2017 FISH SURVEY
FOR THE RESOLUTION COPPER PROJECT
Resolution Copper

Prepared for:

RESOLUTION COPPER

102 Magma Heights – Superior, Arizona 85173

Project Number: 807.132 04 04

March 9, 2018

WestLand Resources

WestLand Resources, Inc. • 4001 E. Paradise Falls Drive • Tucson, Arizona 85712 • 520•206•9585

TABLE OF CONTENTS

TABLES

FIGURES

(follow text)

APPENDICES

1. INTRODUCTION AND BACKGROUND

In 2015, Section 3003 of the National Defense Authorization Act for Fiscal Year 2015 authorized the exchange of lands between the federal government and Resolution Copper Mining, LLC (legislative land exchange). In 2014, the United States Forest Service (USFS) accepted Resolution Copper Mining, LLC's (Resolution) General Plan of Operations (GPO) to conduct mining and mining related activities on National Forest System lands located within Tonto National Forest as administratively complete and sufficient to initiate USFS review under the National Environmental Policy Act (NEPA). On March 18, 2016, the USFS published a Notice of Intent in the federal register to initiate the NEPA review process.

WestLand Resources, Inc. (WestLand), prepared a screening analysis to determine the potential for occurrence of special-status species and/or the presence of designated or proposed critical habitat within the footprint of the GPO and surrounding area in support of USFS and cooperative agency review of these activities under NEPA (WestLand 2017). During screening, WestLand determined that there was no potential for special-status fish species to occur within the Resolution project footprint (GPO Project Area, **Figure 1**). The GPO Project Area lacks suitable perennial aquatic features to support special-status fish species (WestLand 2017). Furthermore, field investigations, which included survey of aquatic features within the GPO Project Area (e.g., drainages, ponds, and impoundments), have not detected any special-status fish species (WestLand 2003; WestLand 2004; WestLand 2009; WestLand 2012a). The results of the screening also indicated that there is currently no potential for special-status fish species to occur within the screened areas downstream from the GPO Project Area, specifically Queen Creek and Devils Canyon (a tributary to Mineral Creek) (WestLand 2017). However, two special-status fish species either occurred historically in, or were introduced to, Queen Creek and Devils Canyon or their tributaries. The Gila chub (*Gila intermedia*) was historically found within Queen Creek, Arnett Creek (a tributary to Queen Creek), and Mineral Creek (USFWS 2015). The Gila chub is now considered extirpated from Queen and Arnett creeks and has not been recorded in Mineral Creek since 2000 (USFWS 2015). The Gila topminnow (*Poeciliopsis occidentalis occidentalis*) is not historically known to occur in Devils Canyon or Mineral, Queen, and Arnett creeks. However, introduction efforts have been carried out within Arnett and Queen creeks (USFWS 1998; AGFD 2017). Gila topminnow were released into Queen Creek in 1977, but there is no evidence that the release was successful and that the population persisted (USFWS 1998). Gila topminnow were introduced into Arnett Creek in 2017 (AGFD, USFWS, and USFS 2017).

Numerous fish surveys have been conducted within the vicinity of the GPO, including surveys within Mineral Creek by the Arizona Game and Fish Department (AGFD) in 2000, 2002, 2006, 2008, and 2013 (AGFD 2006; AGFD 2008; Crowder, Love-Chezem, and Makinster 2014). The AGFD fish surveys in Mineral Creek indicated that Gila chub, longfin dace (*Agosia chrysogaster*), and green sunfish (*Lepomis cyanellus*) were present in 2000, but no fish were recorded during the 2002 and 2006 surveys. In 2008, AGFD reported longfin dace throughout Mineral Creek following a restocking effort in 2006 along with a few fathead minnow (*Pimephales promelas*) and green sunfish below a natural barrier in

lower Mineral Creek. In 2014, only longfin dace were reported by AGFD within Mineral Creek, however AGFD did not survey below the natural barrier in lower Mineral Creek. Mineral Creek was also surveyed for fish by WestLand in 2007 and 2012 (WestLand 2012b; WestLand 2009). The WestLand surveys in Mineral Creek only reported longfin dace, however WestLand did not survey below the natural barrier in lower Mineral Creek. Devils Canyon was surveyed by AGFD in 2009 and 2011 and by WestLand in 2007 and 2008 (Robinson, Orabutt, and Crowder 2010; Crowder and Robinson 2011; WestLand 2009). Fish surveys by both AGFD and WestLand in Devils Canyon recorded green sunfish and crayfish but no native fish species. WestLand assessments of Queen Creek in 2003 reported the presence of green sunfish, however these were not intensive survey efforts for fish species (WestLand 2003).

At the request of Resolution, WestLand identified potential aquatic features within the vicinity of the GPO Project Area to be surveyed for the presence of native fish species. Potential aquatic features identified included portions of Devils Canyon, Arnett Creek, Mineral Creek, and Queen Creek. Devils Canyon was omitted from the 2017 survey as it had been surveyed four times between 2007 and 2011 and presented significant safety and access concerns. Arnett Creek was omitted from the 2017 survey due to the recent release of Gila topminnow in Arnett Creek coupled with the substantial distance of this feature from likely project impacts. The remaining two potential aquatic features, Queen Creek and Mineral Creek, were selected for this survey. While Queen and Mineral creeks are not currently known to contain special-status fish species, Gila topminnow and Gila chub were present previously within these respective drainages.[1] The objective of the 2017 fish surveys was to determine which fish species, if any, were present within Queen and Mineral creeks.

The Gila chub was proposed to be listed under the Endangered Species Act (ESA) in 2002 and was listed as endangered with critical habitat in 2005 (USFWS 2005). No designated critical habitat for the Gila chub is present within the GPO Project Area; however, a portion of Mineral Creek is designated as critical habitat (**Figure 2**). The Gila topminnow was listed as endangered under the ESA in 1967 (USFWS 1967), but no critical habitat has been designated.

The following sections provide:

- A brief natural history of Gila chub and Gila topminnow (**Section 2**),
- A description of the survey methods (**Section 4**),
- Results of the survey (**Section 5**), and
- References cited within the text (**Section 6**).

[1] Gila topminnow was unsuccessfully introduced into Queen Creek (Desert Fishes Team 2003; Stokes & Jones 2002). Gila Chub is believed to be extirpated from Mineral Creek (AGFD 2006; AGFD 2008).

2. NATURAL HISTORY OF SELECT SPECIAL-STATUS FISH SPECIES

2.1. NATURAL HISTORY OF GILA CHUB

The Gila chub is a native fish to Arizona, with a current known range limited to the Gila River basin in Arizona, New Mexico, and Sonora, Mexico (Minckley and Marsh 2009). Within Arizona, the species is currently known to be extant within select waters in the Aqua Fria River basin, the San Pedro River Basin, the Santa Cruz River basin, the upper Gila River basin, and the Verde River basin (USFWS 2015). Within the upper Gila River basin, which encompasses the GPO Project Area and downstream waters in the immediate vicinity, Gila chub is known to be extant in the Blue River, Bonita Creek, Dix Creek, Eagle Creek, and Harden Cienega Creek within Arizona and Turkey Creek within New Mexico (USFWS 2015). The species is considered extirpated within Queen Creek with the last detection occurring in 1938 (USFWS 2015). The species was historically known from Mineral Creek, but no detections have been recorded since 2000 (USFWS 2015).

