Version 1.0 October 3, 2017

**Prepared for:** 



# Spring and Seep Catalog Resolution Copper Project Area Upper Queen Creek and Devils Canyon Watersheds



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### SPRING AND SEEP CATALOG Resolution Copper Project Area Upper Queen Creek and Devils Canyon Watersheds

**DATE:** October 3, 2017

VERSION: 1.0

### Introduction

This catalog has been prepared to summarize available information for selected springs and seeps in the Upper Queen Creek and Devils Canyon watersheds (UQC/DC). The springs and seeps included in this catalog were selected based on proximity to planned facilities as proposed by Resolution Copper (RC) for the Resolution mine project. The catalog was prepared by Montgomery & Associates (M&A) and WestLand Resources, Inc. (WRI) on behalf of Resolution Copper (RC).

Identification of springs and seeps in the UQC/DC watersheds was accomplished as part of ongoing hydrological and biological baseline studies conducted by RC consultants and RC personnel during the period 2002 to present. Many springs/seeps were targeted for field verification based on locations shown on USGS topographic maps, or available in ADWR and ASLD databases. Additional springs were identified during discussions with local ranchers and stakeholders. The remaining springs and seeps were identified during field transects along with analysis of high-resolution satellite imagery and aerial photography.

Spring locations are shown on **Figure 1**. Springs and seeps included in this catalog are labeled in blue. These springs have been visited and cataloged by RC and its consultants. In several cases, no active spring was found at the locations provided in public databases. In most cases, spring location coordinates differed from those provided in public databases. Field-verified location information is given for each spring, where possible.

For each catalog entry, there are 4 sections, which are described below:

Section 1 – General Information: Provides detailed information on the following:

- Naming convention and mapping history
- Georeference data including location coordinates and elevation
- Administrative
- General hydrographic and hydrologic information



- Spring classification details (based on classification approaches described by Springer & Stevens (2009) and Stevens, et.al. (2016)
- Description of existing infrastructure, if present.

**Section 2 – Hydrological Observations:** Section 2 provides a summary of observations by WRI, M&A, GAI, and RC during baseline hydrological studies for RC. It includes observations of flow characteristics, or presence of water. Available field water quality parameters are also provided, when obtained.

**Section 3 – Biological Observations:** Provides a summary of observations by WRI during biological surveys, including general site characteristics, and specific observations of flora and fauna from each field visit.

**Section 4 – Photographs:** Provides photographs showing some of the hydrological and biological features for each site.

Primary public sources of information for springs in the UQC/DC study area include:

- Arizona Land Resource Information System (ALRIS) database: Springs and seeps reported in the ALRIS database include data from the USGS Geonames database and the USGS Digital Line Graphs (DLGs).
- Arizona Department of Water Resources (ADWR) Surface Water Documents database: This database includes water rights filings for diversion and beneficial use of surface water, including perennial and intermittent flow in rivers and streams, ephemeral runoff, lakes and ponds, stock tanks, and springs.

This spring and seep catalog is considered a work in progress. As additional springs and/or seeps are identified within critical locations of the project area, they will be added to this catalog.

### References

- Springer, A.E., and L.E. Stevens, 2009, **Spheres of Discharge of Springs:** in Hydrogeology Journal 17:83-93.
- Stevens, L.E., J.D. Ledbetter, A.E. Springer, C. Campbell, L. Misztal, M.Joyce, and G. Hardwick, 2016, Arizona Springs Restoration Handbook: Spring Stewardship Institute, Museum of Northern Arizona, Flagstaff, Arizona, and Sky island Alliance, Tucson, Arizona.



### **Acronyms and Abbreviations**

- ADWR Arizona Department of Water Resources
- ASLD Arizona State Land Department
- GAI Golder Associates
- GWSI Groundwater Site Inventory
- HUC Hydrologic Unit Code
- M&A Montgomery & Associates
- RC Resolution Copper
- USFS United States Forest Service
- USGS United States Geological Survey
- UTM Universal Transverse Mercator
- WRI WestLand Resources, Inc.
- gpm gallons per minute
- m-meters
- mg/L milligrams per liter
- uS/cm microSiemens per centimeter



GIS-TUC\605.1513\Spring\_Seep\_Catalog\_Locmap.mxd\03Oct2017



# **EXPLANATION**





# BEAR TANK SPRING Section 1: General Information

GENERAL INFORMATION			
SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
		Bear Tank Spring is located in bottom of Bear Tank Canyo	on upstream fr
Bear Tank Spring	Unnamed spring; Bear Spring; Bear Tank Canyon Spring	discharge from alluvial cover and from the Gila conglomera	ate; source of
COUNTY	CADASTRAL (40-acre)		flow another
		bedrock ledge. A further 5 meters downstream a muddy po	col is formed u
Pinal	(D-01-11)25cd	pipe is located	
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST Q
IIS Forest Service	Tonto National Forest	Picketnost A7 / Yes	Superio
	DATUM		
SOURCE OF GEOREFERENCE DATA	DATOM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVA
482360	3685637	2390 feet amsl	Estimat
ADMINISTRATIVE			
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI
Yes	Yes	36-105437 (USFS) 36-76639 (Martin)	No
HYDROLOGY			
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW
Middle Gila	Queen Creek	Bear Tank Canyon	Intermi
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000405	Alamo Canyon - Queen Creek		
GEOMORPHOLOGY			
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCH
Seepage or filtration	Gila Conglomerate (Tg); alluvium	Rheocrene	Beddin
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
gravity	mixed runoff/spring	Yes	
INFRASTRUCTURE			
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND
Cemented rock headwall across creek bottor	Pipe in conglomerate downstream from headwall	Breached headwall below main pool	Main po
ACTIVELY USED?	USE?		
Yes?	Stock watering/wildlife?		



rom crossing of FS Road 2359; the spring appears to water to discharge pipe is unknown, but is evidence of neter pool at the base of a conglomerate ledge. About 10-meters and converge with another seep under a under the conglomerate outcrop where the discharge

### UADS AND EDITIONS WHERE SHOWN

or AZ 15' (1948); bost AZ 7.5' (2004, 2011, 2014)

### **ATION SOURCE**

ted from USGS 7.5' Topo

Spring?

#### PERSISTENCE

ttent

### ING GEOLOGIC UNIT

ig in Gila Conglomerate?

