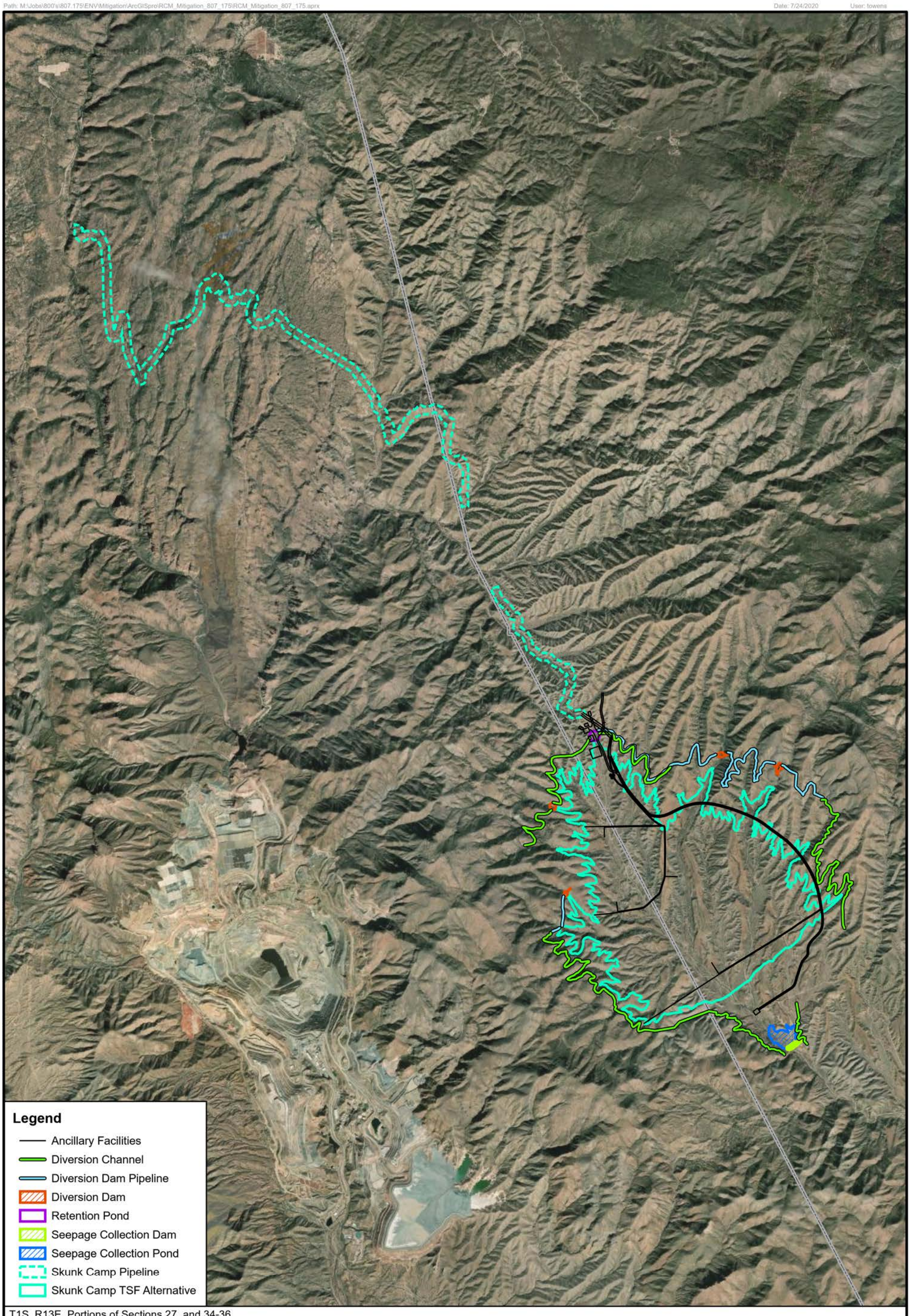
- Bureau of Land Management (BLM)
- Bureau of Reclamation
- County
- Indian Lands
- Local or State Parks
- Military
- Other
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

OVERVIEW OF PROPOSED MINING OPERATION

Figure 1



T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF ALTERNATIVE
AERIAL OVERVIEW

Figure 2

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

N

0 3,000 6,000 Feet

0 1,500 3,000 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF ALTERNATIVE
IMPACTS TO THE AQUATIC ECOSYSTEM

Figure 3

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Diversion Channel
- Diversion Dam Pipeline
- Diversion Dam
- Retention Pond
- Seepage Collection Dam
- Seepage Collection Pond
- Skunk Camp Direct OHWM Impact
- Skunk Camp Indirect OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land

N

0 1,500 3,000 Feet

0 750 1,500 Meters

WestLand Resources

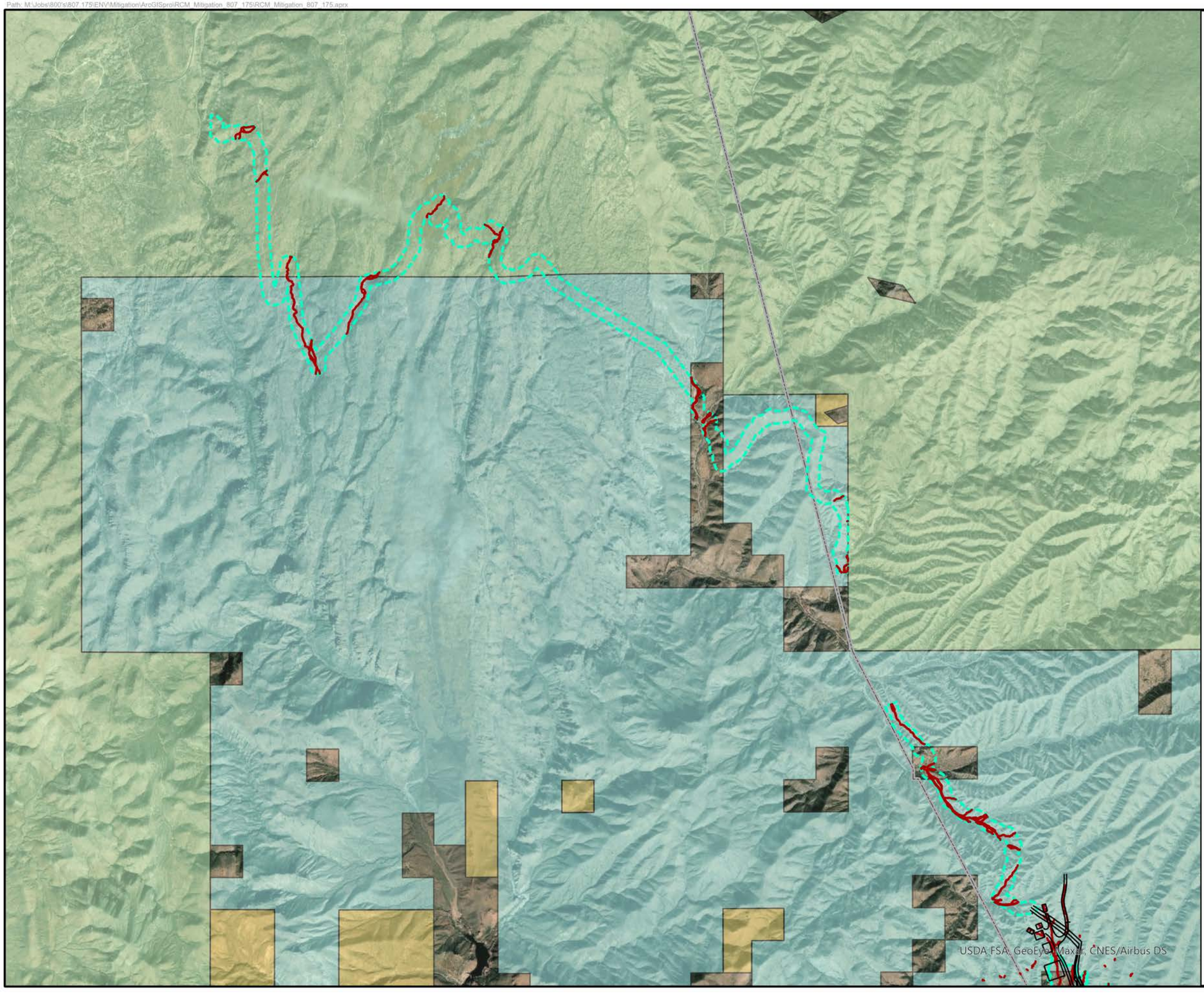
USDA FSA, GeoEye, Maxar, CNES/Airbus DS

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF DIRECT AND INDIRECT IMPACTS

Figure 4



Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018
Surface Management: BLM 2019, WRI Modified 2019

Legend

- Ancillary Facilities
- Skunk Camp Direct OHWM Impact
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Surface Management

- Bureau of Land Management (BLM)
- Private Land (No Color)
- State Trust Land
- US Forest Service (USFS)

Note: Most OHWM impacts in the pipeline corridor are temporary and this analysis conservatively assumes all OHWM will be impacted.