Habitat for the Gila chub typically consists of headwater stream systems and cienegas (USFWS 2015; Minckley and Marsh 2009). Within cienega and other marsh and wetland type habitats, the species inhabits pools with a high amount of cover consisting of terrestrial or aquatic vegetation, submerged logs, or undercut banks (USFWS 2015). Within stream habitats, particularly those within canyons, adult Gila chub occupy pool, riffle, and run habitats proportionate to their occurrence in the system (USFWS 2015). Juvenile Gila chub typically avoid riffle habitat and occupy run and pool habitat with an abundance of cover (USFWS 2015). Aquatic vegetation associated with Gila chub includes rushes (*Juncus* spp.), horsetail (*Equisetum* spp.), and watercress (*Nasturtium officinale*) (USFWS 2015). Terrestrial vegetation associated with Gila chub includes ash (*Fraxinus* spp.), cottonwood (*Populus* spp.), seep-willow (*Baccharis* spp.), sycamore (*Platanus* spp.), and tamarisk (*Tamarix* spp.) (USFWS 2015).

Critical habitat was designated for the Gila chub in 2005 and consists of seven areas or river units (USFWS 2005). The critical unit that encompasses the GPO Project Area is Area 2, the Middle Gila River (USFWS 2005), and consists of a single reach within upper Mineral Creek (**Figure 2**). Critical habitat for Gila chub consists of the designated stream segment and a 300-feet buffer from each bank that is meant to be a surrogate for the 100-year floodplain (USFWS 2005). Critical habitat designations are based on primary constituent elements, which include the physical or biological features essential for the survival, reproduction, and recovery of a species. The seven primary constituent elements defined for the Gila chub are as follows (USFWS 2005):

1. Perennial pools, areas of higher velocity between pools, and areas of shallow water among plants or eddies;
2. Water temperatures for spawning ranging from 17.2°C to 23.9 °C (63°F to 75 °F), and seasonally appropriate temperatures for all life stages (varying from about 10°C to 30 °C [50°F to 86 °F]);

3. Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH (e.g. ranging from 6.5 to 9.5), dissolved oxygen (i.e., ranging from 3.0 to 10.0 parts per million) and conductivity (i.e., 100 millimhos [mmhos] or milli Siemens per unit volume – units used to measure conductivity in water] to 1,000 mmhos);
4. Prey base consisting of invertebrates (i.e., aquatic and terrestrial insects) and aquatic plants (i.e., diatoms and filamentous green algae);
5. Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, a high degree of stream bank stability, and a healthy, intact riparian vegetation community;
6. Habitat devoid of nonnative aquatic species detrimental to Gila chub (i.e. green sunfish, largemouth bass, mosquitofish, and crayfish) or habitat in which detrimental nonnative species are kept at a level that allows Gila chub to continue to survive and reproduce; and
7. Streams that maintain a natural flow pattern including periodic flooding.

The taxonomy of the roundtail chub complex, which includes the Gila chub, has frequently been debated and underwent a revision in 2017 (USFWS 2017b). The roundtail chub complex was considered to be a full generic rank in 1945, and full species status for the Gila chub was accepted in 1995 (USFWS 2015). In 2016, after review of new morphological and genetic studies (Copus et al. 2016; Carter et al. 2016; Page et al. 2016), the roundtail chub complex, which included the Gila chub, the roundtail chub (*Gila robusta*), and the headwater chub (*Gila nigra*), was reclassified as a single species, the roundtail chub (Page et al. 2016). In lieu of new taxonomic classification of the roundtail chub complex, the U.S. Fish and Wildlife Service (USFWS) has withdrawn the proposed rule to list headwater chub and roundtail chub under the ESA, and it has stated that a reevaluation of the Gila chub's status under the ESA and range-wide species status assessment of the newly recognized roundtail chub is forthcoming (USFWS 2017b). Until a formal revision has been accepted and published by the USFWS, the Gila chub remains a listed entity under the ESA with designated critical habitat.

2.2. Natural History of Gila Topminnow

The Gila topminnow is a fish native to Arizona with a current range that includes portions of the Gila River drainage, one location in the Bill Williams river drainage, and drainages throughout northern Sonora Mexico (AGFD 2001; USFWS 1999). The species is currently estimated to be extant in approximately 42 localities, 9 of which are natural and 33 that are stocked (USFWS 2017a). Historically, the Gila topminnow is not known to occur in Queen, Arnett, or Mineral creeks or in Devils Canyon, nor has it been stocked into either Mineral Creek or Devils Canyon. The species was, however, introduced into Queen Creek in 1977; and while it has not been officially classified as extirpated from the stream, this effort was listed as failed in 1997 (USFWS 1999; Weedman and

Girmendonk 1997). Gila topminnow was stocked into [redacted] in 2017 and is assumed to be extant (AGFD, USFWS, and USFS 2017).

Habitat for the Gila topminnow consists of intermittent to perennial streams, headwater springs, and marshes (AGFD 2001; USFWS 1999; Minckley and Marsh 2009). Within these habitats, the Gila topminnow typically occupies shallow areas with slow to moderate currents and dense vegetation including algal mats (Minckley and Marsh 2009; AGFD 2001). Aquatic vegetation associated with Gila topminnow includes watercress, *Chara* spp., *Potamogeton* spp., and green algae (AGFD 2001). Terrestrial vegetation associated with Gila topminnow includes cottonwood, willow, seep willow, and burrobrush (*Hymenoclea salsola*). The Gila topminnow is listed as endangered under the ESA; however, no critical habitat was designated for this species.

3. STUDY AREA DESCRIPTION

WestLand conducted a screening analysis for potential occurrence of special-status fish species within the vicinity of the GPO Project Area (WestLand 2017) and determined that the GPO footprint does not contain suitable habitat for special-status fish species. The screening analysis also determined that there is currently no potential for special-status fish species to occur in the downstream waters of Queen Creek and Devils Canyon. As described in **Section 2**, records indicate that Gila chub were historically found in Queen Creek and Mineral Creek and that designated critical habitat is present in Mineral Creek (**Figure 2**). Gila topminnow was previously stocked into Queen Creek, but it is assumed that the species failed to perpetuate. In 2017, the species was released into [redacted]. Based on the historic presence of special-status species fish in Queen and Mineral creeks, and the recent stocking of Gila topminnow into [redacted], survey transects were placed in both Queen and Mineral creeks. [redacted] was not surveyed due to the recent stocking of Gila topminnow, and Devils Canyon was not surveyed due to the availability of recent data from surveys conducted within the drainage (four surveys between 2007 and 2011) and safety concerns associated with access into this remote, rugged canyon. Ponds, drainages, and impoundments within the GPO Project Area were not surveyed due to lack of proper habitat for any of the screened special-status fish species and lack of any record of special-status fish in any of these features from previous surveys (WestLand 2003; WestLand 2004; WestLand 2009; WestLand 2012a).

The selected Survey Area consists of selected reaches within Mineral Creek and Queen Creek (**Figure 1**). Survey reaches within both creeks were subdivided into survey segments based on habitat changes or the amount of stream length the team could survey within a single trapping session (**Table 1; Figures 3 and 4**). The following sections provide a description of the Mineral Creek and Queen Creek survey transects.

Table 1. Survey Reaches for Fish Survey

Drainage	ID	Land Ownership	Total Length (in meters)
Mineral Creek	Segment I	Private, ASLD	350
Mineral Creek	Segment II	Private, ASLD	1,110
Mineral Creek	Segment III	ASLD	1, 900
Mineral Creek	Segment IV	ASLD	2,135
		Total	**5,495**
Queen Creek	Segment I	Private, USFS	815
Queen Creek	Segment II	Private, USFS	685
Queen Creek	Segment III	Private, USFS	810
		Total	**2,310**

3.1. MINERAL CREEK SURVEY TRANSECT

Mineral Creek is generally a north-south trending drainage originating in a valley between the Pinal Mountains to the northeast and Dripping Springs Mountains to the southwest, and terminating at the confluence with the Gila River, approximately 5.2 miles (8.4 km) northwest of Kearney, Arizona (**Figure 1**). From the headwaters of Mineral Creek to the confluence with Devils Canyon, above the Big Box Dam, the creek is confined by moderately steep canyon walls and is spatially intermittent to perennial with periods of sustained winter and summer streamflow (Montgomery & Associates 2017). The 3.4-mile (5.5-km) span of Mineral Creek surveyed was divided into four segments (**Table 1; Figure 3**). Elevations range from roughly 2,800 ft (853 m) amsl at the northern end of Segment I to approximately 2,400 ft (732 m) amsl at the southern end of Segment IV. Surface water was present along all four segments during the survey period.