)

ond at top of spring area, with flow below



# BEAR TANK SPRING Section 2: Hydrological Observations

			Spri	ng Flow		V	Vater Quality Parame	eters				
						Electrical	Specific		Dissolved			
			Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
05-2012		WRI	0								No	Dry
12-Feb-13	12:40	M&A/RC	0.65	stopwatch & 1/2 gal container							No	Seepage in chan inflow observed f conglomerate wit of canyon about breached(?) head rate was measure emerges on cany cows
18-Feb-13	16:40	M&A/RC	0.65	stopwatch & 4 L cubitainer	69.8		710	3.0	4.5	7.3	Yes	Sample collected main pool is clear by cows
26-Jun-13	12:22	RC	0		86.4		769		3.0	6.6	Yes	Sample collected
7-Aug-13	11:02	RC	0		81.0	717	685		2.0	8.4	Yes	Greenish-brown
28-Oct-13	14:27	RC	< 1		68.0	588		4.6		7.9	Yes	Small poolabou
4-Mar-14	11:50	RC	3		65.3	480		2.3		8.0	Yes	Murky; no odor; s flowing ~1 to 5 gp
21-May-14	12:07	RC	0		81.9	738		11.4	0.4	8.5	Yes	Murky; no odor; r
14-Aug-14	8:38	RC	0		79.3	367.0		11.9	6.6	8.9	Yes	Murky; no odor; s
4-Nov-14	12:42	RC			62.1	610.0				8.6	Yes	Sample collected
4-Mar-15	11:00	RC	0		58.0	703		1.9	12.5	6.9	Yes	Clear; no visible f
13-May-15	10:40	RC	0		72.5	724.0		4.3	9.5	7.8	Yes	Murky; no visible
9-Sep-15	12:40	RC			84.2	293		7.2	16.0	9.7	Yes	Very murky; no o
20-Oct-15	12:54	RC	0		73.9	316			12.4	9.0	Yes	Clear with yellow
24-Mar-16	13:45	RC	0		67.1	668.0		8.8	12.8	7.3	Yes	Slightly murky wa
28-Apr-16	14:10	RC	1		75.5	722		14.8	14.0	7.8	Yes	Murky with surfici the surface from flowing ~1 GPM;
26-Jul-16	12:25	RC	0		92.0	311		33.3	24.6	9.6	Yes	Murky; film on su observed pool 1/4 component: same



#### OBSERVATIONS

nel alluvium about 40 feet upstream from first large pool (main pool); from creek bottom to main pool; much of the creek floor is on Gila th thin alluvial cover; pipe in low outcrop of conglomerate on NW wall 120 feet downstream from main pool; remnant of possible old dwall about halfway between main pool and pipe in canyon wall; flow ed at pipe; persistent intermittent flow downstream from where water yon floor, but not upstream; large main pool is heavily impacted by

I from pipe in canyon wall downstream from the main pool; no odor; r to murky with lots of floating organic matter; pool area is impacted

from stagnant pool

water; small pool; no flow; no odor; sample collected from pool

It 250 gallons; sample collected from pool

sample collected from pool downstream from spring; stream is pm

no evidence of flow; sample collected from spring-fed pool

stagnant; sample collected from spring-fed pool

from spring-fed pool

flow; no odor; sample collected from spring-fed pool

e flow; no odor; sample collected from spring-fed pool

odor; sample collected from spring-fed pool

vish brown tint; no visible flow; no odor

ater; no visible flow; no odor; sample collected from spring-fed pool

ial film (algae?); no odor; no visible flow; small bubbles coming up to depth - inflow?; lots of floating organic material; nearby pipe is sampled from spring-fed pool

Irface; no evidence of flow; odor; no flow out of pipe downstream; 4 mile downstream close to the road - possible groundwater ple collected from pool



# BEAR TANK SPRING Section 2: Hydrological Observations

			Sprii	ng Flow		Water Quality Parameters						
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
9-Nov-16	8:55	RC	<1		58.7	166		45.7	8.2	7.5	Yes	Water is murky; r spring-fed pool. 76.66 °F, Actual ( was taken in a 1 approx. 1/4 mile ( Conductivity: 186 of formation (<0.2
30-Mar-17	13:30	RC	0.25 - 2		75.6	416		261.0		8.1	Yes	Clear to semi-mu approx. 0.25 GPN Upstream flow a formation downst
05-2017		WRI			88.3	740				8.8	No	Water is pooled a
29-Jun-17	10:07	RC	0		82.1	773		150.0	18.4	9.0	Yes	Very murky with g
31-Aug-17	14:00	M&A	0.2		82.8		759	0.6		7.1	Yes	Clear; very light y

RC = Resolution Copper

WRI = Westland Resources, Inc.

M&A = Montgomery & Associates



#### OBSERVATIONS

minor floating debris; no odor; no visible flow; sample collected from Took parameters from 1" steel pipe 100 ft downstream: Temp: Conductivity: 692 µS, pH: 7.44, DO: 4.90 mg/L (DO measurement Liter bottle), clear water, <1GPM. Took parameters from pool downstream from Bear Tank Spring: Temp: 61.75 °F, Actual 6 µS, DO: 8.56 mg/L, pH: 8.26, water is murky; seeps on south side 1GPM); depth of pool is at least 4.5 ft.

urky; no odor; water is flowing into tank from ~20 ft long reach at M. Surface water is flowing downstream and upstream of tank. remnant reach from winter storm run-off? 1-inch pipe plumbed into tream is flowing ~2 GPM

at upper end and seeps over approximately 50 meters.

green tint; foul odor; sample collected from pool; no flow from nearby

yellow.



## BEAR TANK SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE							
South	South Center 3 Alluvium over bedrock									
ASPLET       SIDE OF CARTON       SLOPL //       SUBSTRATE         South       Center       3       Alluvium over bedrock         COMMENTS:       Several seeps that occur in the contact between the bedrock strata maintain a pool at the upstream contact and several wet areas over approximately 40 neters that support herbaceous plants. There is an open-ended horizontal pipe coming out of a concrete slab that drips water, evidence of former spring development. A lone Goodding's willow (Salix gooddingii) and an understory of annual forbs and grasses are present. The vegetation on the slopes mmediately adjacent to the spring area is desert scrub. Downstream where the canyon crosses the road, a tinaja may hold water for up to several months following rain events and supports a small patch of herbaceous wetland vegetation.										