N

0 2,000 4,000 Feet

0 1,000 2,000 Meters

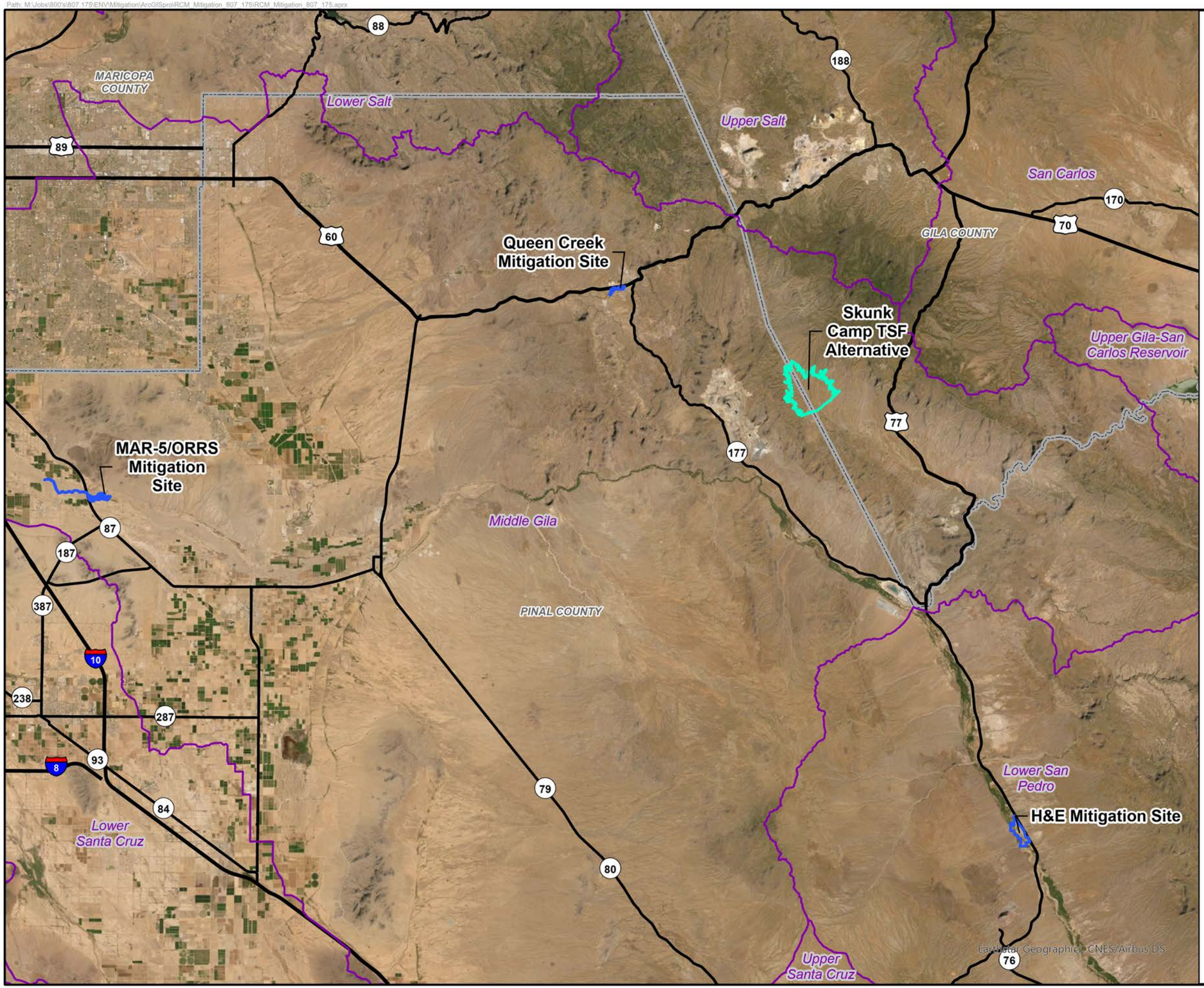
WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF PIPELINE DIRECT IMPACTS

Figure 5



Portions of T2S R12-14E, T4S R6-7E, T6S R20E, T7S R16E, and T8S R16E,
Pinal, Graham, and Gila Counties, Arizona,
Image Source: Maxar 2018

Legend

- Mitigation Boundaries
- Skunk Camp TSF Alternative
- USGS HUC 8

N

0 4 8 Miles

0 8 16 Kilometers

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

MITIGATION SITES AERIAL OVERVIEW

Figure 6

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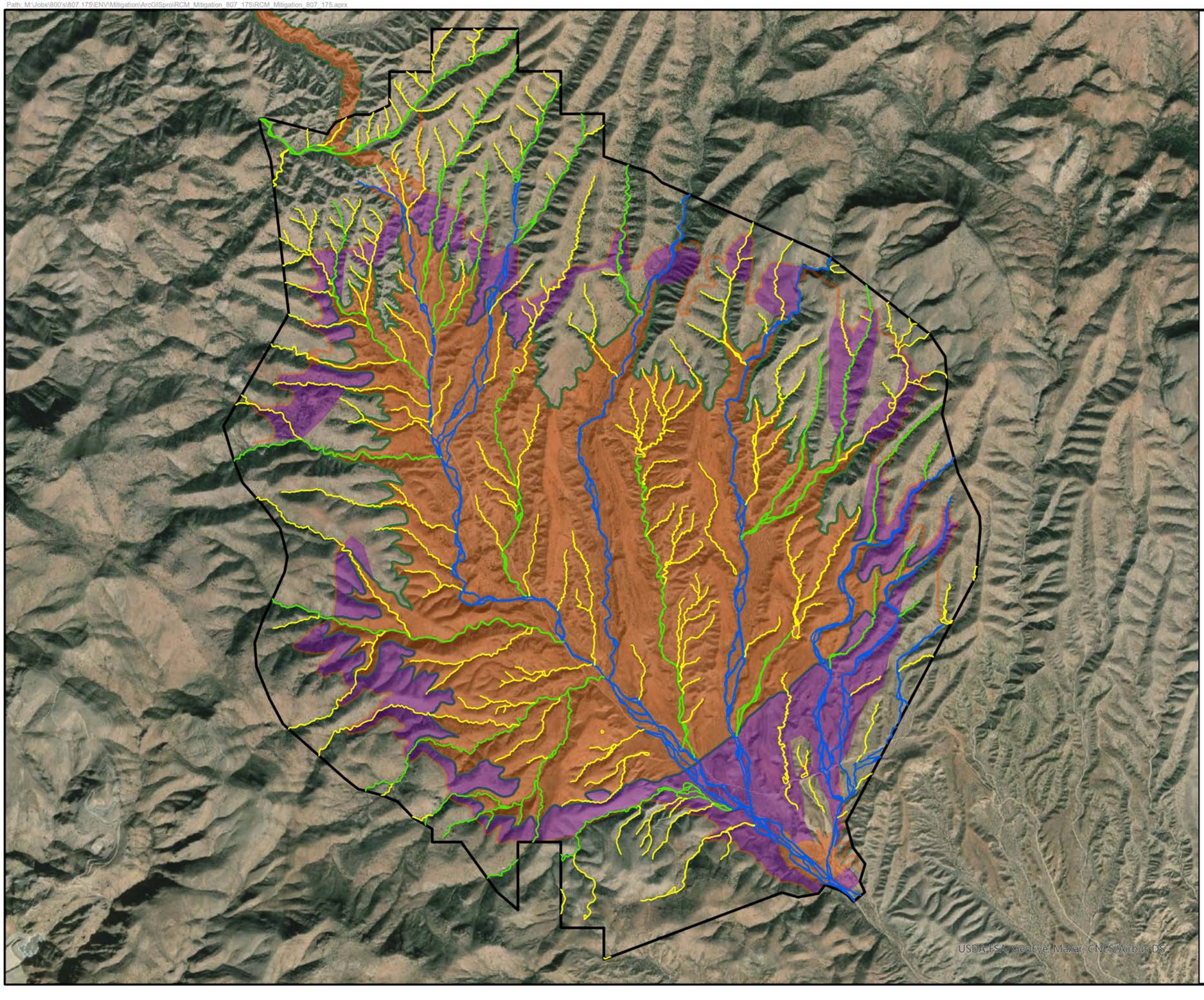

Skunk Camp Pipeline and TSF within:
T1S, R13E, Portions of Sections 27, and 34-36,
T2S, R13E, Portions of Sections 1-4, and 12,
T2S, R14E, Portions of Sections 7, 8, 17, 18, 20, 27-29, and 32-36,
T3S, R14E, Portions of Sections 1-5, 8-17, and 21-24,
Pinal and Gila Counties, Arizona
Image Source: Maxar 2/6/2018

Legend

- Skunk Camp Analysis Area
- Skunk Camp Direct Impact Area
- Skunk Camp Indirect Impact Area
- Skunk Camp Pipeline
- Skunk Camp TSF Alternative

Skunk Camp OHWM Drainage Class

- Class A
- Class B
- Class C

N

0 1,500 3,000 Feet

0 750 1,500 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

SKUNK CAMP TSF IMPACT DRAINAGE CLASSES

Figure 7

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T4S, R6E, Portions of Sections 8-14,
Pinal County, Arizona,
Image Source: Maxar 6/19/2018