Along Mineral Creek, Interior Riparian Deciduous Forest is the dominant community, and vegetation includes a diverse mixture of Bonpland willow (*Salix bonplandiana*), Goodding's willow (*S. gooddingii*), velvet ash (*Fraxinus arizonica*), Fremont cottonwood (*Populus fremontii*), Arizona sycamore (*Platanus wrightii*), and Arizona walnut (*Juglans major*). Steeply sloping hillsides along the creek rise rapidly through velvet mesquite (*Prosopis velutina*) groves into Arizona Upland Subdivision of Sonoran Desertscrub vegetation.

3.1.1. Mineral Creek Segment I

Mineral Creek Segment I was the northernmost reach of Mineral Creek within the survey transect and included a portion of the Lyons Fork tributary (**Figure 3**). During the 2017 survey period, surface flow was present along all of Segment I. Surface flow within Mineral Creek was intermittent immediately upstream from Segment I during the survey period. Within Segment I, both Mineral Creek and Lyons Fork consisted primarily of shallow runs and riffles over gravel, cobble, and boulder substrate with little pool habitat present (**Appendix A, Photos 7-8**). At the downstream limit of Segment I, an area of exposed bedrock with a natural spill was present and could potentially be a barrier to any fish movement upstream of this point (**Appendix A, Photo 9**). Overstory vegetation

was mixed throughout Segment I, providing shaded areas along portions of the transect, but was absent in other areas. Aquatic vegetation was present mostly in shallow runs and consisted primarily of algae (**Appendix A, Photos 7 and 9**).

3.1.2. Mineral Creek Segment II

Mineral Creek Segment II consisted mostly of long runs broken up by small riffle complexes (**Appendix A, Photos 10-12**). Runs were present along areas of exposed bedrock, which constrained and deepened the channel (**Appendix A, Photo 10**), and in areas that were open, contained cobbles, and were typically shallower (**Appendix A, Photo 11**). Near the downstream end of Segment II, a large spill over a section of exposed bedrock is present with large plunge pools below the spill (**Appendix A, Photo 13**). Upland vegetation was more prevalent in Segment II than in Segment I and provided a larger portion of shaded areas along the channel (**Appendix A, Photos 10 and 12**). Aquatic vegetation was present along runs, and within the plunge pools, and consisted primarily of algae with some watercress (**Appendix A, Photos 10 and 13**).

3.1.3. Mineral Creek Segment III

Mineral Creek Segment III consisted of a diverse set of habitats. Portions of Segment III consisted of large boulders that altered the flow of the channel and provided for riffle and pool complexes (**Appendix A, Photo 14**). Segment III also contained a narrow, high-walled canyon, that provided natural shading, and long undisturbed runs with small, eroded cut-out pools along bends in the canyon (**Appendix A, Photo 15**). Additionally, Segment III contained long, shallow runs and riffle complexes over gravel substrate that were broken up occasionally by large cobbles (**Appendix A, Photos 16 and 17**). Upland vegetation was prevalent along most of Segment III providing significant canopy cover along much of the segment (**Appendix A, Photos 14, 16, and 17**). Aquatic vegetation was less prevalent in Segment III than in Segments I and II and was concentrated in pools within the canyon section (**Appendix A, Photo 15**).

3.1.4. Mineral Creek Segment IV

Mineral Creek Segment IV is the southernmost segment within the Mineral Creek transect (**Figure 3**). Mineral Creek Segment IV consisted of a diverse set of habitats. Portions of Segment IV consisted of long, shallow runs and riffle complexes over gravel substrate that were occasionally broken up by large cobbles (**Appendix A, Photos 18 and 21**). Segment IV also contained exposed bedrock that formed spills and numerous plunge pools (**Appendix A, Photo 19**). Additionally, Segment IV contained a few areas where the structure of the canyon allowed for deep slackwater pools adjacent to the main channel (**Appendix A, Photo 20**). Upland vegetation was prevalent along most of Segment IV providing significant canopy cover along much of the segment (**Appendix A, Photos 18, 19, and 21**). Aquatic vegetation was limited, consisted of algae, and was typically concentrated around spills and plunge pools (**Appendix A, Photo 19**).

3.2. QUEEN CREEK SURVEY TRANSECT

Queen Creek is an east-west trending drainage originating in the Superstition Mountains northeast of Superior and terminating at the confluence with Roosevelt Canal located between the cities of Chandler and Queen Creek, Arizona. The Queen Creek transect is located along Queen Creek, approximately (1.3 km) upstream of the Boyce Thompson Arboretum and downstream of the Superior Waste Water Treatment Plant, approximately 1.5 miles west of Superior (**Figure 1**). This stretch of Queen Creek is channelized and runs along the northern edge of an extensive outcrop belt formed from the Picketpost Mountain volcanics (Montgomery & Associates 2013). Downstream of the Superior Waste Water Treatment Plant and the Haborlite perlite mine, discharges from these facilities maintain perennial flow for approximately one mile (Montgomery & Associates 2017). The 1.4-mile (2.3-km) span of Mineral Creek surveyed was divided into three segments (**Table 1; Figure 4**). Elevations range from roughly 2,600 ft (792 m) amsl at the eastern end of the transect to approximately 2,445 ft (745 m) amsl at the western end.

Along Queen Creek, native trees are dominant and include Fremont cottonwood, Goodding's willow, velvet ash, velvet mesquite, netleaf hackberry (*Celtis reticulata*), and catclaw acacia (*Acacia greggii*). Non-native trees are common and include date palm (*Phoenix dactylifera*), tree tobacco (*Nicotiana glauca*), Mexican paloverde (*Parkinsonia aculeaticarpa*), tree of heaven (*Ailanthus altissima*), and Mexican fan palm (*Washingtonia robusta*). Herbaceous vegetation was robust and included the wetland plants nutsedge (*Cyperus esculentus*), cattail (*Typha* sp.), pale spike rush (*Eleocharis macrostachya*), yellow monkey flower (*Mimulus guttatus*), rabbitsfoot grass (*Polypogon monspeliensis*), speedwell (*Veronica anagallis-aquatica*), and watercress.

3.2.1. Queen Creek Segment I

Queen Creek Segment I was the easternmost reach of Queen Creek within the survey transect (**Figure 4**). During the 2017 survey period, surface flow was present along all of Segment I. The eastern portion of Segment I was shallow, typically less than six inches in depth, with a silty mucky substrate (**Appendix A, Photo 23**). The central portion of Segment I consisted primarily of shallow runs with silty substrate interspersed with cobbles (**Appendix A, Photo 24**). Near the western portion of Segment I a large pool complex was present with water depth greater than one meter in some places (**Appendix A, Photo 25**). The pool was bounded by exposed bedrock on the north side and contained a slackwater area on the southeastern portion off the main channel. The westernmost portion of Segment I consisted of slow moving run habitat (**Appendix A, Photo 26**). Overstory vegetation was dense along the eastern portion of Segment I and provided almost complete canopy cover (**Appendix A, Photos 22, and 23**). Upland vegetation thinned out as the transect progressed west, but still contained a significant amount of canopy and streamside cover (**Appendix A, Photo 24**).