#### **BIOLOGICAL OBSERVATIONS**

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED*	MAMMAL FAUNA OBSERVED*
May 2012	Water not present	None observed	Cynodon dactylon	None	None Recorded	None Recorded	None Recorded	None Recorded
May 2017	The uppermost water feature is a 10 by 10-meter pool at the base of a conglom-erate ledge, 30-meter downsteam small seeps at the base of a willow flow another 10-meter and con-verge with another seep under a bedrock ledge. A further 5-meters downstream a muddy pool is formed under an open- ended horizontal spring pipe.	None observed	Bermuda grass (Cynodon dactylon), beardless rabbitsfoot grass (Polypogon monspeliensis)	seepwillow (Baccharis salicifolia), yellow monkeyflower (Mimulus guttatus), watercress (Nasturtium officinale)	canyon ragweed (Ambrosia ambrosiodes), Bermuda grass (Cynodon dactylon), cocklebur (Xanthium strumarium)	boatmen, backswimmers, beetles, belostomatids, toebiters, water scorpions, Sonoran desert toad (Incilius alvarius), Sonoran mud turtle (Kinosternon sonoriense)	Abert's towhee (Pipilo aberi), barn owl (Tyto alba), common raven (Corvus corax), Gambel's quail (Callipepla gambelii), Gila woodpecker (Melanerpes uropygialis), greater roadrunner (Geococcyx californianus), house finch (Carpodacus mexicanus), unidentified owl, mourning dove (Zenaida macroura), Northern cardinal (Cardinalis cardinalis), redtailed hawk (Buteo jamaicensis), turkey vulture (Cathartes aura), white-winged dove (Zenaida asiatica)	blacktailed jackrabbit (Lepus californicus), bobcat (Lynx rufus), cottontail (Sylvilagus audubonii), coyote (Canis latrans), gray fox (Urocyon cinereoargenteus), javelina (Tayassu tajacu), mule deer (Odocoileus hemionus), rock squirrel (Spermophila variegatus), whitetailed deer (Odocoileus virginianus), unidentified bat

\*Incidental Observations on date of visit and wildlife camera observations February 2014 - March 2016







**Photo I.** Bear Tank, view of 10- by 10-meter pool, June 2017.



Photo 3. Bear Tank, view of seep around open-ended horizontal spring pipe, June 2017.



road, June 2017.



Photo 2. Bear Tank, view of small seeps at base of Goodding's willow, June 2017.



Photo 4. Bear Tank, view downstream from 10- by 10-meter pool Goodding's willow, June 2017.

# **BEAR TANK SPRING** Section 4: Photographs



Photo 5. Bear Tank, view downstream from Goodding's willow towards



**Photo 6.** Bear Tank, view of tinaja below road. June 2017.



# BENSON SPRING Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION					
		Benson Spring is located in bottom of Benson Spring Canyon; appears to dischare					
Benson Spring	None	contact with Pinal Schist; seeps emanate from bedding pla	anes in the Gila Conglome				
COUNTY	CADASTRAL (40-acre)	southeast ledge with pool and pumping equipment. Uppe	r portion of spring is a 20 k for approximately 50 meter				
Pinal	(D-01-11)35da						
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND				
			Superior AZ 15' (19				
U.S. Forest Service	Tonto National Forest	Picketpost, AZ / Yes	Picketpost AZ 7.5' (				
GEOREFERENCE							
SOURCE OF GEOREFERENCE DATA	DATUM						

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
481576	3684496	2300 feet amsl	Estimated from US

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Well ?
Yes	Yes	36-76642 (Martin); 36-14696 (USFS)	No

### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW CONSISTEN
Middle Gila	Queen Creek	Benson Spring Canyon	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000405	Alamo Canvon - Queen Creek		

### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	
Seepage or filtration	Gila Conglomerate (Tg)	Rheocrene	Bedding in Gila Cor
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
gravity	mixed runoff/spring dominated	Yes	

### INFRASTRUCTURE

FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
concrete headwall at mouth of small			
cave/sump	Evidence of piping from small cave/sump	Exclosure fencing around source of spring and main pools	Main pond at top of
ACTIVELY USED?	USE?		
Yes?	Stock watering/wildlife?		



e from Gila Conglomerate upstream from erate; site has fenced exclosure; 2 main ; small cave with headwall and sump along by 20-meter tinaja in conglomerate. Seeps ers, with several small pools along the flow.

### EDITIONS WHERE SHOWN

948) (2004, 2011, 2014)

### RCE

GS 7.5' Topo

NCY

OGIC UNIT

nglomerate?

f spring area, several smaller pools below



# BENSON SPRING Section 2: Hydrologic Observations

			Spring Flow		Water Quality Parameters			Water Quality Parameters				
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
31-Oct-02		WRI	DRY								No	Dry
17-Sep-03	9:54				81.9	231			7.4	8.3	No	
05-2012		WRI									No	Water present in
18-Feb-13	14:04	M&A/RC	0		68.4		224			8.6	No	No observed flow conglomerate; in smaller pools do
7-Aug-13	10:30	RC	0		81.0	237	277		1.9	8.3	Yes	No flow
28-Oct-13	13:43	RC	DRY								No	Dry
4-Mar-14	11:00	RC	0		62.8	98		13.2	2.0	7.9	Yes	No flow; murky; r alluvium; sample
21-May-14	11:45	RC	DRY								No	Dry
8-Aug-14	11:00	RC	0								No	~20-25 gallons ir water
4-Nov-14	12:14	RC	0								No	No visible flow; w tint; water is likel
4-Mar-15	11:35	RC	0		59.4	150		1.9	10.3	8.2	Yes	Murky; no visible
13-May-15	11:05	RC	0								No	Dry except for tir
9-Sep-15	13:20	RC	0		86.5	151		22.0	10.9	9.9	Yes	Murky; no visible
20-Oct-15	12:20	RC	0		74.6	161			9.5	8.9	Yes	Clear water with
22-Jul-16	14:33	RC	0								No	Big, murky, fetid
9-Nov-16	10:25	RC	0		61.0	115		75.1	6.1	8.3	Yes	Murky; minor floa sampled from up
30-Mar-17	14:10	RC	0		75.8	265		75.1	11.8	8.9	No	Slightly murky; lo
06-2017		WRI			81.8	915				8.3	No	Standing water p
22-Jun-17	13:12	RC			95.4	1080		4.6	3.1	7.4	Yes	Sample collected bedding plane

WRI = WestLand Resources, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown



#### OBSERVATIONS

three small pools and a small channel of water

v; damp soft bedding plane at base of 10 ft ledge of competent npacted by cows; standing water in potholes on top of ledge; several wnstream

no odor; could be connected to lower pool as flow disappears into ed from upper pool

n pool; dark green; murky and stagnant; no visible flow; likely rain

vater level in pool is much higher than usual; murky with dark yellow y run-off

e flow; no odor; sampled from upper pool

ny murky puddle

flow; no odor; sampled from upper pool

brownish tint; no visible flow; no odor; sampled from pool

pool; impacted by cows; high water level due to recent rain

ating debris; no visible flow; no odor; both pools in area are filled; oper pool

ots of floating debris; no inflow

resent in pool; water pesent in three pools and a small channel

d 70 feet downstream from usual location; seep on Gila conglomerate



# BENSON SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
Southwest	Center	5	Clay loam

### COMMENTS

Several seeps occur in the contact between the bedrock strata; seasonally present are pools and a channel of water that supports herbaceous plants. There is a small cave in the bedrock with water and open-ended metal spring pipe as evidence of former spring development. A canopy of Fremont cottonwood (Populus fremontii), Goodding's willow (Salix gooddingii), desert willow (Chilopsis linearis) and netleaf hackberry (Celtis reticulata) contribute to a thick layer of leaf litter. An understory of annual forbs and grasses cover the ground. The vegetation on the slopes immediately adjacent to the spring area is desert scrub with palo verde (Parkinsonia spp.), saguaro (Carnegeia gigantea), and velvet mesquite (Prosopis velutina).

#### **BIOLOGICAL OBSERVATIONS**

		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES	AQUATIC FAUNA	BIRD FAUNA	MAMMAL FAUNA
DATE	WATER PRESENCE	SPECIES	INVASIVE SPECIES	OBSERVED	OBSERVED	OBSERVED	OBSERVED*	OBSERVED*
October 2002	No surface water present	None observed	None Recorded	None Recorded	None Recorded	Sonoran mud turtle (Kinosternon sonoriense)	Harris' hawk (Parabuteo unicinctus), Gambel's quail (Callipepla gambelii), Gila woodpecker (Melanerpes	None Recorded
May 2012	Water present in three pools and channel	None observed	Bermuda grass (Cynodon dactylon), sowthistle (Sonchus sp.), beardless rabbitsfoot grass (Polypogon monspeliensis)	pale spikerush (Eleocharis macrostachya), cattail (Typha sp.)	fleabane (Erigeron sp.), flax (Linum sp.), purslane (Portulaca suffrutescens)	Sonoran mud turtle (Kinosternon sonoriense)	None Recorded	None Recorded
June 2017	Upper portion of spring is a 20 by 20-meter tinaja in conglomerate. Seeps occur downstream from the loamy substrate and continue for approximately 50 meters, with several small pools along the flow.	None observed	Cynodon dactylon, Sonchus sp., Polypogon monspeliensis	Eleocharis macrostachya, toadrush (Juncus bufonius), yellow monkeyflower (Mimulus guttatus),pondweed (Potamageton sp.), speedwell (Veronica anagallis-aquatica)	Portulaca suffrutescens	Beetles, water striders, Sonoran desert toad (Incilius alvarius), red spotted toad (Anaxyrus punctatus)	Harris' hawk (Parabuteo unicinctus), Gambel's quail (Callipepla gambelii), Gila woodpecker (Melanerpes uropygialis), greater roadrunner (Geococcyx californianus), great horned owl (Bubo virginianus), Western screech owl (Megascops kennicottii), white-winged dove (Zenaida asiatica)	blacktailed jackrabbit (Lepus californicus), bobcat (Lynx rufus), coyote (Canis latrans), gray fox (Urocyon cinereoargenteus), javelina (Tayassu tajacu), mule deer (Odocoileus hemionus), rock squirrel (Spermophila variegatus), western canyon bat (Parastrellus hesperus), cave myotis (Myotis velifer), Yuma myotis (Myotis yumanensis), pallid bat (Antrozous pallidus)

\*Incidental Observations on date of visit and wildlife camera observations February 2014 - March 2017







**Photo I.** Benson Spring, view of bedrock strata and area that holds pool of water seasonally, November 2002.



**Photo 2.** Benson Spring, view of pool and upland desert scrub adjacent to the spring area, March 2009.



**Photo 3.** Benson Spring, view of a Sonoran mud turtle near a pool with herbaceous vegetation including beardless rabbits foot grass, Bermuda grass and cattail, May 2011.



**Photo 4.** Benson Spring, view of cave in bedrock and trunks of Goodding's willows, June 2017.



**Photo 6.** Benson Spring, view of pool with herbaceous vegetation including pale spikerush and yellow monkeyflower, June 2017.



BENSON SPRING Section 4: Photographs



**Photo 5.** Benson Spring, view upstream from fence at south end of enclosure showing Goodding's willow and velvet mesquite with understory of Bermuda grass and beardless rabbit's foot grass, June 2017.



# BITTER SPRING Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION			
		Bitter Spring is a developed spring that occurs in incise	ed channel of an unnamed trib		
Bitter Spring	None	is constructed at the top of a hand dug sump or well, a	ell, approximately 8 feet by 6 feet.		
COUNTY	CADASTRAL (40-acre)	running along bottom of V-notch. Some evidence of de	evelopment or excavation from		
Pinal	(D-01-12)13cd	downstream nom sump.			
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND EDI		
U.S. Forest Service	Tonto National Forest	Superior, AZ/ yes	Superior, AZ (2011,		
GEOREFERENCE					
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE			
GPS	NAD83	12Z			
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOURCE		
491936	3688855	3640 feet amsl	Estimated from USC		
ADMINISTRATIVE					
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?		
Yes	Yes	36-24054 (USFS)	No		
HYDROLOGY					
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW CONSISTENCY		
Middle Gila	Queen Creek	Silver King Wash	Intermittent/epheme		
HYDROLOGIC UNIT CODE (HUC)	HUC Basin				
Middle Gila HYDROLOGIC UNIT CODE (HUC)	Queen Creek HUC Basin	Silver King Wash			

#### GEOMORPHOLOGY

150501000402

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLOGIC
Fracture-controlled with contact	Cretaceous quartz diorite (TKg) with Pinal		Diorite may act is ba
contribution from pCpi 100 feet upstream	schist (pCpi) upstream	Rheocrene	in diorite probably fe
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
gravity	mixed runoff/spring dominated	Yes	

Silver King Wash - Queen Creek

#### INFRASTRUCTURE

FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
	Hand dug sump with solar pump; piping from		No; steel storage ta
Yes	sump to closed steel tank and trough	solar panel and pump	spring sump
ACTIVELY USED?	USE?		
Voc2	Stock watering/wildlife?		