WestLand Resources

N

0 750 1,500 Feet

0 250 500 Meters

Legend

- MAR-5/ORRS Mitigation Site
- MAR-5 Restoration Area
- ORRS Area

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

MAR-5/ORRS MITIGATION SITE

Figure 8

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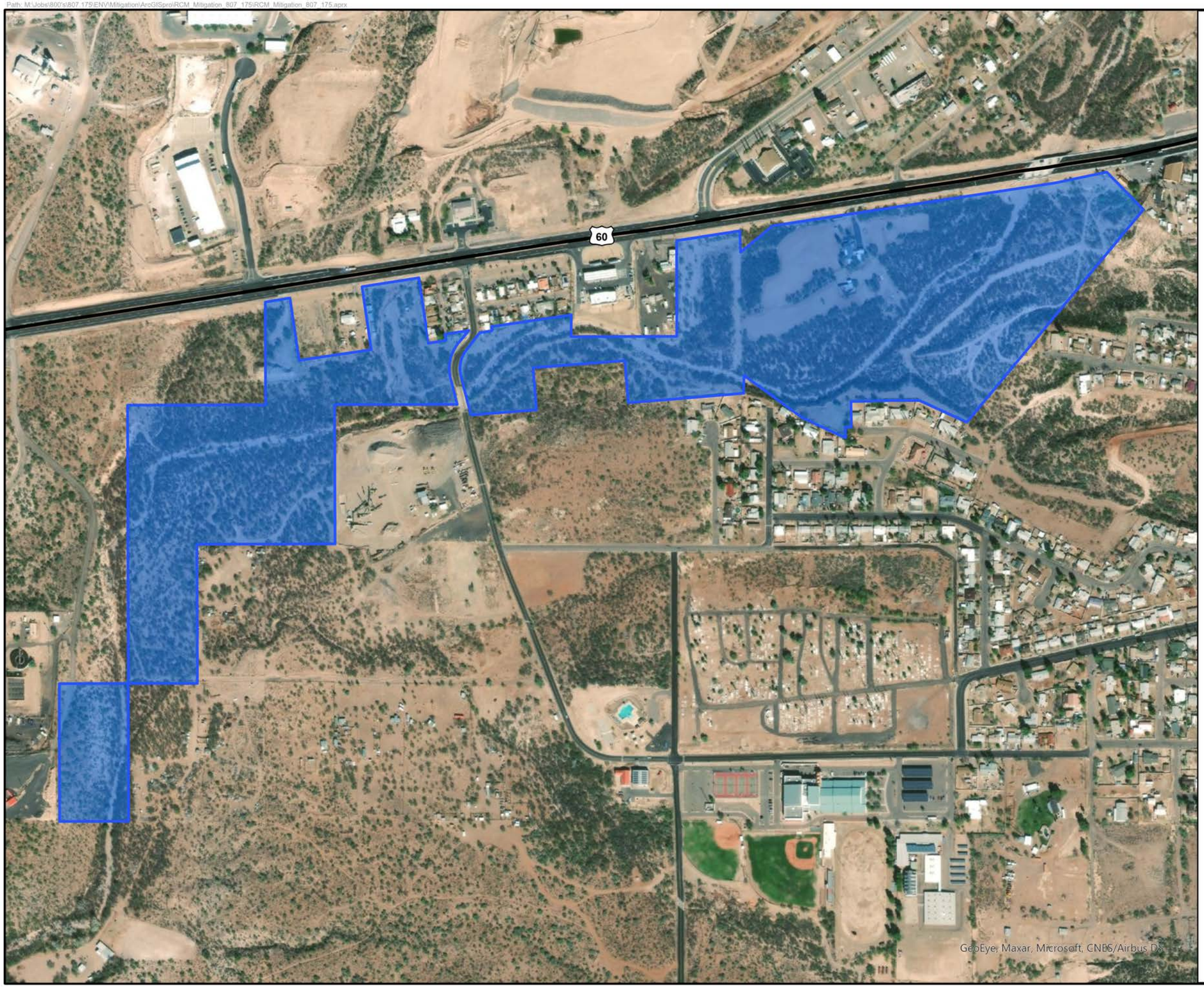

T2S, R12E, Portions of Sections 3 and 4,
Pinal County, Arizona,
Image Source: Maxar 2/6/2018

Legend

- Queen Creek Enhancement Area
- Queen Creek Mitigation Site

N

0 250 500 Feet

0 100 200 Meters

WestLand Resources

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

QUEEN CREEK MITIGATION SITE

Figure 9

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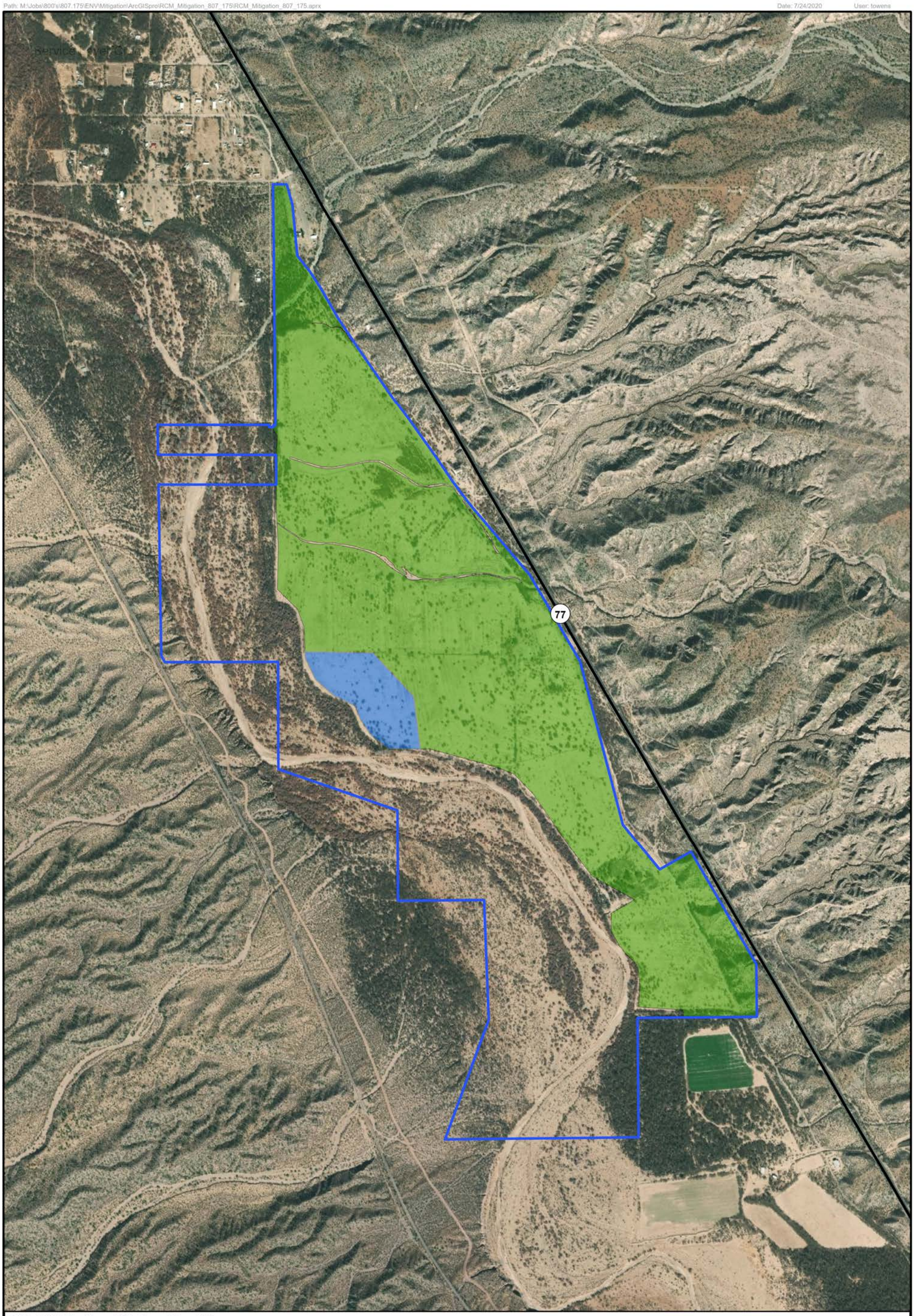

T7S, R16E, Portions of Sections 35 and 36,
T8S, R16E, Portion of Section 1,
Pinal County, Arizona,
Image Source: Maxar 1/31/2018

WestLand Resources

N

0 500 1,000 Feet

0 250 500 Meters

Legend

- H&E Farm Mitigation Site
- H&E Terrace Reestablishment Area
- H&E Wetland Reestablishment Area

RESOLUTION COPPER PROJECT

Mitigation Ratio-Setting Checklist

H&E FARM MITIGATION SITE

Figure 10

APPENDIX A

Functional Scoring Summaries

IMPACT CLASS A

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	5 High	Class A features consist of low-gradient, braided, lower-watershed ephemeral channels. The channels lack major impediments to flow and are capable of transporting moderate high volumes of water, though transport capacity is dependent on rainfall.
Subsurface Flow/Groundwater Recharge	4 Moderate-High	Water flow through the loose alluvial soils in Class A channels provides some subsurface flow and potential to replenish groundwater aquifers, with subsurface flows strongly dependent on precipitation events. Limited xeroriparian vegetation indicates that temporary lateral subsurface flow potential may exist.
Energy Dissipation	5 High	Class A features exhibit braided channels, channel sinuosity, low-gradient, a well-developed floodplain, and loose alluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features.
Sediment Transport/Regulation	5 High	Class A features have braided channels with well-sorted bed material and primarily unrestricted floodplains and can retain and deposit large amounts of sediment during precipitation events. Lack of dense riparian habitat may limit the ability of these features to regulate excessive sediment loads.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	4 Moderate-High	Class A features have broad channels with loose alluvium and have the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. These systems are ephemeral and are generally vegetated only with xeroriparian and upland species, which may limit nutrient cycling ability.
Organic Carbon Export/Sequestration	4 Moderate-High	Class A features have the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The features, along with upstream and downstream adjacent waters, are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. These features also lack a significant amount of in-channel vegetation and a dense riparian buffer, which limits the ability of the system to generate or export high amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	1 Low	Class A features do not exhibit permanent or intermittent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0 None	Class A features do not contain any permanent or intermittent waters. Flow events within these ephemeral systems will not result in the presence of fish species.

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	4 Moderate-High	Class A features generally do not support riparian-obligate vegetation. Xeroriparian vegetation is common and widespread along the banks and floodplain terraces of these features. Vegetated area supports 2 or more plant layers, and these features have a "high" to "moderate" degree of horizontal vegetation interspersion.
Age Class Distribution of Woody Riparian or Wetland Vegetation	4 Moderate-High	In Class A features, wetland vegetation is generally absent. Xeroriparian and upland vegetation is common and widespread. Woody trees and shrubs from a range of age classes are present.
Native/Non-native Vegetation Species	5 High	The vegetation communities in Class A features are mostly native. Vegetation sampling indicates an average of less than 15% invasion by non-native species.