3.2.2. Queen Creek Segment II

Queen Creek Segment II contained intermittent flow with long stretches of dry stream bed during the 2017 survey. The easternmost portion of Segment II consisted of large broad patches of rocky cobbles, but contained no surface flow during the survey (**Appendix A, Photo 27**). The central portion of Segment II consisted of intermittent dry gaps interspersed with brackish pools (**Appendix A, Photo 28**). The western portion of Segment II had surface flow throughout and contained deep runs and shaded pool habitats that exceeded 0.5 meters in depth (**Appendix A, Photo 29**). Overstory vegetation was prevalent along most of Segment II, but did not always form enclosed canopies. Aquatic vegetation consisted mostly of algae and was concentrated along the runs near the western end of the segment and was present in large, thick mats (**Appendix A, Photo 29**).

3.2.3. Queen Creek Segment III

Queen Creek Segment III was the westernmost portion of the transect and contained surface flow throughout the entire transect. Segment III typically consisted of deep, slow-moving pool and run complexes with sandy silt substrate (**Appendix A, Photos 30-31**). Within Segment III, small areas where the channel was pinched between areas of exposed bedrock created faster moving runs and a few plunge pools (**Appendix A, Photo 32**). Overstory vegetation typically consisted of large mature trees that provided moderate to dense canopy cover (**Appendix A, Photo 31**). Portions of the transect also consisted of exposed rock and canyon walls that provided additional shade and cover to portions of the stream within this segment. Aquatic vegetation was present throughout the shallower runs within Segment III and consisted primarily of algae.

4. METHODS

No standardized survey protocol of native fish in Arizona is currently available. In lieu of a defined survey protocol, passive sampling using minnow traps, which has been shown to be successful in sampling desert fish species, was used (Hamaker and Tupen 2006). Prior surveys within Mineral Creek have employed both active sampling through the use of electrofishing and passive sampling through the use of minnow traps (AGFD 2008; Crowder, Love-Chezem, and Makinster 2014). Sampling was conducted using Gee® G-40 metal mesh traps (17.5 x 9 inches with dual 1- to 2-inch entrances and 0.25-inch mesh). Traps were set during the afternoon, left open overnight, and checked the following morning. Trapping efforts within each surveyed segment occurred across a single afternoon or night. Traps were set in pools, riffles, and runs. Within each microhabitat, traps were set at various depths when practicable, i.e., in the shallows along the stream perimeter and in intermediate and deeper areas within the stream channel. A majority of traps were set in a manner in which part of the trap was above the waterline in order to provide a breathing pocket in the event that non-target, air-breathing species were captured. Traps were tied off to a secure anchor point (e.g., a rock, tree, or shrub) to minimize the chance that traps would be moved into deeper water by current or mammals. All fish that were captured during trapping efforts were identified to species, counted, and recorded. Surveys

were conducted under WestLand's AGFD Scientific Collecting License No. SP504218, and the AGFD was informed of the surveys prior to commencement.

Each transect was surveyed once. The Mineral Creek transect was surveyed from June 6 through June 9, 2017. Survey efforts within this transect included a total of 72 trap nights. The Queen Creek transect was surveyed from June 21 through June 23, 2017. Survey efforts within this transect included a total of 35 trap nights.

5. RESULTS

5.1. MINERAL CREEK

WestLand did not detect any Gila chub, Gila topminnow, or any other special-status fish species during the 2017 survey in Mineral Creek. However, one native fish species, longfin dace, was found in large numbers throughout three of the survey segments (**Table 2**). In 2006, following numerous surveys of Mineral Creek that resulted in no fish detections, all fish species were assumed to be extirpated from the segment of Mineral Creek upstream of Big Box Dam (AGFD 2008). Longfin dace were reintroduced into upper Mineral Creek in October 2006 (AGFD 2008), and have persisted within the stream. Fathead minnow and green sunfish were reported from a segment of Mineral Creek downstream of a natural barrier (i.e., a waterfall) located at the confluence with Tillman's Wash. These species have not been reported upstream from this segment of Mineral Creek (AGFD 2008; Crowder, Love-Chezem, and Makinster 2014). An exposed section of bedrock formed a natural fish barrier between Segment I and the downstream Segments II through IV (**Figure 3**). No fish were captured above this natural barrier. The total number of longfin dace captured across all segments was 985 (**Table 2**). The percentage of occupied traps by species provides a rough representation of how dispersed species are throughout the Survey Area. No longfin dace were recorded within Segment I; however, longfin dace were recorded in 88 percent of traps in Segment II, 92 percent of traps in Segment III, and 87 percent of traps in Segment IV (**Table 2**). This indicates that longfin dace were widespread throughout these three segments and are found in all habitat types including riffles, runs, and pools. No nonnative fish were detected during the 2017 survey in Mineral Creek.

In addition to longfin dace, 165 lowland leopard frog tadpoles (*Lithobates yavapaiensis*) were captured [redacted], and one trap within [redacted] contained 3 canyon tree frog (*Hyla arenicolor*) tadpoles (**Table 2**). Lowland leopard frog tadpoles were captured [redacted]. The tadpoles were found in the highest density of traps in [redacted] (88%). No nonnative amphibians were detected during the survey.

During the survey, there were two incidental observations of Sonora mud turtles (*Kinosternon sonoriense*). Incidental invertebrate captures included giant water bugs (*Abedus herberti*), sunburst diving beetles (*Thermonectus marmoratus*), and damselfly larvae.

Representative photographic vouchers of captured species are provided in **Appendix A** along with photographs of aquatic habitat (pools, riffles, and runs).

Table 2. Survey Results for Mineral Creek in 2017

Survey Segment	Number of Traps	Results - Total Number Captured (Percentage of Occupied Traps)		
		Longfin dace (*Agosia chrysogaster*)	Lowland leopard frog (*Lithobates yavapaiensis*)	Canyon tree frog (*Hyla arenicolor*)
Segment I	7	0 (0)	[redacted]	[redacted]
Segment II	16	213 (88%)	[redacted]	[redacted]
Segment III	25	414 (92%)	[redacted]	[redacted]
Segment IV	23	358 (87%)	[redacted]	[redacted]
Total	**71**	**985**	**165**	**3**

5.2. QUEEN CREEK

WestLand did not detect any Gila chub, Gila topminnow, or any other special-status fish species during the 2017 survey in Queen Creek. No native fish were detected during the 2017 survey. Eleven nonnative green sunfish were found in a single large pool in Segment I (**Table 3; Figure 3**). There was intermittent flow within Segment II which contained patches of dry stream bed. No fish were captured within the intermittent Segment II or downstream in Segment III.

Lowland leopard frog tadpoles were recorded in [redacted]. A total of 214 lowland leopard frog tadpoles were recorded during the survey. The majority of the tadpoles were recorded in [redacted] with a total of 212 individuals captured and captures were reported in [redacted] of the traps. One lowland leopard frog tadpole was recorded in both [redacted]

During the survey, there were incidental observations of a single Sonoran coralsnake (*Micruroides euryxanthus*) and Sonora mud turtles (*Kinosternon sonoriense*).

The invasive red swamp crayfish (*Procambarus clarkii*) was captured in Segment I, with a total of 11 individuals captured at 38 percent of trap sites, and in Segment III, with a total of 7 individuals captured at 33 percent of trap sites. Additionally, incidental invertebrate captures included giant water bugs (*Abedus herberti*) and sunburst diving beetles (*Thermonectus marmoratus*).

Representative photographic vouchers of captured species are provided in **Appendix A** along with photographs of aquatic habitat (pools, riffles, and runs).

Table 3. Survey Results for Queen Creek in 2017

Survey Segment	Number of Traps	Results - Total Number Captured (Percentage of Occupied Traps)		
		Green Sunfish (*Lepomis cyanellus*)	Red Swamp Crayfish (*Procambarus clarkii*)	Lowland leopard frog (*Lithobates yavapaiensis*)
Segment I	16	11 (19%)	11 (38%)	[redacted]
Segment II	7	0 (0)	0 (0)	[redacted]
Segment III	12	0 (0)	7 (33%)	[redacted]
Total	**35**	**11**	**18**	**214**

6. REFERENCES

Arizona Game and Fish Department. 2001. "Gila Topminnow (Poeciliopsis Occidentalis Occidentalis)." *Unpublished Abstract Compiled and Edited by the Heritage Data Management System*. Phoenix, Arizona. https://www.azgfd.gov/w_c/edits/documents/Poecococ.fo_002.pdf.