Dutary of Silver King Wash. A wooden deck Deck is 3 - 4 feet above the bottom of the controlled with prominent open fracture in sump, with some alluvium or fill material

### TIONS WHERE SHOWN

, 2014)

GS 7.5' Topo

eral

**C UNIT** arrier for discharge from pCpi, but fractures eed sump

ank and concrete trough downstream from



# BITTER SPRING Section 2: Hydrological Observations

Spring Flow		ng Flow		I	Nater Quality Parame	eters						
						Electrical	Specific		Dissolved			
			Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
9-Aug-12		M&A	0								No	Developed sprin wooden deck; sc
9-Sep-15	9:49	RC			76.9	696		3.4	9.5	8.9	Yes	Murky
1-Dec-15	11:50	RC			42.3	440			11.7	9.0	Yes	No visible flow; r
17-Mar-16	11:30	RC			65.2	514		0.6	7.5	8.3	Yes	Water is clear, co
10-Jun-16	10:35	RC			87.3	978		1.0	4.9	8.1	Yes	Clear water; hea
26-Jul-16	10:35	RC			90.2	999		1.3	5.1	7.8	Yes	Water is flowing green algae. No
11-Nov-16	12:00	RC			65.2	682		0.6	7.4	8.1	Yes	DO measuremer
29-Mar-17	11:30	RC			64.9	619		1.1	7.6	8.4	Yes	Water is very cle
05-2017		WRI									No	Surface water pr
22-Jun-17	8:50	RC			88.9	807		0.9	5.0	8.4	Yes	From spigot; clea

WRI = WestLand Resources, Inc. M&A = Montgomery & Associates RC = Resolution Copper ---- = unknown



#### OBSERVATIONS

g; hand dug well in	channel; depth to w	vater 12.21 feet	below top of
lar panel and pum	o installed.		

nurky water in trough, clear from tank

omes from water tank. Trough is murky.

rd tank fill up after discharging from spiggot.

into trough. Water is clear from tap; water in trough is murky with ot able to detect natural flow.

nt was taken from 1 Liter bottle.

ear; trough is filled 2/3 full. DO measurement taken in 1L field bottle.

esent

ar



# BITTER SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE									
Southwest	Northeast	15	Bedrock									
COMMENTS												
Spring occurs in in	Spring occurs in incised channel, and is not visible from above. In the streambed, below a rock outcrop, surface water flow is present and supports a dense patch of											
herbaceous vegetation. Aquatic invertebrates and tadpoles are present. No riparian vegetation overstory. Upland vegetation of desert scrub continues to edge of channel.												

#### **BIOLOGICAL OBSERVATIONS**

		SPECIAL STATUS			OTHER PLANT SPECIES	AQUATIC FAUNA		MANINAL FAUNA
DATE	WATER PRESENCE	SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OBSERVED	OBSERVED	BIRD FAUNA OBSERVED	OBSERVED
May 2017	Surface water present	None Observed	None Observed	toadrush (Juncus bufonius), yellow monkeyflower (Mimulus guttatus)	oats (Avena sp.), ragwort (Senecio sp.), plumeseed (Rafinesquia), Indian paintbrush (Castilleja sp.), poppy (Eschscholzia sp.)	water boatmen, tadpoles	None Observed	None Observed







**Photo 1.** Bitter Spring sump, view downstream, dry conditions, August 2012.



Photo 3. Bitter Spring sump and fracture-controlled canyon upstream, sump collared in quartz diorite, Pinal schist crops out 100 feet upstream, August 2012.







Photo 2. Bitter Spring, view of flow with yellow monkeyflower and oats, May 2017.



Photo 4. Bitter Spring, view of bedrock in streambed surrounded by herbaceous vegetation, May 2017.

**BITTER SPRING** Section 4: Photographs



Photo 5. Bitter Spring, view of dense patch of herbaceous vegetation including oats, ragwort, plumeseed, Indian paintbrush and poppy, May 2017.



Photo 6. Bitter Spring, view of surface water flow and dense patch of ragwort in upper right of photograph, May 2017.



# **BORED SPRING Section 1: General Information**

### 

GENERAL INFORMATION					
SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION			
Bored Spring	Bored Well Spring	Bored Spring is located in a small drainage immediatel Water seeps out of the ground below a medium-sized of	y east of Arizona Highway 177 cottonwood tree. Water prese		
COUNTY	CADASTRAL (40-acre)	trough downstream. Substantial reworking of land surf	ace in the area; historical repo		
Pinal	(D-02-12)11cb	source of spring normanesian now - not located.			
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND EDI		
U.S. Forest Service	Tonto National Forest	Superior AZ / Yes	Superior AZ 7.5' (20		
GEOREFERENCE					
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE			
GPS	NAD83	12Z			
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOURCE		
491129	3681159	2880 feet amsl	Estimated from USC		
ADMINISTRATIVE					
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?		
Yes	Yes	4A-2014 (USFS)	No		
HYDROLOGY					
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTENCE		
Middle Gila	Queen Creek	Pacific Canyon	Intermittent		
HYDROLOGIC UNIT CODE (HUC)	HUC Basin				
150501000402	Silver King Wash-Queen Creek				
GEOMORPHOLOGY					
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLOGIC		
Contact	Qal - alluvium/pCd - diabase	Anthropogenic	Diabase/Concentrat		
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS			
Gravity	Mixed runoff/spring dominated	Developed area below seep			
INFRASTRUCTURE					
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?		
Yes	discharge pipe into cement trough	Man-made spring	Yes		
ACTIVELY USED?	USE?				



unknown

unknown

177 downslope from diabase rock quarry. esent in 5 meter diameter pond with a cattle eports of a well near this location as possible

### DITIONS WHERE SHOWN

2011, 2014)