IMPACT CLASS B

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	4 Moderate-High	Class B features consist of ephemeral, typically moderate- to high-gradient single-thread upper watershed channels. The channels lack major impediments to flow and are capable of transporting moderate low to moderate volumes of water, though transport capacity is dependent on rainfall.
Subsurface Flow/Groundwater Recharge	3 Moderate	Water flow through the Class B channels provides limited amount of subsurface flow and potential to replenish groundwater aquifers, with subsurface flows strongly dependent on precipitation events. Infiltration limited by impervious layers at shallow depths. Limited xeroriparian vegetation indicates that temporary lateral subsurface flow potential may exist.
Energy Dissipation	3 Moderate	Class B features typically contain single-thread channels and are moderate to high gradient. Energy dissipation through infiltration limited by lack of in-channel sediments and impervious layers at shallow depths. Energy dissipation occurs through natural physical control features such as cut banks, channel sinuosity, boulder steps, and/or flood debris.
Sediment Transport/Regulation	3 Moderate	Class B features have well or poorly-sorted bed material and can retain and deposit a moderate amount of sediment during precipitation events. Confined floodplains may limit the extent of sediment regulation in these features.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	3 Moderate	Class B features have a limited capacity to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. These systems are ephemeral and are generally vegetated with a narrow band of xeroriparian vegetation, which may limit nutrient cycling ability.
Organic Carbon Export/Sequestration	2 Low-Moderate	Class B features have limited potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The features, along with upstream and downstream adjacent waters, are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. These features lack a dense riparian buffer and may have shallow depths to bedrock, which limits the ability of these features to generate or export high amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	1 Low	Class B features do not exhibit permanent or intermittent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0 None	Class B features do not contain any permanent or intermittent waters. Flow events within these ephemeral systems will not result in the presence of fish species.

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	3 Moderate	Class B features generally do not support riparian-obligate vegetation. Xeroriparian vegetation is present but limited along the banks of these features. Vegetated area supports 2 or more plant layers, and these features have a "high" to "moderate" degree of horizontal vegetation interspersion.
Age Class Distribution of Woody Riparian or Wetland Vegetation	3 Moderate	In Class B features, wetland vegetation is generally absent. Xeroriparian and upland vegetation is common but limited along the bed and banks. Woody trees and shrubs from a range of age classes are present.
Native/Non-native Vegetation Species	5 High	The vegetation communities in Class B features are mostly native. Vegetation sampling indicates an average of less than 15% invasion by non-native species.

IMPACT CLASS C

Function	Score	Explanation
Hydrologic Functions		
Hydrologic Connectivity	2 Low-Moderate	Class C features consist of ephemeral, moderate- to high-gradient single-thread headwater channels. The channels lack major impediments to flow and are capable of transporting moderate low volumes of water, and only in response to heavy precipitation events.
Subsurface Flow/Groundwater Recharge	2 Low-Moderate	Water flow through the Class C channels provides very small amount of subsurface flow, if any, with very limited potential to replenish groundwater aquifers. Infiltration limited by impervious layers at shallow depths and shallow depth to bedrock. Narrow bands of xeroriparian vegetation indicate that temporary lateral subsurface flow potential may exist.
Energy Dissipation	2 Low-Moderate	Class C features contain single-thread channels and are moderate to high gradient. Energy dissipation through infiltration limited by lack of in-channel sediments and impervious layers at shallow depths. Energy dissipation occurs through natural physical control features such as cut banks, channel sinuosity, boulder steps, and/or flood debris.
Sediment Transport/Regulation	2 Low-Moderate	Class C features have well or poorly-sorted bed material and deposit only small amounts of sediment during precipitation events. Confined floodplains typically limit the extent of sediment deposition and transport in these features.
Chemical Functions		
Elements, Compounds, and Particulate Cycling	2 Low-Moderate	Class C features have shallow depths to bedrock and thus have a very limited capacity to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. These systems are ephemeral and are generally vegetated with a narrow band of xeroriparian vegetation, which may further limit nutrient cycling ability.
Organic Carbon Export/Sequestration	1 Low	Class C features have limited potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The features, along with upstream and downstream adjacent waters, are ephemeral, limiting both the amount and timing of carbon sequestration and export through the system. These features have confined floodplains, shallow depths to bedrock, and narrow xeroriparian buffers, which limit the ability of these features to generate or export high amounts of organic carbon.
Biotic Functions		
Aquatic Invertebrate Fauna	1 Low	Class C features do not exhibit permanent or intermittent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0 None	Class C features do not contain any permanent or intermittent waters. Flow events within these ephemeral systems will not result in the presence of fish species.

Function	Score	Explanation
Riparian/Wetland Vegetation Structure	3 Moderate	Class C features do not support riparian-obligate vegetation. Xeroriparian vegetation is present in but limited narrow bands along the banks of these features. Vegetated area supports 2 or more plant layers, and these features have a "high" to "moderate" degree of horizontal vegetation interspersion.
Age Class Distribution of Woody Riparian or Wetland Vegetation	3 Moderate	In Class C features, wetland vegetation is absent. Xeroriparian and upland vegetation is common but limited along the bed and banks. Woody trees and shrubs from a range of age classes are present.
Native/Non-native Vegetation Species	5 High	The vegetation communities in Class C features are mostly native. Vegetation sampling indicates an average of less than 15% invasion by non-native species.

MAR-5 RESTORATION AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	4 Moderate-High	4 Moderate-High	This mitigation site includes the Gila River mainstem, a large, multi-threaded, low-gradient channel. The channel lacks major impediments to flow and is capable of transporting moderate to high volumes of water. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Subsurface Flow/Groundwater Recharge	2 Low-Moderate	5 High	The Gila River mainstem possess deep alluvial deposits, but depth to groundwater can also be considerable. Subsurface flow is present. Dense riparian vegetation indicates lateral flow high, but dependent on discharge. The intent of the pilot project and continued discharge of the CAP allotment is groundwater recharge and storage.
Energy Dissipation	2 Low-Moderate	4 Moderate-High	The Gila River mainstem channel has some sinuosity, is low-gradient, and possesses alluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features. The river has a well-developed floodplain. Dense riparian vegetation provides increased overland roughness, but this vegetation is limited to the wetted area. Prior to the discharge of CAP water for mitigation, vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Sediment Transport/Regulation	2 Low-Moderate	4 Moderate-High	The Gila River mainstem has braided channels with well-sorted bed material and primarily unrestricted floodplains. It can retain and deposit large amounts of sediment during precipitation events. The dense riparian habitat enhances the ability of this area to regulate excessive sediment loads, but this vegetation is limited to the wetted area. Prior to the discharge of CAP water for mitigation, vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	2 Low-Moderate	4 Moderate-High	The Gila River's broad alluvial channel has the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Dense riparian habitat enhances nutrient cycling ability. This site also possesses a hyporheic zone when saturated, but this zone is limited to the wetted area. Prior to the discharge of CAP water for mitigation, the site lacked both the dense riparian vegetation and the hyporheic zone.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Organic Carbon Export/Sequestration	2 Low-Moderate	4 Moderate-High	The Gila River mainstem has the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The upstream adjacent reaches are ephemeral limiting both the amount and timing of carbon sequestration and export through the system. The Gila River mainstem has a significant amount of in-channel vegetation and a dense riparian buffer, which increases the ability of the system to generate or export high amounts of organic carbon, but this vegetation is limited to the wetted area. Prior to the discharge of CAP water for mitigation, vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	3 Moderate	The wetted area creates intermittent flows. Irruptive aquatic insects are present and provide a prey community for aquatic-feeding species. Adjacent riparian vegetation provides additional opportunities for enhancement of invertebrate fauna community. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Presence of Fish and Fish Habitat Structure	0 None	2 Low-Moderate	The Gila River possesses some diversity of structure in terms of potential fish habitat. Fish may be present during flow events in this system. Prior to the discharge of CAP water for mitigation, intermittent flows were not present.
Riparian/Wetland Vegetation Structure	2 Low-Moderate	4 Moderate-High	This area supports riparian-obligate vegetation and dense riparian vegetation is common and widespread. The vegetated area supports 1 or more plant layers but is anticipated to develop additional layers from mitigation. Currently the vegetated areas have a "low" degree of horizontal vegetation interspersion but are anticipated to be "high" to "moderate" at completion of mitigation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.
Age Class Distribution of Woody Riparian or Wetland Vegetation	2 Low-Moderate	4 Moderate-High	Wetland vegetation is generally absent in this area. Dense riparian vegetation has become common and widespread. Woody trees and shrubs have developed from the discharge of water and all age classes will be present with continued mitigation. Prior to the discharge of CAP water for mitigation vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Native/Non-native Vegetation Species	1 Low	4 Moderate-High	The vegetation community in this area is a mix of native and non-native species. Exotic removal and control is anticipated to be successful, providing a higher proportion of native to non-native vegetation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited to a sparse collection of upland woody shrubs, desert forbs, and tamarisk.