———. 2006. "Upper Mineral Creek Technical Report." Phoenix, Arizona: Arizona Game and Fish Department.

———. 2008. "Mineral Creek Fish Survey, April 21-22, 2008. Arizona Game & Fish Department Technical Report." Phoenix, Arizona: Arizona Game and Fish Department.

Arizona Game and Fish Department, U.S. Fish and Wildlife Service, and U.S. Forest Service. 2017. "Native Fish Project, 25 Years in Making, Comes to Fruition." *News Release*, May 12. https://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/GilaTopminnow/170512_Gila_stocking_Arnett_Creek_final.pdf.

Carter, J. M., C. D. Crowder, D. J. Leavitt, A. S. Makinster, and B. Hickerson. 2016. "Classification Success of Species within the Gila Robusta Complex Using Morphological and Meristic Characters - a Reexamination of Taxonomic Designations." *Report to the Arizona Game and Fish Department*. Flagstaff, Arizona.

Copus, J. M., Z. Foresman, W. L. Montgomery, B. W. Bowen, and R. J. Toonen. 2016. "Revision of the Gila Robusta (Teleostei, Cyprinidae) Species Complex: Morphological Examination and Molecular Phylogenetics Reveal a Single Species." *Report to the Joint American Fisheries Society and American Society of Ichthyologists and Herpetologists Committee on Name of Fishes*.

Crowder, Clayton D., Tiffany S. Love-Chezem, and Andrew S. Makinster. 2014. "Mineral Creek and Mineral Creek Drainage Stock Tank Surveys During 2013." *Annual Report to Gila River Basin Native Fishes Conservation Program for Tasks 4-51 and 3-78a. U.S. Fish and Wildlife Service Cooperative Agreement No. F09AC00084*. Phoenix, Arizona: Arizona Game and Fish Department.

Crowder, Clayton D., and Anthony T. Robinson. 2011. "Devils Canyon Drainage Stock Tank Surveys During 2010 and 2011." Phoenix, Arizona: Arizona Game and Fish Department.

Desert Fishes Team. 2003. "Status of Federal- and State-Listed Fishes of the Gila River Basin, with Recommendations for Management." *Report Number 1*. Desert Fishes Team.

Hamaker, Timothy, and Jeff Tupen. 2006. "Review and Recommendations of Methods for Monitoring Desert Pupfish (Cyprinidon Macularius) Presence and Absence." *Prepared for Imperial Irrigation District*. CH2M HILL.

Minckley, W.L., and P.C. Marsh. 2009. *Inland Fishes of the Greater Southwest - Chronicle of a Vanishing Biota*. Tucson, Arizona: The University of Arizona Press.

Montgomery & Associates. 2013. "Results of Queen Creek Corridor Survey: Superior Basin, Pinal County, Arizona." *Prepared for Resolution Copper Mining*. Tucson, Arizona: Montgomery & Associates.

———. 2017. "Surface Water Baseline Addendum: Upper Queen Creek, Devils Canyon, and Mineral Creek Watersheds." *Prepared for Resolution Copper*. Tucson, Arizona: Montgomery & Associates.

Page, L. M., H. Espinosa-Pérez, C. R. Gilbert, K. E. Hartel, R. N. Lea, N. E. Mandrak, J. J. Schmitter-Soto, and H. J. Walker. 2016. "Taxonomy of Gila in the Lower Colorado River Basin of Arizona and New Mexico." *Report to the Arizona Game and Fish Department*.

Robinson, A., D. Orabutt, and C. Crowder. 2010. "Devils Canyon and Mineral Creek Fish Surveys during 2009."

Stokes & Jones. 2002. "Environmental Assessment - Funding Assistance for the Town of Superior Queen Creek Riparian Restoration." *Prepared for Bureau of Reclamation*. Phoenix, AZ.

U.S. Fish and Wildlife Service. 1967. "Notices: Native Fish and Wildlife Endangered Species." *Federal Register* 32 (48): 4001.

———. 1998. "Gila Topminnow, Poeciliopsis Occidentalis Occidentalis, Revised Recovery Plan." Albuquerque, New Mexico: U.S. Fish and Wildlife Service.

———. 1999. "Draft Revised Recovery Plan for the Gila Topminnow. U.S. Fish and Wildlife Service." Albuquerque, New Mexico: U.S. Fish and Wildlife Service.

———. 2005. "Endangered and Threatened Wildlife and Plants; Listing Gila Chub as Endangered with Critical Habitat." *Federal Register* 70 (211). U.S. Fish and Wildlife Service: 66664–723.

———. 2015. "Gila Chub (Gila Intermedia) Draft Recovery Plan." Albuquerque, New Mexico: U.S. Fish and Wildlife Service, Southwest Region. https://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/GilaChub/GilaChub_DraftRecoveryPlan_Final_October2014.pdf.

———. 2017a. "Biological Opinion and Conference Opinion for Coronado National Forest Land and Resources Management Plan." *AESO/SE 02EAAZ00-2015-F-0347*. Phoenix, AZ: U.S. Fish and Wildlife Service.

———. 2017b. "Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Headwater Chub and Roundtail Chub Distinct Population Segment." *Federal Register* 82 (66). U.S. Fish and Wildlife Service: 16981–88. https://www.gpo.gov/fdsys/pkg/FR-2017-04-07/pdf/2017-06995.pdf.

Weedman, D. A., and A. L. Girmendonk. 1997. "Gila Topminnow Sites in Arizona: Provisional Extirpation Report 1996-1997 Field Season." *Nongame and Endangered Wildlife Program Technical Report Draft*. Phoenix, Arizona: Arizona Game and Fish Department.

WestLand Resources. 2003. "Seep and Spring Reconnaissance Report Fall/Winter 2002." *Prepared for Resolution Copper Company*. Tucson, Arizona: WestLand Resources, Inc.

———. 2004. "2004 Reptile and Amphibian Survey Federal Parcel, Pinal County, Arizona." *Prepared for Resolution Copper Company*. Tucson, Arizona: WestLand Resources, Inc.