SGS 7.5' Topo

**SIC UNIT** 

rator Fault



# **BORED SPRING** Section 2: Hydrological Observations

Spring Flow			ng Flow		W	ater Quality Param	eters					
						Electrical	Specific		Dissolved		1	
			Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
1-Nov-02		WRI									No	No water preser downstream
26-May-04	14:00	GAI	<0.1	estimated	80.1		446	4.5	>20.0	10.1	Yes	
3-Nov-04	12:40	GAI	<0.1	estimated	53.1		540	0.8	12.5	7.9	Yes	
9-Feb-05	10:07	GAI	1.1	Bucket & Stop Watch	65.3		598	7.7	6.4	7.7	Yes	
3-May-05	13:40	GAI	1.3		74.1		523	0.4	10.4	7.6	Yes	
3-Aug-05		GAI	0.5	estimated	76.3		609	1.9	3.6	7.1	Yes	
21-Aug-08		M&A	0								No	Dry
13-Nov-08	10:30	RC	<0.1	estimated	64.4		642	9.8		7.9	Yes	
12-Feb-09	8:15	RC	<0.1	estimated	52.7		592	4.8	6.2	7.5	Yes	
13-May-09	15:00	RC	<0.1	estimated	88.9		465	1.9	>20.0	9.6	Yes	
4-Aug-09	10:09	RC	DRY								No	Dry
12-Feb-10	13:30	RC	0.17	Bucket & Stop Watch	60.1		609	2.7	7.4	8.2	Yes	Abundant green
13-Jul-10	11:30	RC	0						0.6	7.6	No	10 gallons in tro
9-Nov-10	11:30	RC	0		60.8		580	1.9	8.7	7.4	Yes	No inflow to trou
14-Feb-11	11:22	RC	0		52.3		682			8.8	No	Trough full but n
13-May-11	10:45	RC	1	estimated	73.9		719			8.4	No	Foul smelling wa
7-May-12	13:00	RC	1	estimated	73.8		573	12.2	8	8.6	Yes	
2-Jun-14	11:45	RC	DRY								No	Dry
22-Aug-14	11:00	RC									No	Trough filled with green tint.
9-Mar-16	8:30	RC	1	estimated	55.2	604		1.5	5.3	7.8	Yes	First time in 2 ye pipe, source un



### OBSERVATIONS

nt in 20-meter x 8-meter man-made spring with a cattle trough

algae

ugh (stagnant)

ugh; water color brown

no flow into it

ater flowing over sides of through

th 5-10 gallons of what appears to be rain water. Stagnant, murky,

ears seeing water in trough; approx 1 gpm flow into trough from 1" known; plumbed into hillside?



# BORED SPRING Section 2: Hydrological Observations

			Sprii	ng Flow		W	ater Quality Param	eters				
						Electrical	Specific		Dissolved			
			Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
8-Jun-16	11:12	RC	0								No	No inflow; stagna algae.
28-Jul-16	12:55	RC	DRY								No	Dry
1-May-17		WRI				752				7.7	No	A stagnant pool ovegetation. A mu Water is piped ir

WRI = WestLand Resources, Inc.

GAI = Golder Associates

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown

NOTE: Results of hydrochemical analysis for this spring are presented in the following reports:

Montgomery & Associates, 2010, Interim results of groundwater monitoring, Upper Queen Creek and Devils Canyon watersheds: Final report prepared for Resolution Copper Mining LLC, February 17, 2010.

Montgomery & Associates, 2012, **Results of hydrochemical characterization, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, March 9, 2012.

Montgomery & Associates, 2013, **Surface water baseline report, Devils Canyon, Mineral Creek, and Queen Creek watersheds:** Final report prepared fro Resolution Copper Mining LLC, May 16, 2013.

Montgomery & Associates, 2016, Hydrochemistry addendum, groundwater and surface water, Upper Queen Creek/Devils Canyon study area: Final report prepared for Resolution Copper Mining LLC, August 11, 2016.



### OBSERVATIONS

ant water (thought to be rain water) 6" deep. Lots of bright green

of approximately 5-meter diameter, with cattle sign, is fringed by uddy stretch extends about 20 meter downstream from the pool. nto a cement trough, which was overflowing.



# BORED SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

Southwest	Center	3	Soil	
ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE	

#### COMMENTS

In a small drainage immediately east of AZ Highway 177, west of the rock quarry a 20 by 8 meter depression in the ground is overstoried by a large Fremont cottonwood (Populus fremontii). The depression is muddy and evidently held water recently. Approximately 20 meters southwest a cement trough is present. Spring area has concentration of riparian vegetation, with a string of scattered riparian trees for approximately 150 meters southwest. Other trees present include Goodding's willow (Salix gooddingii), velvet mesquite (Prosopis velutina), saltcedar (Tamarix sp.), and African sumac (Rhus lancea).

#### **BIOLOGICAL OBSERVATIONS**

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
November 2002	Water not present	None observed	None recorded	cattail (Typha sp.)	None recorded	None recorded	None recorded	Javelina (Tayassu tajacu)
May 2017	Water seeps out of the ground below a large cottonwood. A stagnant pool of approximately 5- meter diameter, with cattle sign, is fringed by vegetation. A muddy stretch extends about 20 meter downstream from the pool. Water is present in a cement trough, which was overflowing.	None observed	red brome (Bromus rubens), Bermuda grass (Cynodon dactylon), fountain grass (Pennisetum setaceum), African sumac (Rhus lancea), saltcedar (Tamarix sp.)	yellow monkeyflower (Mimulus guttatus), Goodding's willow (Salix gooddingii)	canyon ragweed (Ambrosia ambrosiodes), desert broom (Baccharis sarothroides), yellow clover (Melilotus officinalis), blue paloverde (Parkinsonia florida)	boatmen, beetles	None observed	javelina (Tayassu tajacu), mule deer (Odocoileus hemionus)







Photo I. Bored Spring, view of Fremont cottonwood at edge of depression with the wetland plant cattail, November 2002.



Photo 2. Bored Spring, view east showing Fremont cottonwood in background and cement trough in midground, November 2002.



Photo 3. Bored Spring, view of Fremont cottonwood at edge of muddy depression, May 2017.



Photo 4. Bored Spring, closeup view of muddy depression with stagnant pool below Fremont cottonwood, May 2017.







### **BORED SPRING Section 4: Photographs**

Photo 5. Bored Spring view of cement trough and overflow creating small flow. AZ Highway 177 is visible in the background, May 2017.

background and cement trough in midground. The invasive plant, Bermuda grass is visible in the foreground, May 2017.