ORRS AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	4 Moderate-High	4 Moderate-High	This mitigation site includes the Gila River mainstem, a large, multi-threaded, low-gradient channel. The channel lacks major impediments to flow and is capable of transporting high volumes of water. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Subsurface Flow/Groundwater Recharge	2 Low-Moderate	2 Low-Moderate	The Gila River mainstem possess deep alluvial deposits, but depth to groundwater can also be considerable. Subsurface flow is present but may become perched under certain conditions. Dense riparian vegetation indicates lateral flow high, but dependent on discharge. The intent of the pilot project and continued discharge of the CAP allotment is groundwater recharge and storage.
Energy Dissipation	2 Low-Moderate	4 Moderate-High	The Gila River mainstem channel has some sinuosity, is low-gradient, and possesses alluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features. The river has a well-developed floodplain. Dense riparian vegetation provides increased overland roughness throughout site. Groundwater recharge and storage at MAR-5 increase the function of this vegetation community and restoration of the native vegetation character will provide additional lift for this function.
Sediment Transport/Regulation	2 Low-Moderate	4 Moderate-High	The Gila River mainstem has braided channels with well-sorted bed material and primarily unrestricted floodplains. It can retain and deposit large amounts of sediment during precipitation events. The dense riparian habitat enhances the ability of this area to regulate excessive sediment loads. Groundwater recharge and storage at MAR-5 increase the function of this vegetation community and restoration of the native vegetation character will provide additional lift for this function.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	2 Low-Moderate	3 Moderate	The Gila River's broad alluvial channel has the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Dense riparian habitat enhances nutrient cycling ability. Groundwater recharge and restoration of the native vegetation character will provide lift for this function.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Organic Carbon Export/Sequestration	2 Low-Moderate	3 Moderate	The Gila River mainstem has the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The upstream adjacent reaches are ephemeral limiting both the amount and timing of carbon sequestration and export through the system. The Gila River mainstem has a significant amount of in-channel vegetation and a dense riparian buffer, which increases the ability of the system to generate or export high amounts of organic carbon. Groundwater recharge and storage at MAR-5 increase the function of this vegetation community and restoration of the native vegetation character will provide additional lift for this function.
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	4 Moderate-High	Irruptive aquatic insects are present and provide a prey community for aquatic-feeding species. Adjacent riparian vegetation provides additional opportunities for enhancement of invertebrate fauna community. Prior to the discharge of CAP water for mitigation, intermittent flows were not present.
Presence of Fish and Fish Habitat Structure	0 None	2 Low-Moderate	The Gila River possesses some diversity of structure in terms of potential fish habitat. Fish may be present during flow events in this system. Prior to the discharge of CAP water for mitigation, intermittent flows were not present.
Riparian/Wetland Vegetation Structure	2 Low-Moderate	3 Moderate	This area supports riparian-obligate vegetation and dense riparian vegetation is common and widespread. The vegetated area supports 1 or more plant layers but is anticipated to develop additional layers from mitigation. Currently the vegetated areas have a "low" degree of horizontal vegetation interspersion but are anticipated to be "high" to "moderate" at completion of mitigation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited mainly to non-native tamarisk.
Age Class Distribution of Woody Riparian or Wetland Vegetation	2 Low-Moderate	3 Moderate	Wetland vegetation is generally absent in this area. Dense riparian vegetation has become common and widespread. Woody trees and shrubs have developed from the discharge of water and all age classes will be present with continued mitigation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited mainly to non-native tamarisk.
Native/Non-native Vegetation Species	1 Low	4 Moderate-High	The vegetation community includes an abundance of non-native species. Exotic removal and control is anticipated to be successful, providing a higher proportion of native to non-native vegetation. Prior to the discharge of CAP water for mitigation, intermittent flows were not present, and vegetation was limited mainly to non-native tamarisk.

QUEEN CREEK ENHANCEMENT AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	5 High	5 High	This mitigation site includes the Queen Creek mainstem, a medium to large, well-defined, single to multi-threaded, low-gradient drainage channel. The channel lacks major impediments to flow and is capable of transporting high volumes of water. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Subsurface Flow/Groundwater Recharge	4 Moderate-High	4 Moderate-High	The Queen Creek mainstem has quaternary alluvial and colluvial deposits, as well as relatively shallow (20 to 75 ft bgs) depth to groundwater. There is potential for subsurface flow and potential to replenish groundwater aquifers. Dense vegetation indicates lateral flow exists, but dependent on discharge. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Energy Dissipation	5 High	5 High	The Queen Creek mainstem channel has sinuosity, is low-gradient, and possess alluvium/colluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features. Dense riparian vegetation provides increased overland roughness. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Sediment Transport/Regulation	5 High	5 High	The Queen Creek mainstem has braided channels with well-sorted bed material and can retain and deposit of sediment during precipitation events. The dense riparian habitat enhances the ability of this area to regulate excessive sediment loads. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	3 Moderate	4 Moderate-High	The Queen Creek mainstem has the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Dense riparian habitat enhances nutrient cycling ability. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Organic Carbon Export/Sequestration	4 Moderate-High	4 Moderate-High	The Queen Creek mainstem has the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The upstream adjacent reaches are ephemeral limiting both the amount and timing of carbon sequestration and export through the system. The Queen Creek mainstem has a dense riparian buffer, which increases the ability of the system to generate or export high amounts of organic carbon, this is also constrained by the narrow floodplain. No lift from the current state for this function was anticipated as a result of the mitigation actions.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	2 Low-Moderate	The Queen Creek mainstem does not exhibit permanent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species. A minor lift from the removal of anthropogenic disturbances is anticipated.
Presence of Fish and Fish Habitat Structure	0 None	0 None	The Queen Creek mainstem does not contain any permanent or intermittent waters. Flow events within this ephemeral system will not result in the presence of fish species. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Riparian/Wetland Vegetation Structure	3 Moderate	4 Moderate-High	Dense xeroriparian vegetation is common and widespread. The vegetated area supports 2 or more plant layers and is anticipated to develop additional layers from mitigation. Currently the vegetated areas have a "high" to "moderate" degree of horizontal vegetation interspersion. A minor lift in function from the removal of anthropogenic disturbances and development of additional vegetation structure is anticipated.
Age Class Distribution of Woody Riparian or Wetland Vegetation	4 Moderate-High	4 Moderate-High	Wetland vegetation is generally absent in this area. Dense xeroriparian vegetation is common and widespread. Woody trees and shrubs from a range of age classes are present. Mitigation actions will have limited effect on this distribution.
Native/Non-native Vegetation Species	4 Moderate-High	5 High	The vegetation community in this feature is mostly native with some limited exotics. Exotic removal and control is anticipated to be successful, providing a higher proportion of native to non-native vegetation.

H&E TERRACE REESTABLISHMENT AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	1 Low	4 Moderate-High	This mitigation area is located between the uplands and the San Pedro River and proposes the reestablishment of low-gradient, single channel, lower-watershed ephemeral channels and alluvial fans. The area currently consists entirely of farm fields that have removed the natural connection between the uplands and the river. This mitigation will restore connectivity of the river floodplain between uplands and San Pedro River mainstem. This area will lack major impediments to flow. This area will be capable of transporting moderate to high volumes of water, though transport capacity is dependent on rainfall.
Subsurface Flow/Groundwater Recharge	1 Low	3 Moderate	The compacted soils of these agricultural fields prevent normal subsurface flow, as evidenced by sinkholes in field structure. Mitigation will help increase infiltration but not completely alleviate post-agriculture conditions. There is currently little lateral flow, but mitigation will slow flows and increase infiltration.
Energy Dissipation	1 Low	3 Moderate	The compacted soils of these agricultural fields impede normal energy dissipation for this landform. Mitigation will help increase energy dissipation but not completely alleviate post-agriculture conditions. New channels, alluvial fans, and riparian vegetation will provide increased overland roughness and energy dissipation.
Sediment Transport/Regulation	1 Low	4 Moderate-High	The compacted soils of these agricultural fields interfere with normal sediment transport/regulation for this landform. Mitigation will help increase this function over much of the area. New channels, alluvial fans, and riparian vegetation will provide increased sediment transport/regulation.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	1 Low	4 Moderate-High	The compacted soils of these agricultural fields have a limited capacity to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Mitigation will help increase this function over much of the area.
Organic Carbon Export/Sequestration	1 Low	3 Moderate	The compacted soils of these agricultural fields have a limited capacity to store organic matter in subsurface soils and provide downstream pulses during flow events. Mitigation will help increase this function, but not completely alleviate post-agriculture conditions. Development of a significant amount of dense riparian vegetation will increase the ability of the system to generate or export high amounts of organic carbon.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	2 Low-Moderate	This area does not exhibit permanent or intermittent flows. Irruptive aquatic insects may be present in small pools or water collection areas that occur during significant precipitation events, but these temporary populations are not indicative of a stable prey community for aquatic-feeding species.
Presence of Fish and Fish Habitat Structure	0 None	0 None	This area does not contain any permanent or intermittent waters. Flow events within these ephemeral systems will not result in the presence of fish species. No lift from the current state for this function was anticipated as a result of the mitigation actions.
Riparian/Wetland Vegetation Structure	1 Low	2 Low-Moderate	Vegetation in the former fields is sparse and uncommon. This area generally will not support riparian-obligate vegetation, but dense xeroriparian vegetation will become common and widespread with mitigation. Vegetated area generally supports 1 plant layer, where present, but will be anticipated to develop additional layers. Currently the vegetated areas have a "low" degree of horizontal vegetation interspersion but are anticipated to be "moderate" at completion of mitigation.
Age Class Distribution of Woody Riparian or Wetland Vegetation	1 Low	3 Moderate	Vegetation in the former fields is sparse and uncommon. Wetland vegetation is generally absent in this area. Riparian vegetation will become common and widespread. Woody trees and shrubs will develop from the mitigation actions and all age classes will be present with continued mitigation.
Native/Non-native Vegetation Species	1 Low	4 Moderate-High	Vegetation in the former fields is sparse and uncommon. The vegetation community in this area is anticipated to be mostly native, with limited opportunity for exotics. Exotic removal and control during mitigation implementation is anticipated to be very successful, providing a higher proportion of native to non-native vegetation.

H&E WETLAND REESTABLISHMENT AREA

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Hydrologic Functions			
Hydrologic Connectivity	1 Low	5 High	This mitigation site includes an area of historic agricultural fields immediately adjacent to existing wetlands in the San Pedro River channel, a large, well-defined, multi-threaded, low-gradient channel. The channel lacks major impediments to flow and is capable of transporting high volumes of water. The mitigation site currently consists entirely of farm fields that have removed the natural connection between the uplands and the river.
Subsurface Flow/Groundwater Recharge	1 Low	4 Moderate-High	The adjacent San Pedro River mainstem possesses quaternary alluvial and surficial deposits, has relatively shallow (20 to 50 ft bgs) depth to groundwater, and the existing wetland characteristics show subsurface flow and potential to replenish groundwater aquifers. Mitigation will increase area with these favorable conditions. The compacted soils of these agricultural fields prevent normal subsurface flow, as evidenced by sinkholes in field structure. Dense riparian vegetation indicates lateral flow is present.
Energy Dissipation	1 Low	3 Moderate	The San Pedro River mainstem channel has some sinuosity, is low-gradient, and possesses alluvium capable of reducing flow intensities through evaporation, channel infiltration, and natural physical control features. The river has a well-developed floodplain. Restoring this area to the floodplain would enhance these functions in the new area. The compacted soils of the agricultural fields impede normal energy dissipation for this landform. Riparian vegetation provides increased overland roughness.
Sediment Transport/Regulation	1 Low	4 Moderate-High	Braided channels with well-sorted bed material and primarily unrestricted floodplains can retain and deposit large amounts of sediment during precipitation events. Restoring this area to the floodplain would enhance these functions in the new area. The compacted soils of these agricultural fields interfere with normal sediment transport/regulation for this landform. The riparian habitat will enhance the ability of this area to regulate excessive sediment loads.
Chemical Functions			
Elements, Compounds, and Particulate Cycling	1 Low	4 Moderate-High	The compacted soils of these agricultural fields have a limited capacity to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Broad alluvial channels have the potential to store and mix nutrients and particles in subsurface soils and provide downstream pulses during flow events. Riparian habitat enhances nutrient cycling ability. This site may possess a hyporheic zone when saturated.