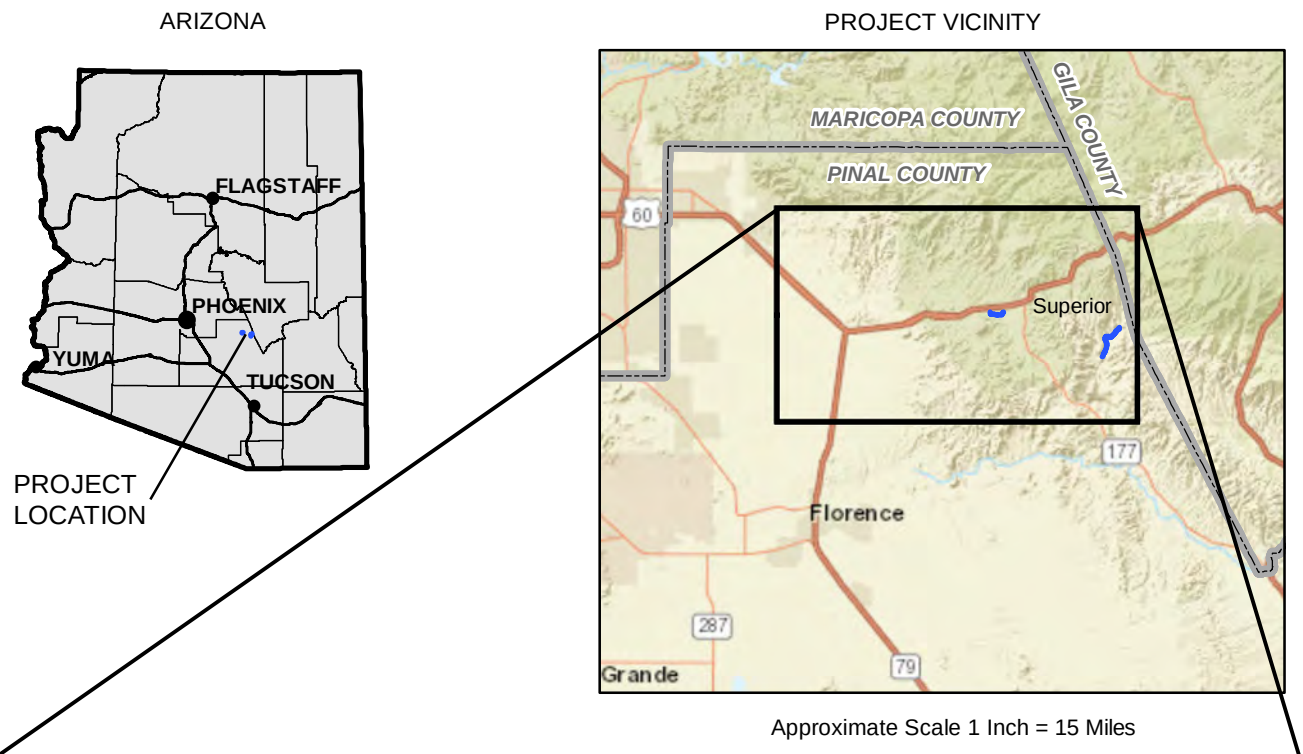
———. 2009. "2007-2008 Fish Survey Resolution Baseline Biological Surveys Pinal County, Arizona." *Prepared for Resolution Copper Mining*. Tucson, Arizona: WestLand Resources, Inc.

———. 2012a. "Amphibian and Reptile Surveys." *Prepared for Resolution Copper Mining*. Tucson, Arizona: WestLand Resources, Inc.

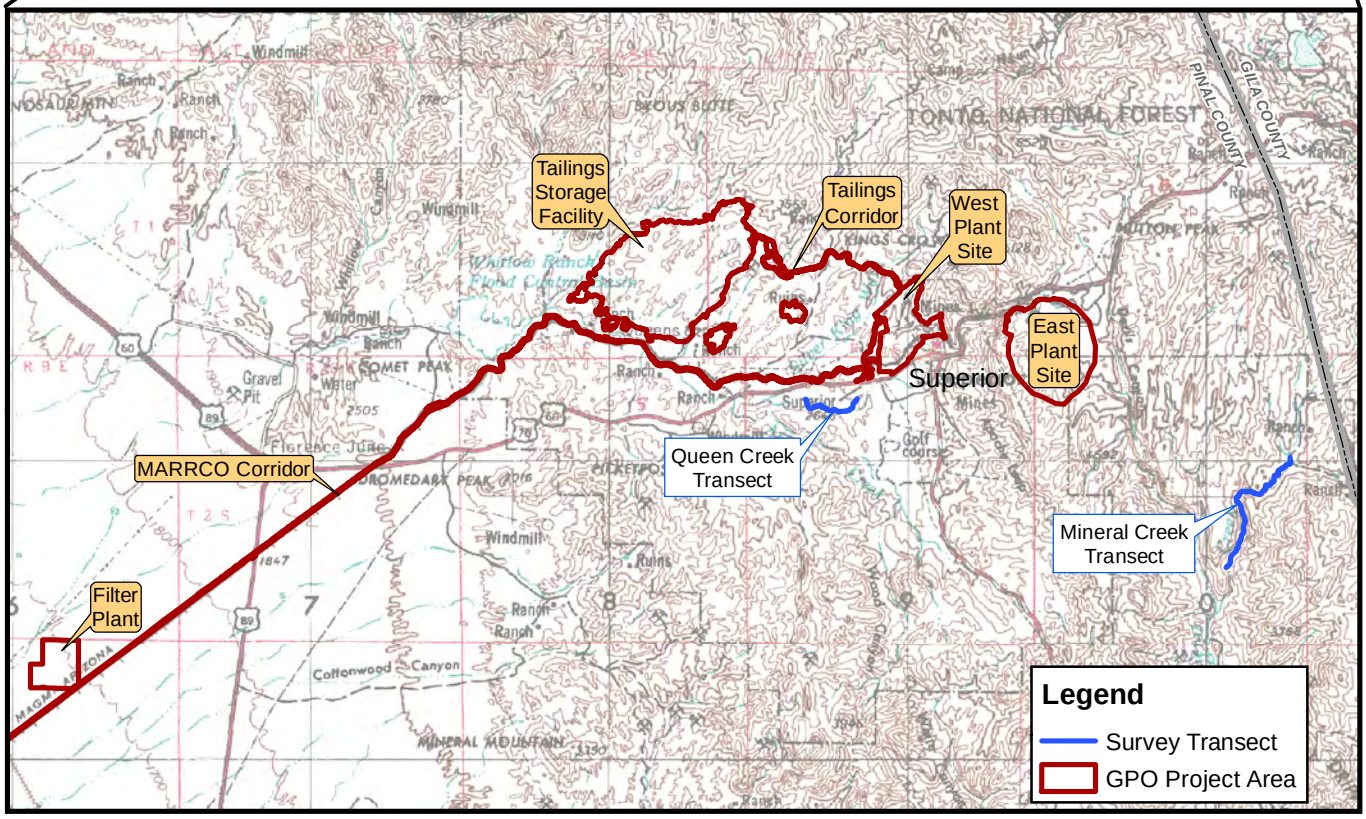
———. 2012b. "Vegetation and Wildlife Assessment of the Mineral Creek Study Area." *Prepared for Resolution Copper Mining*. Tucson, Arizona: WestLand Resources, Inc.

———. 2017. "General Plan of Operations and Legislative Land Exchange Screening Analysis for Special Status Species Resolution Copper." *Prepared for Tonto National Forest - Globe and Mesa Ranger Districts*. Tucson, Arizona: WestLand Resources, Inc.

FIGURES



Approximate Scale 1 Inch = 15 Miles



T2S, R12E, Portions of Sections 4, 5, 8, and 9,
T2S, R13E, Portions of Sections 13, 14, 23, and 26,
Pinal County, Arizona,
Mesa 1:250,000 USGS Quadrangle
Image Source: ArcGIS Online World Street Map