# CONLEY SPRING Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
Conley Spring	None	Spring located in narrow drainage that runs parallel to the	Conley Spring falut. Surfa
COUNTY	CADASTRAL (40-acre)	ends where bedrock turns into sandy bottom. Travertine- limestone cropping out locally.	cemented cobbles in char
Pinal	(D-01-12)24cc		
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
U.S. Forest Service	Tonto National Forest	No	N/A

#### GEOREFERENCE

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
491459	3687135	3640 feet amsl	Estimated from US

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	No	N/A	No

#### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Queen Creek	Silver King Wash	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		

### GEOMORPHOLOGY

No

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere) PERCHING (				
Fracture/contact spring	Younger Precambrian Mescal (pCm) or Dripping Springs quartzite (pCds); Conley Spring fault zone	Rheocrene	Younger Precambri			
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS				
Gravity	Mixed runoff/spring dominated	None evident locally				
INFRASTRUCTURE						
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?			
Unknown	old steel pipe evident	none	none			
ACTIVELY USED?	USE?					



No

face flow starts in small pool underneath dead eters, occasionally forming small pools. Flow nnel. Highly faulted diabase, quartzite and

### D EDITIONS WHERE SHOWN

### RCE

GS topo map

NCE

OGIC UNIT

ian Diabase (pCd) and/or possibly the fault



# CONLEY SPRING Section 2: Hydrological Observations

			Spri	ng Flow			Vater Quality Parame	eters				
			Flow		Temperature	Electrical Conductivity	Specific Conductance	Turbidity	Dissolved Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
9-Aug-12	13:30	M&A	DRY								No	Dry, but recently cemented cobble cottonwood; son
05-2017		WRI			68.0	902				8.1	No	Incised channel

WRI = WestLand Resources, Inc. M&A = Montgomery & Associates RC = Resolution Copper --- = unknown



#### OBSERVATIONS

v active travertine in steep-sided V-notch channel; travertine es and flowstone whre channel opens up; native tobacco, dead ne cattails;

has flow for about 100 meters.



# CONLEY SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
Northwest	Center	10	Conglomerate
COMMENTS			

Spring occurs in incised channel, and is not visible from above. Water seeps where bedrock intrudes across stream channel. Flows and small pools are present for approximately 100 meters occupied by aquatic invertabrates and tadpoles. Where water is present herbaceous vegetation grows along the streambed. Flow ends where bedrock lined channel becomes sandy bottom. No riparian vegetation overstory. Upland vegetation of desert scrub continues to edge of channel.

#### **BIOLOGICAL OBSERVATIONS**

								1
DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
May 2017	Incised channel has flow for about 100 meters. Surface flow starts in small pool underneath dead cottonwood. Watercress is present in the pool. The surface flow extends over bedrock substrate for over 100 meters, occasionally forming small pools with aquatic insects and tadpoles present. Flow ends where bedrock turns into sandy bottom.	None observed	fountain grass (Pennisetum setaceum)	Algae, hummingbird trumpet (Epilobium canum), yellow monkeyflower (Mimulus guttatus), watercress (Nasturtium officinale)	oats (Avena sativa)	Beetles, water striders, tadpoles	No Records	No Records







**Photo 1.** Conley Spring, view of small pool underneath dead cottonwood where surface flow starts. Watercress and yellow monkeyflower are present, May 2017.



**Photo 2.** Conley Spring, view of flow and pool with yellow monkeyflower, May 2017.



**Photo 3.** Conley Spring, view of oats and the invasive plant fountain grass growing along the channel, May 2017.



**Photo 4.** Conley Spring, view of flow along bedrock lined channel, May 2017.



**Photo 5.** Conley Spring, view of tadpoles where flow pools along stream channel, May 2017.



**Photo 6.** Conley Spring, view of end of flow where bedrock lined channel becomes sandy bottom, May 2017.



CONLEY SPRING Section 4: Photographs



# CROSS CANYON SPRING Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
		Large inactive travertine mound in bottom of Cross Canyor	n near contact between Pa
Cross Canyon	Cross	abundant faulting in area. No evidence of modern flow. T	ravertine is deeply eroded
COUNTY	CADASTRAL (40-acre)	Paleospring was likely upstream from the mound as there mound.	is evidence of travertine fo
Pinal	(D-02-12)02db		
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
U.S. Forest Service	Tonto National Forest	No	
GEOREFERENCE			
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS (M&A)	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
491923	3682881	3100 feet amsl	Estimated from USG
ADMINISTRATIVE			
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	None	NA	NA
HYDROLOGY			
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Queen Creek	Cross Canyon	dry, paleo-feature
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		
GEOMORPHOLOGY			
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLO
Contact	Dm - Martin Limestone?; Fault?	Paleospring	Fault? Cb - Bolsa Qu
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Runoff dominated	None	
INFRASTRUCTURE			
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
none	none		no
ACTIVELY USED?	USE?		
No			



aleozoic limestones and quartzites with I with no evidence of recent deposition. or several hundred meters above the

### EDITIONS WHERE SHOWN

### RCE

GS 7.5' topo

### ICE

### OGIC UNIT

Quartzite?



# CROSS CANYON SPRING Section 2: Hydrological Observations

			Spri	ng Flow		N	Vater Quality Parame	eters				
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
17-Jul-10	13:40	M&A	DRY								No	No evidence of f ledge of Bolsa C Martin limestone paleospring may
Jun-2011		WRI	DRY								No	No evidence of a

WRI = WestLand Resources, Inc. M&A = Montgomery & Associates RC = Resolution Copper --- = unknown



### OBSERVATIONS

flow. Deeply eroded travertine mound in bottom of canyon where Quartzite crosses canyon; fault running parallel to canyon offsets e and Bolsa qtzt. Travertine evident upstream from main mound y have been several hundred meters above mound

active spring



# CROSS CANYON SPRING Section 3: Biological Observations

### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE						
West	Center	2	Bedrock						
COMMENTS	COMMENTS								
Depicted on the topographic map as a spring at the confluence of two canyons. This spring has not been located in several field efforts. Some more robust upland									
regetation visible along a limestone fault with travertine calcium carbonate deposits.									