Function	Baseline Functional Score	Post-Mitigation Functional Score	Explanation
Organic Carbon Export/Sequestration	1 Low	4 Moderate-High	The San Pedro River mainstem has the potential to store organic matter in subsurface soils and provide downstream pulses during flow events. The upstream adjacent reaches are ephemeral limiting both the amount and timing of carbon sequestration and export through the system. The compacted soils of the agricultural fields have a limited capacity to store organic matter in subsurface soils and provide downstream pulses during flow events. Restoring this area to the floodplain would enhance these functions in the new area. The San Pedro River mainstem has a significant amount of in-channel vegetation and some riparian buffer, which increases the ability of the system to generate or export high amounts of organic carbon, but this vegetation is limited to the wetted area.
Biotic Functions			
Aquatic Invertebrate Fauna	1 Low	4 Moderate-High	This area does not currently exhibit permanent or intermittent flows and was given over to agriculture. The adjacent wetland areas support irruptive aquatic insects and provides some prey community for aquatic-feeding species. Enhancement of riparian vegetation provides additional opportunities for enhancement of invertebrate fauna community.
Presence of Fish and Fish Habitat Structure	0 None	1 Low	This area does not currently exhibit permanent or intermittent flows and was given over to agriculture. The San Pedro River possesses diversity of structure in terms of potential fish habitat. Fish may be present during flow events in this system once mitigation is complete, but the wetland area will remain off-channel.
Riparian/Wetland Vegetation Structure	1 Low	4 Moderate-High	Vegetation in the former fields is sparse and uncommon. The adjacent wetlands area support wetland and riparian-obligate vegetation. Riparian vegetation is common and widespread and widespread but will only be dense along wetland margins. The vegetated area supports 2 or more plant layers but is anticipated to develop additional layers from mitigation. The vegetated areas are anticipated to have a "moderate" degree of horizontal vegetation interspersion at completion of mitigation.
Age Class Distribution of Woody Riparian or Wetland Vegetation	1 Low	4 Moderate-High	Vegetation in the former fields is sparse and uncommon. Wetland vegetation is present in the adjacent wetlands. generally absent in this area. Riparian vegetation is common and widespread but will only along wetland margins. Woody trees and shrubs from a range of age classes are present. Mitigation actions will increase the area exhibiting these conditions.
Native/Non-native Vegetation Species	1 Low	4 Moderate-High	Vegetation in the former fields is sparse and uncommon. The vegetation community in this area is a mix of native and non-native species. Exotic removal and control is anticipated to be successful, providing a higher proportion of native to non-native vegetation.

APPENDIX B

MRSC
Worksheets

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet)

1	9/15/2020	Corps File No.: SPL-2016-00547		Project Manager:MWL									
	Impact Site Name:	Class A	ORM Resource	River/Stream			Hydrology: Ephemeral						
	Impact Cowardin or HGM type:	Riverine	Impact area :	86.94			Impact distance:	linear feet					
		Mitigation Sites											
		Mitigation Site Name:	MAR-5	Mitigation Site Name:	ORRS		Mitigation Site Name:	Queen Creek		Mitigation Site Name:	H&E Terrace		Mitigation Site Name:	H&E Wetland
		Mitigation Type:	Restoration	Mitigation Type:	Restoration		Mitigation Type:	Enhancement		Mitigation Type:	Restoration		Mitigation Type:	Restoration
		ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream
		Cowardin/HGM type:		Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:	
		Hydrology:		Hydrology:			Hydrology:			Hydrology:			Hydrology:	
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**
		Ratio adjustment:	**1.50**	Ratio adjustment:	**1.75**		Ratio adjustment:	**3.50**		Ratio adjustment:	**1.50**		Ratio adjustment:	**0.75**
		Baseline ratio:	**2.50 : 1.00**	Baseline ratio:	**2.75 : 1.00**		Baseline ratio:	**4.50 : 1.00**		Baseline ratio:	**2.50 : 1.00**		Baseline ratio:	**1.75 : 1.00**
		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment	
3	**Quantitative impact-mitigation comparison**:	N/A	:	N/A	:		N/A	:		N/A			N/A	
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**1**		Ratio adjustment:	**1**
		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.			PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**0**	Ratio adjustment:	**1**		Ratio adjustment:	**1**		Ratio adjustment:	**0**		Ratio adjustment:	**0**
		PM justification: Aquatic resource establishment has occurred.		PM justification: No aquatic resource establishment is proposed.			PM justification: No aquatic resource establishment is proposed.			PM justification: Aquatic resource establishment proposed as part of mitigation.			PM justification: Aquatic resource establishment proposed as part of mitigation.	
6	**Type conversion:**	Ratio adjustment:	**-3**	Ratio adjustment:	**-3**		Ratio adjustment:	**-1.5**		Ratio adjustment:	**-2.5**		Ratio adjustment:	**-3.5**
		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to Queen Creek is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.			PM justification: Wetland habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.	
7	**Risk and uncertainty**:	Ratio adjustment:	**2**	Ratio adjustment:	**2**		Ratio adjustment:	**0.7**		Ratio adjustment:	**0.7**		Ratio adjustment:	**0.7**
		PM justification: Permittee-responsible mitigation, vegetation maintenance, artifical hydrology (during establisment).		PM justification: Permittee-responsible mitigation, vegetation maintenance.			PM justification: Permittee-responsible mitigation, vegetation maintenance			PM justification: Permittee-responsible mitigation, vegetation maintenance, structures, artificial hydrology (establishment)			PM justification: Permittee-responsible mitigation, vegetation maintenance, difficult-to-replace resource	
8	**Temporal loss**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**
		PM justification: Tree species already present.		PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.	
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	2.50 : 1.00	Baseline ratio from 2 or 3:	2.75 : 1.00		Baseline ratio from 2 or 3:	4.50 : 1.00		Baseline ratio from 2 or 3:	2.50 : 1.00		Baseline ratio from 2 or 3:	1.75 : 1.00
		Total adjustments (4-8):	-1	Total adjustments (4-8):	0		Total adjustments (4-8):	0.2		Total adjustments (4-8):	-0.8		Total adjustments (4-8):	-1.8
		Final ratio:	**2.50 : 2.00**	Final ratio:	**2.75 : 1.00**		Final ratio:	**4.70 : 1.00**		Final ratio:	**2.50 : 1.80**		Final ratio:	**1.75 : 2.80**
			1.25 : 1		2.75 : 1			4.70 : 1			1.39 : 1			0.63 : 1
		to Resource type:	River/Stream	to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream
		Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine
		Hydrology:		Hydrology:			Hydrology:			Hydrology:			Hydrology:	
		Total Acreage at Site	123.00 acres / feet	Total Acreage at Site	23.00 acres / feet		Total Acreage at Site	33.00 acres / linear feet		Total Acreage at Site	300.00 acres / linear feet		Total Acreage at Site	15.00 acres / linear feet
		of Resource type:	River/Stream	of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream
		Cowardin or HGM:	Riverine	Cowardin or HGM:	0		Cowardin or HGM:	0		Cowardin or HGM:	0		Cowardin or HGM:	0
		Hydrology:	0	Hydrology:	0		Hydrology:	0		Hydrology:	0		Hydrology:	0
		Mitigation Credits:	acres / feet	Mitigation Credits:	acres / feet		Mitigation Credits:	acres / linear feet		Mitigation Credits:	acres / linear feet		Mitigation Credits:	acres / linear feet
10	**Final compensatory mitigation requirements:**	Starting impact:	acres	Starting impact:	acres		Starting impact:	acres		Starting impact:	acres		Starting impact:	acres
		Remaining Impact:	acres	Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres
		Additional PM comments:		Additional PM comments:			Additional PM comments:			Additional PM comments:			Additional PM comments:	

Impact Class A

	Function	Score
Physical	Hydrologic Connectivity	5
	Subsurface Flow\Groundwater Recharge	4
	Energy Dissipation	5
	Sediment Transport/Regulation	5
Chemical	Elements, Compounds, and Particulate Cycling	4
	Organic Carbon Export/Sequestration	4
Biotic	Aquatic Invertebrate Fauna	1
	Presence of Fish\Fish Habitat Structure	0
	Riparian/Wetland Habitat Structure	4
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4
	Native/Non-native Vegetation Species	5

MAR-5 Restoration Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	4	4	0		
	Subsurface Flow\Groundwater Recharge	4	2	5	3		
	Energy Dissipation	5	2	4	2		
	Sediment Transport/Regulation	5	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	4	2	4	2		
	Organic Carbon Export/Sequestration	4	2	4	2		
Biotic	Aquatic Invertebrate Fauna	1	1	3	2		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	4	2	4	2		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	2	4	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	41	20	42	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	1.50
PM Justification:	

ORRS Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	4	4	0		
	Subsurface Flow\Groundwater Recharge	4	2	2	0		
	Energy Dissipation	5	2	4	2		
	Sediment Transport/Regulation	5	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	4	2	3	1		
	Organic Carbon Export/Sequestration	4	2	3	1		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	4	2	3	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	2	3	1		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	41	20	36	16		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	1.75
PM Justification:	