RESOLUTION COPPER

2017 Fish Survey for the Resolution Copper Project

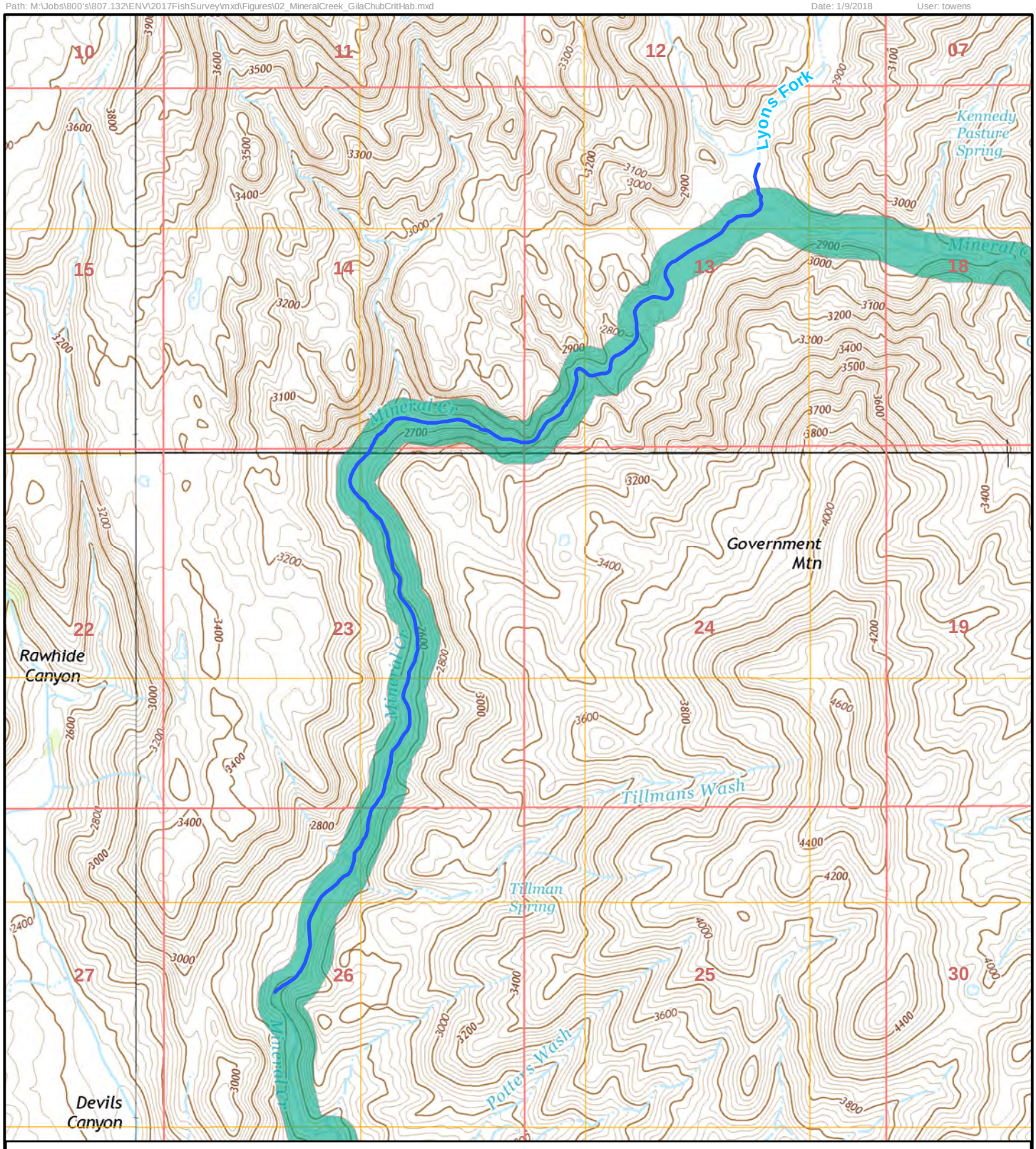
VICINITY MAP
Figure 1

WestLand Resources

N

0 2 4 Miles

0 5 10 Kilometers



T2S, R13E, Portions of Sections 13, 14, 23, and 26,
Pinal County, Arizona,
Hot Tamale Peak and Pinal Ranch
USGS 7.5' Quadrangles (2014)
Critical Habitat Data Acquired from
USFWS on 1/8/2018

N

0 1,000 2,000 Feet

0 300 600 Meters

WestLand Resources

Legend

- Mineral Creek Survey Transect
- Gila Chub Critical Habitat, Designated, 11/2/2005

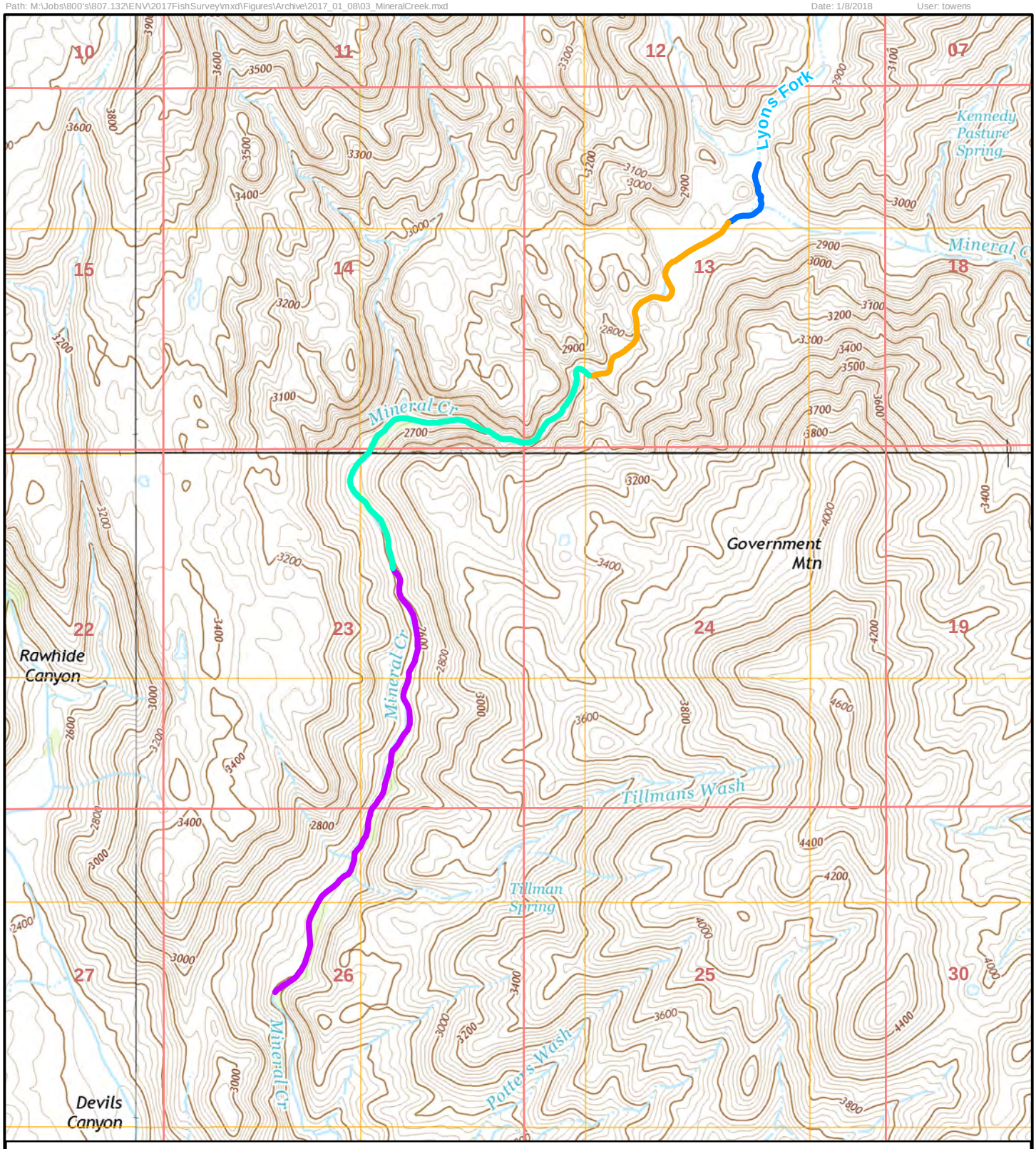
RESOLUTION COPPER

2017 Fish Survey for the Resolution Copper Project

GILA CHUB CRITICAL HABITAT WITHIN AREA 2 - MIDDLE GILA RIVER

Figure 2

Path: M:\Jobs\800's\807.132\ENV\2017FishSurvey\mxd\Figures\Archive\2017_01_08\03_MineralCreek.mxd Date: 1/8/2018 User: towens



T2S, R13E, Portions of Sections 13, 14, 23, and 26,
Pinal County, Arizona,
Hot Tamale Peak and Pinal Ranch
USGS 7.5' Quadrangles (2014)

N

0 1,000 2,000 Feet

0 300 600 Meters

WestLand Resources

Legend

Mineral Creek Survey Transects:

- Segment I
- Segment II
- Segment III
- Segment IV

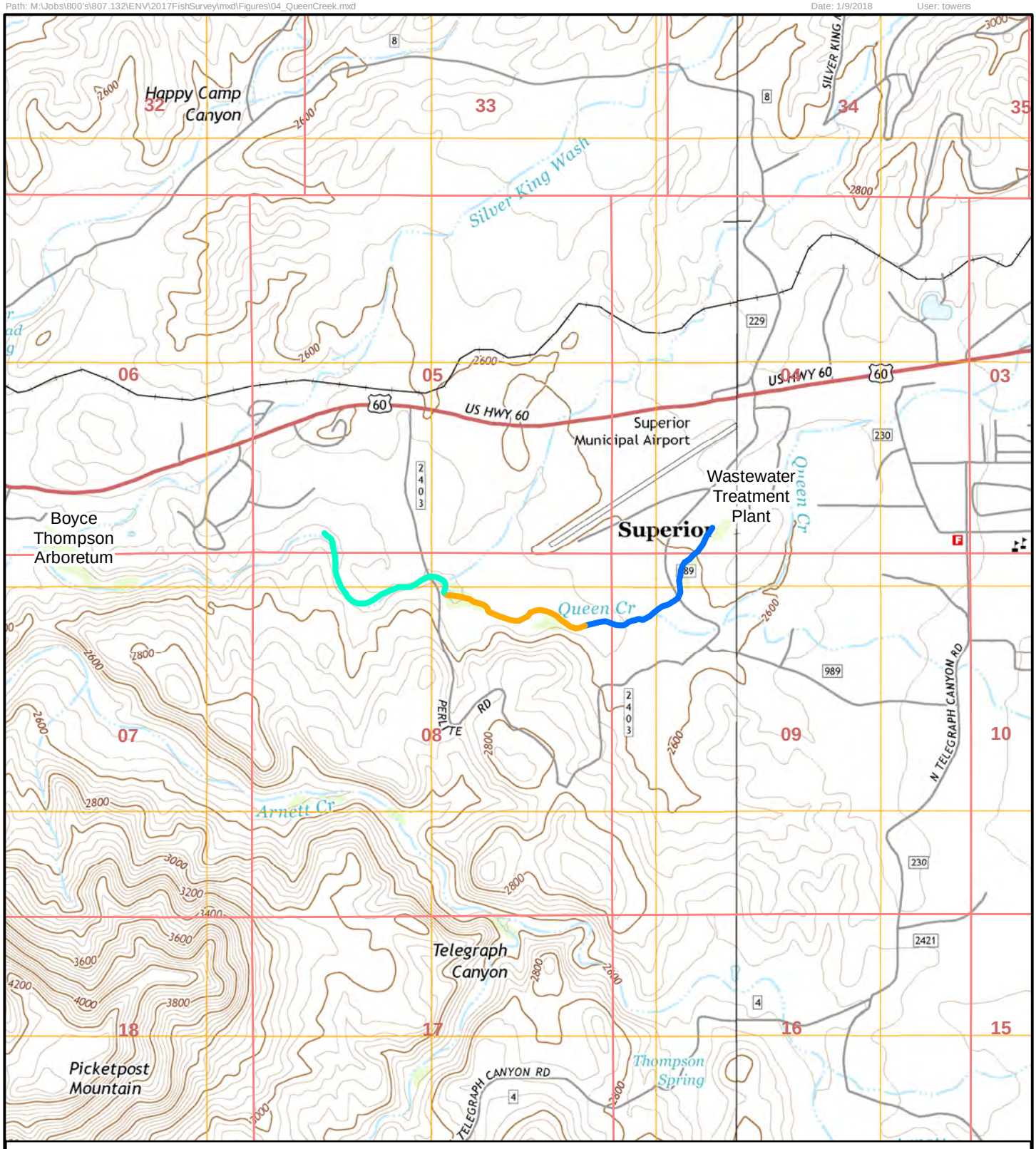
RESOLUTION COPPER

2017 Fish Survey for the Resolution Copper Project

MINERAL CREEK SURVEY AREA

Figure 3

Path: M:\Jobs\800's\807.132\ENV\2017FishSurvey\mxd\Figures\04_QueenCreek.mxd Date: 1/9/2018 User: towens



T2S, R12E, Portions of Sections 4, 5, 8, and 9,
Pinal County, Arizona,
Picketpost Mountain USGS 7.5' Quadrangle (2014)

N

0 1,000 2,000 Feet

0 300 600 Meters

WestLand Resources

Legend

Queen Creek Survey Transects:

- Segment I
- Segment II
- Segment III

RESOLUTION COPPER

2017 Fish Survey for the Resolution Copper Project

QUEEN CREEK SURVEY AREA

Figure 4

APPENDIX A

Representative Photographs

Photo 1.
Longfin dace (*Agosia chrysogaster*) captured in Mineral Creek.

Photo 2.
Green sunfish (*Lepomis cyanellus*) captured in a pool in Queen Creek.

Photo 3.
Canyon treefrog (*Hyla arenicolor*) froglet captured in Mineral Creek.

Photo 4.
Lowland leopard frog (*Lithobates yavapaiensis*) tadpole captured in Mineral Creek.

Photo 5.
Red swamp crayfish (*Procambarus clarkii*) captured in Queen Creek.

Photo 6.
Giant water bug (*Abedus herberti*) captured in Mineral Creek.

Photo 7.
Mineral Creek Segment I – Shallow run habitat**.**

Photo 8.
Mineral Creek Segment I – Riffle habitat.

Photo 9.
Mineral Creek Segment I – Natural bedrock spill and barrier. No fish were captured upstream from this point.

Photo 10.
Mineral Creek Segment II – Riffle-run complex.

Photo 11.
Mineral Creek Segment II – Run with little overhead canopy cover.

Photo 12.
Mineral Creek Segment II – Shaded run habitat.

Photo 13.
Mineral Creek Segment II – Pool habitat below a natural barrier. Fish were present on both sides of the barrier.

Photo 14.
Mineral Creek Segment III – Riffle complex with pools.

Photo 15.
Mineral Creek Segment III – Run adjacent to steep canyon walls.

Photo 16.
Mineral Creek Segment III – Shallow run with gravel substrate.

Photo 17.
Mineral Creek Segment III – Shallow run habitat.

Photo 18.
Mineral Creek Segment IV – Shallow riffle habitat.

Photo 19.
Mineral Creek Segment IV – Exposed bedrock spillway.

Photo 20.
Mineral Creek Segment IV – Slackwater pool habitat.

Photo 21.
Mineral Creek Segment IV – Run habitat.

Photo 22.
Queen Creek Segment I – Shallow run habitat with thick vegetation and debris covering the channel.

Photo 23.
Queen Creek Segment I – Shallow run habitat.

Photo 24.
Queen Creek Segment I – Shallow run habitat with emergent vegetation.

Photo 25.
Queen Creek Segment I – Large pool with multiple green sunfish (*Lepomis cyanellus*) nests.

Photo 26.
Queen Creek Segment I – Slow moving run habitat.

Photo 27.
Queen Creek Segment II – Queen creek is intermittent within Segment II with large patches of zero surface flow during the survey.

Photo 28.
Queen Creek Segment II – Pool between intermittent dry stretches.

Photo 29.
Queen Creek Segment II – Deep pool-run complex with surface and emergent vegetation.

Photo 30.
Queen Creek Segment III – Run habitat along a large rock outcrop.

Photo 31.
Queen Creek Segment III – Run habitat with shaded overstory.

Photo 32.
Queen Creek Segment III – Pool habitat.