Queen Creek Enhancement Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	5	5	0		
	Subsurface Flow\Groundwater Recharge	4	4	4	0		
	Energy Dissipation	5	5	5	0		
	Sediment Transport/Regulation	5	5	5	0		
Chemical	Elements, Compounds, and Particulate Cycling	4	3	4	1		
	Organic Carbon Export/Sequestration	4	4	4	0		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	4	3	4	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	4	4	0		
	Native/Non-native Vegetation Species	5	4	5	1		
	Total	41	38	42	4		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	3.50
PM Justification:	

H&E Terrace Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	1	4	3		
	Subsurface Flow\Groundwater Recharge	4	1	3	2		
	Energy Dissipation	5	1	3	2		
	Sediment Transport/Regulation	5	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	4	1	4	3		
	Organic Carbon Export/Sequestration	4	1	3	2		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	4	1	2	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	1	3	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	41	10	32	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	1.50
PM Justification:	

H&E Wetland Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	5	1	5	4		
	Subsurface Flow\Groundwater Recharge	4	1	4	3		
	Energy Dissipation	5	1	3	2		
	Sediment Transport/Regulation	5	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	4	1	4	3		
	Organic Carbon Export/Sequestration	4	1	4	3		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	1	1		
	Riparian/Wetland Habitat Structure	4	1	4	3		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	4	1	4	3		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	41	10	41	31		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.75
PM Justification:	

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet)

1	9/15/2020	Corps File No.: SPL-2016-00547		Project Manager:MWL									
	Impact Site Name:	Class B	ORM Resource	River/Stream		Hydrology: Ephemeral							
	Impact Cowardin or HGM type:	Riverine	Impact area :	39.98		Impact distance:	linear feet						
		Mitigation Sites											
		Mitigation Site Name:	MAR-5	Mitigation Site Name:	ORRS	Mitigation Site Name:	Queen Creek	Mitigation Site Name:	H&E Terrace	Mitigation Site Name:	H&E Wetland		
		Mitigation Type:	Restoration	Mitigation Type:	Restoration	Mitigation Type:	Enhancement	Mitigation Type:	Restoration	Mitigation Type:	Restoration		
		ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream	ORM Resource Type:	River/Stream		
		Cowardin/HGM type:		Cowardin/HGM type:		Cowardin/HGM type:		Cowardin/HGM type:		Cowardin/HGM type:			
		Hydrology:		Hydrology:		Hydrology:		Hydrology:		Hydrology:			
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**	Starting ratio:	**1.00 : 1.00**		
		Ratio adjustment:	**0.75**	Ratio adjustment:	**1.60**	Ratio adjustment:	**3.00**	Ratio adjustment:	**0.50**	Ratio adjustment:	**-0.50**		
		Baseline ratio:	**1.75 : 1.00**	Baseline ratio:	**2.60 : 1.00**	Baseline ratio:	**4.00 : 1.00**	Baseline ratio:	**1.50 : 1.00**	Baseline ratio:	**1.00 : 1.50**		
		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment		PM justification: See qualitative sheet for adjustment			
3	**Quantitative impact-mitigation comparison**:	N/A	:	N/A	:	N/A	:	N/A		N/A			
4	**Mitigation site location**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**1**	Ratio adjustment:	**1**		
		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Impact site and mitigation site are within the same HUC 8.		PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.		PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.			
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**0**	Ratio adjustment:	**1**	Ratio adjustment:	**1**	Ratio adjustment:	**0**	Ratio adjustment:	**0**		
		PM justification: Aquatic resource establishment has occurred.		PM justification: No aquatic resource establishment is proposed.		PM justification: No aquatic resource establishment is proposed.		PM justification: Aquatic resource establishment proposed as part of mitigation.		PM justification: Aquatic resource establishment proposed as part of mitigation.			
6	**Type conversion:**	Ratio adjustment:	**-3**	Ratio adjustment:	**-3**	Ratio adjustment:	**-1.5**	Ratio adjustment:	**-2.5**	Ratio adjustment:	**-3.5**		
		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to Queen Creek is a rare and valuable resource in Arizona.		PM justification: Riparian habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.		PM justification: Wetland habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.			
7	**Risk and uncertainty**:	Ratio adjustment:	**2**	Ratio adjustment:	**2**	Ratio adjustment:	**0.7**	Ratio adjustment:	**0.7**	Ratio adjustment:	**0.7**		
		PM justification: Permittee-responsible mitigation, vegetation maintenance, artifical hydrology (during establisment).		PM justification: Permittee-responsible mitigation, vegetation maintenance.		PM justification: Permittee-responsible mitigation, vegetation maintenance		PM justification: Permittee-responsible mitigation, vegetation maintenance, structures, artificial hydrology (establishment)		PM justification: Permittee-responsible mitigation, vegetation maintenance, difficult-to-replace resource			
8	**Temporal loss**:	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**0**	Ratio adjustment:	**0**		
		PM justification: Tree species already present.		PM justification: Mitigation completed before impact incurred.		PM justification: Mitigation completed before impact incurred.		PM justification: Mitigation completed before impact incurred.		PM justification: Mitigation completed before impact incurred.			
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	1.75 : 1.00	Baseline ratio from 2 or 3:	2.60 : 1.00	Baseline ratio from 2 or 3:	4.00 : 1.00	Baseline ratio from 2 or 3:	1.50 : 1.00	Baseline ratio from 2 or 3:	1.00 : 1.50		
		Total adjustments (4-8):	-1	Total adjustments (4-8):	0	Total adjustments (4-8):	0.2	Total adjustments (4-8):	-0.8	Total adjustments (4-8):	-1.8		
		Final ratio:	**1.75 : 2.00**	Final ratio:	**2.60 : 1.00**	Final ratio:	**4.20 : 1.00**	Final ratio:	**1.50 : 1.80**	Final ratio:	**1.00 : 3.30**		
			0.88 : 1		2.60 : 1		4.20 : 1		0.83 : 1		0.30 : 1		
		to Resource type:	River/Stream	to Resource type:	River/Stream	to Resource type:	River/Stream	to Resource type:	River/Stream	to Resource type:	River/Stream		
		Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine	Cowardin or HGM:	Riverine		
		Hydrology:		Hydrology:		Hydrology:		Hydrology:		Hydrology:			
		Total Acreage at Site	123.00 acres / feet	Total Acreage at Site	23.00 acres / feet	Total Acreage at Site	33.00 acres / linear feet	Total Acreage at Site	300.00 acres / linear feet	Total Acreage at Site	15.00 acres / linear feet		
		of Resource type:	River/Stream	of Resource type:	River/Stream	of Resource type:	River/Stream	of Resource type:	River/Stream	of Resource type:	River/Stream		
		Cowardin or HGM:	Riverine	Cowardin or HGM:	0	Cowardin or HGM:	0	Cowardin or HGM:	0	Cowardin or HGM:	0		
		Hydrology:	0	Hydrology:	0	Hydrology:	0	Hydrology:	0	Hydrology:	0		
		Mitigation Credits:	acres / feet	Mitigation Credits:	acres / feet	Mitigation Credits:	acres / linear feet	Mitigation Credits:	acres / linear feet	Mitigation Credits:	acres / linear feet		
10	**Final compensatory mitigation requirements:**	Starting impact:	acres	Starting impact:	acres	Starting impact:	acres	Starting impact:	acres	Starting impact:	acres		
		Remaining Impact:	acres	Remaining Impact:	acres	Remaining Impact:	acres	Remaining Impact:	acres	Remaining Impact:	acres		
		Additional PM comments:		Additional PM comments:		Additional PM comments:		Additional PM comments:		Additional PM comments:			

Impact Class B

	Function	Score
Physical	Hydrologic Connectivity	4
	Subsurface Flow\Groundwater Recharge	3
	Energy Dissipation	3
	Sediment Transport/Regulation	3
Chemical	Elements, Compounds, and Particulate Cycling	3
	Organic Carbon Export/Sequestration	2
Biotic	Aquatic Invertebrate Fauna	1
	Presence of Fish\Fish Habitat Structure	0
	Riparian/Wetland Habitat Structure	3
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3
	Native/Non-native Vegetation Species	5

MAR-5 Restoration Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	4	0		
	Subsurface Flow\Groundwater Recharge	3	2	5	3		
	Energy Dissipation	3	2	4	2		
	Sediment Transport/Regulation	3	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	3	2	4	2		
	Organic Carbon Export/Sequestration	2	2	4	2		
Biotic	Aquatic Invertebrate Fauna	1	1	3	2		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	3	2	4	2		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	2	4	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	30	20	42	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.75
PM Justification:	

ORRS Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	4	4	0		
	Subsurface Flow\Groundwater Recharge	3	2	2	0		
	Energy Dissipation	3	2	4	2		
	Sediment Transport/Regulation	3	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	3	2	3	1		
	Organic Carbon Export/Sequestration	2	2	3	1		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	3	2	3	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	2	3	1		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	30	20	36	16		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	1.60
PM Justification:	

Queen Creek Enhancement Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	5	5	0		
	Subsurface Flow\Groundwater Recharge	3	4	4	0		
	Energy Dissipation	3	5	5	0		
	Sediment Transport/Regulation	3	5	5	0		
Chemical	Elements, Compounds, and Particulate Cycling	3	3	4	1		
	Organic Carbon Export/Sequestration	2	4	4	0		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	3	3	4	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	4	0		
	Native/Non-native Vegetation Species	5	4	5	1		
	Total	30	38	42	4		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	3.00
PM Justification:	

H&E Terrace Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	1	4	3		
	Subsurface Flow\Groundwater Recharge	3	1	3	2		
	Energy Dissipation	3	1	3	2		
	Sediment Transport/Regulation	3	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	3	1	4	3		
	Organic Carbon Export/Sequestration	2	1	3	2		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	3	1	2	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	1	3	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	30	10	32	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.50
PM Justification:	

H&E Wetland Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	4	1	5	4		
	Subsurface Flow\Groundwater Recharge	3	1	4	3		
	Energy Dissipation	3	1	3	2		
	Sediment Transport/Regulation	3	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	3	1	4	3		
	Organic Carbon Export/Sequestration	2	1	4	3		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	1	1		
	Riparian/Wetland Habitat Structure	3	1	4	3		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	1	4	3		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	30	10	41	31		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	-0.50
PM Justification:	

Attachment 12501.6 - SPD Mitigation Ratio Setting Checklist (See 12501-SPD for Revisions Sheet)

1	9/15/2020	Corps File No.: SPL-2016-00547			Project Manager:MWL								
	Impact Site Name:	Class C	ORM Resource		River/Stream			Hydrology: Ephemeral					
	Impact Cowardin or HGM type:	Riverine	Impact area :		45.7			Impact distance:		linear feet			
		Mitigation Sites											
		Mitigation Site Name:	MAR-5		Mitigation Site Name:	ORRS		Mitigation Site Name:	Queen Creek		Mitigation Site Name:	H&E Terrace		Mitigation Site Name:	H&E Wetland
		Mitigation Type:	Restoration		Mitigation Type:	Restoration		Mitigation Type:	Enhancement		Mitigation Type:	Restoration		Mitigation Type:	Restoration
		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream		ORM Resource Type:	River/Stream
		Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:			Cowardin/HGM type:	
		Hydrology:			Hydrology:			Hydrology:			Hydrology:			Hydrology:	
2	**Qualitative impact-mitigation comparison**:	Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**		Starting ratio:	**1.00 : 1.00**
		Ratio adjustment:	**0.00**		Ratio adjustment:	**0.10**		Ratio adjustment:	**3.00**		Ratio adjustment:	**0.20**		Ratio adjustment:	**-1.75**
		Baseline ratio:	**1.00 : 1.00**		Baseline ratio:	**1.10 : 1.00**		Baseline ratio:	**4.00 : 1.00**		Baseline ratio:	**1.20 : 1.00**		Baseline ratio:	**1.00 : 2.75**
		PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment			PM justification: See qualitative sheet for adjustment	
3	**Quantitative impact-mitigation comparison**:	N/A	:		N/A	:		N/A	:		N/A			N/A	
4	**Mitigation site location**:	Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**1**		Ratio adjustment:	**1**
		PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Impact site and mitigation site are within the same HUC 8.			PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.			PM justification: Located in adjacent HUC 8 with direct hydrologic connection to Gila River near impact site.	
5	**Net loss of aquatic resource surface area**:	Ratio adjustment:	**0**		Ratio adjustment:	**1**		Ratio adjustment:	**1**		Ratio adjustment:	**0**		Ratio adjustment:	**0**
		PM justification: Aquatic resource establishment has occurred.			PM justification: No aquatic resource establishment is proposed.			PM justification: No aquatic resource establishment is proposed.			PM justification: Aquatic resource establishment proposed as part of mitigation.			PM justification: Aquatic resource establishment proposed as part of mitigation.	
6	**Type conversion:**	Ratio adjustment:	**-3**		Ratio adjustment:	**-3**		Ratio adjustment:	**-1.5**		Ratio adjustment:	**-2.5**		Ratio adjustment:	**-3.5**
		PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to Gila River is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to Queen Creek is a rare and valuable resource in Arizona.			PM justification: Riparian habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.			PM justification: Wetland habitat adjacent to the San Pedro River is a rare and valuable resource in Arizona.	
7	**Risk and uncertainty**:	Ratio adjustment:	**2**		Ratio adjustment:	**2**		Ratio adjustment:	**0.7**		Ratio adjustment:	**0.7**		Ratio adjustment:	**0.7**
		PM justification: Permittee-responsible mitigation, vegetation maintenance, artifical hydrology (during establisment).			PM justification: Permittee-responsible mitigation, vegetation maintenance.			PM justification: Permittee-responsible mitigation, vegetation maintenance			PM justification: Permittee-responsible mitigation, vegetation maintenance, structures, artificial hydrology (establishment)			PM justification: Permittee-responsible mitigation, vegetation maintenance, difficult-to-replace resource	
8	**Temporal loss**:	Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**		Ratio adjustment:	**0**
		PM justification: Tree species already present.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.			PM justification: Mitigation completed before impact incurred.	
9	**Final mitigation ratio(s):**	Baseline ratio from 2 or 3:	1.00 : 1.00		Baseline ratio from 2 or 3:	1.10 : 1.00		Baseline ratio from 2 or 3:	4.00 : 1.00		Baseline ratio from 2 or 3:	1.20 : 1.00		Baseline ratio from 2 or 3:	1.00 : 2.75
		Total adjustments (4-8):	-1		Total adjustments (4-8):	0		Total adjustments (4-8):	0.2		Total adjustments (4-8):	-0.8		Total adjustments (4-8):	-1.8
		Final ratio:	**1.00 : 2.00**		Final ratio:	**1.00 : 1.00**		Final ratio:	**4.20 : 1.00**		Final ratio:	**1.20 : 1.80**		Final ratio:	**1.00 : 4.55**
			0.50 : 1			1.00 : 1			4.20 : 1			0.67 : 1			0.22 : 1
		to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream		to Resource type:	River/Stream
		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine		Cowardin or HGM:	Riverine
		Hydrology:			Hydrology:			Hydrology:			Hydrology:			Hydrology:	
		Total Acreage at Site	123.00 acres / feet		Total Acreage at Site	23.00 acres / feet		Total Acreage at Site	79.00 acres / linear feet		Total Acreage at Site	300.00 acres / linear feet		Total Acreage at Site	15.00 acres / linear feet
		of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream		of Resource type:	River/Stream
		Cowardin or HGM:	Riverine		Cowardin or HGM:	0		Cowardin or HGM:	0		Cowardin or HGM:	0		Cowardin or HGM:	0
		Hydrology:	0		Hydrology:	0		Hydrology:	0		Hydrology:	0		Hydrology:	0
		Mitigation Credits:	acres / feet		Mitigation Credits:	acres / feet		Mitigation Credits:	acres / linear feet		Mitigation Credits:	acres / linear feet		Mitigation Credits:	acres / linear feet
10	**Final compensatory mitigation requirements:**	Starting impact:	acres		Starting impact:	acres		Starting impact:	acres		Starting impact:	acres		Starting impact:	acres
		Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres		Remaining Impact:	acres
		Additional PM comments:			Additional PM comments:			Additional PM comments:			Additional PM comments:			Additional PM comments:	

Impact Class C

	Function	Score
Physical	Hydrologic Connectivity	2
	Subsurface Flow\Groundwater Recharge	2
	Energy Dissipation	2
	Sediment Transport/Regulation	2
Chemical	Elements, Compounds, and Particulate Cycling	2
	Organic Carbon Export/Sequestration	1
Biotic	Aquatic Invertebrate Fauna	1
	Presence of Fish\Fish Habitat Structure	0
	Riparian/Wetland Habitat Structure	3
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3
	Native/Non-native Vegetation Species	5

MAR-5 Restoration Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	4	4	0		
	Subsurface Flow\Groundwater Recharge	2	2	5	3		
	Energy Dissipation	2	2	4	2		
	Sediment Transport/Regulation	2	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	2	2	4	2		
	Organic Carbon Export/Sequestration	1	2	4	2		
Biotic	Aquatic Invertebrate Fauna	1	1	3	2		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	3	2	4	2		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	2	4	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	23	20	42	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.00
PM Justification:	

ORRS Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	4	4	0		
	Subsurface Flow\Groundwater Recharge	2	2	2	0		
	Energy Dissipation	2	2	4	2		
	Sediment Transport/Regulation	2	2	4	2		
Chemical	Elements, Compounds, and Particulate Cycling	2	2	3	1		
	Organic Carbon Export/Sequestration	1	2	3	1		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	2	2		
	Riparian/Wetland Habitat Structure	3	2	3	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	2	3	1		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	23	20	36	16		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.10
PM Justification:	

Queen Creek Enhancement Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	5	5	0		
	Subsurface Flow\Groundwater Recharge	2	4	4	0		
	Energy Dissipation	2	5	5	0		
	Sediment Transport/Regulation	2	5	5	0		
Chemical	Elements, Compounds, and Particulate Cycling	2	3	4	1		
	Organic Carbon Export/Sequestration	1	4	4	0		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	3	3	4	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	4	4	0		
	Native/Non-native Vegetation Species	5	4	5	1		
	Total	23	38	42	4		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	3.00
PM Justification:	

H&E Terrace Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	1	4	3		
	Subsurface Flow\Groundwater Recharge	2	1	3	2		
	Energy Dissipation	2	1	3	2		
	Sediment Transport/Regulation	2	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	2	1	4	3		
	Organic Carbon Export/Sequestration	1	1	3	2		
Biotic	Aquatic Invertebrate Fauna	1	1	2	1		
	Presence of Fish\Fish Habitat Structure	0	0	0	0		
	Riparian/Wetland Habitat Structure	3	1	2	1		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	1	3	2		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	23	10	32	22		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	0.20
PM Justification:	

H&E Wetland Reestablishment Area

	Function	Functional Score of Impact Site	Baseline Functional Score of Mitigation Site	Post-Mitigation Functional Score	Functional Gain from Mitigation		Ratio Adjustment
Physical	Hydrologic Connectivity	2	1	5	4		
	Subsurface Flow\Groundwater Recharge	2	1	4	3		
	Energy Dissipation	2	1	3	2		
	Sediment Transport/Regulation	2	1	4	3		
Chemical	Elements, Compounds, and Particulate Cycling	2	1	4	3		
	Organic Carbon Export/Sequestration	1	1	4	3		
Biotic	Aquatic Invertebrate Fauna	1	1	4	3		
	Presence of Fish\Fish Habitat Structure	0	0	1	1		
	Riparian/Wetland Habitat Structure	3	1	4	3		
	Age Class Distribution of Wooded Riparian or Wetland Habitat	3	1	4	3		
	Native/Non-native Vegetation Species	5	1	4	3		
	Total	23	10	41	31		

Baseline Score=pre-mitigation condition of mitigation site
Post-Mitigation Score=F&A after mitigation work completed
Functional gain=difference between the two ("functional lift")

Total Adjustment:	-1.75
PM Justification:	