### **BIOLOGICAL OBSERVATIONS**

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
November 2002	None	None observed		None Observed	Saguaro (Carnegeia gigantea), cholla (Cylindropuntia sp.), ocotillo (Fouquieria splendens), mimosa (Mimosa sp.), palo verde (Parkinsonia sp.), prickly pear (Opuntia sp.), jojoba (Simmondsia chinensis)	N.A.	No Records	No Records
May 2011	None	None observed		None Observed	cane cholla (Cylindropuntia spinosior), catclaw acacia (Senegalia greggii), chuparosa (Anisacanthus thurberi), whitethorn acacia (Vachellia constricta), mariola (Parthenium incanum), brittlebush (Encelia farinosa), golden agave (Agave chrysantha), beebush (Aloysia wrightii), jojoba (Simmondsia chinensis)	N.A.	No Records	No Records







Photo I. Cross Canyon, view upstream from west of travertine mound, July 2010.



Photo 2. Cross Canyon, view of travertine mound from the south, November 2002.



**Photo 3.** Cross Canyon, view from south of Cross canyon, November 2002



Photo 4. Cross Canyon, view vegetation along channel showing catclaw acacia and jojoba, June 2011.

Photo 5. Cross Canyon view upstream showing no evidence of spring, June 2011.



Photo 6. Cross Canyon, cave formed in travertine mound, no evidence of modern flow, July 2010.



**CROSS CANYON Section 4: Photographs** 





# SPRING DC 4.1 E Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION					
DC 4.1 E	Monkey Spring	DC4.1E discharges from the Apache Leap Tuff on the eas	DC4.1E discharges from the Apache Leap Tuff on the east wall of Devils Canyon.				
COUNTY	emerging from 10-m high walls above canyon floor, quickl during 2002 during Resolution spring and seep surveys.	nyon floor, quickly infiltrates unconsolidated					
Pinal	(D-02-13)22ba						
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND				
U.S. Forest Service	Tonto National Forest	No	N/A				

### GEOREFERENCE

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
499211	3678638	2720 feet amsl	Estimated from US

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	No	N/A	No

#### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Devils Canyon	Southern Reach	Perennial/intermitte
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000205	Devils Canvon		

### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL
Seepage or filtration; fracture control	Apache Leap Tuff/surficial colluvium	hanging garden	Apache Leap Tuff
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Spring dominated	none	

### INFRASTRUCTURE

FLOW MODIFICATION?		PIPING or other DIVERSION?	OTHER	POND?
	none	none	NA	no
	ACTIVELY USED?	USE?		
	Yes?	wildlife		



Vertical fins in cliff face suggest fracture of a 200-meter long complex of springs ed materials. Spring DC 4.1 E identified

### **EDITIONS WHERE SHOWN**

### RCE

GS topo map

### ICE

nt

### OGIC UNIT



# SPRING DC 4.1 E Section 2: Hydrological Observations

			Spri	ng Flow		Water Quality Parameters						
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
11-2002		WRI										a 1m by 8m pool.
21-May-03	12:30	GAI			73.8		247	0.2	6.1	8.0	Yes	
26-Aug-03	11:00	GAI			76.6		264	0.3	6.1	7.6	Yes	
11-Nov-03	9:50	GAI			72.0		261	0.1	6.7	7.1	Yes	
10-Feb-04	11:10	GAI	1.5	estimated	68.0		243	0.6	6.8	7.1	Yes	
05-2011		WRI										Water is present fo
20-May-14	13:12	RC	1.5		72.0	278		0.3	9.0	8.1	Yes	Clear; multiple see
28-Aug-14	12:27	RC	3		78.8	273		0.3	7.3	8.1	No	Very clear; minor a
25-Nov-14	12:54	RC	1		70.0	242		0.9	8.1	7.6	Yes	Clear; 1-2GPM.
16-Dec-15	13:45	RC	2		68.0	255			7.8	7.7	Yes	Very clear water; n
24-May-16	11:20	RC	0.3	estimated	60.6	262		4.3	11.7	7.4	Yes	5.0' for this event.
15-Dec-16	12:00	RC	0.8		68.7	241		0.3	7.4	7.6	Yes	Clear; 2 main seep upstream from 2 m
31-Mar-17	12:00	RC	0.1		65.8	232		0.4	7.7	8.0	Yes	Clear; multiple see

WRI = WestLand Resources, Inc. GAI = Golder Associates M&A = Montgomery & Associates RC = Resolution Copper

--- = unknown

NOTE: Results of hydrochemical analysis for this spring are presented in the following reports:

Montgomery & Associates, 2010, Interim results of groundwater monitoring, Upper Queen Creek and Devils Canyon watersheds: Final report prepared for Resolution Copper Mining LLC, February 17, 2010. Montgomery & Associates, 2010, Interim results of groundwater monitoring, Upper Queen Creek and Devils Canyon watersheds: Final report prepared for Resolution Copper Mining LLC, February 17, 2010. Montgomery & Associates, 2010, Interim results of groundwater monitoring, Upper Queen Creek and Devils Canyon watersheds: Final report prepared for Resolution Copper Mining LLC, February 17, 2010. Montgomery & Associates, 2016, Hydrochemistry addendum, groundwater and surface water, Upper Queen Creek/Devils Canyon study area: Final report prepared for Resolution Copper Mining LLC, August 11, 2016.



#### OBSERVATIONS

In a tock wait on east side of carryon for approximately to meters to At this point the water submerges and does not re-emerge until 40

or 70 m in a series of small pools and seeps.

eps coming out of wall

lgae.

nineral deposits on wall.

4. re, it was sampled approx. 0.9 km upstream, thus deemed DC Could not find sample location at 4.1e. Site sampled near westland

os (each with a hanging garden); approx. 0.5-1 GPM; sampled nain seeps

eps flowing with main seep discharging ~0.1 GPM.



# SPRING DC4.1E Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
West	East	25	Bedrock

### COMMENTS

Issues from the east canyon wall of Devils Canyon, then travels down a narrow rock slot to a pool in the streambed. Water goes subsurface and reemerges downstream in flows and pools. Arizona sycamore (Platanus wrightii), Arizona alder (Alnus oblongifolia), burrobush (Hymenoclea salsola), and cottonwood (Populus fremontii) are present along the canyon floor.

#### **BIOLOGICAL OBSERVATIONS**

DATE		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES		BIRD FAUNA	MAMMAL FAUNA
November 2002	Water emerges from a rock wall on east side of canyon for approximately 10 meters to a 1m by 8m pool. At this point the water submerges and does not re-emerge until 40 meters downstream. A few scattered pools are present 200 meters downstream from where the water reemerges.	None Recorded	None	Arizona ash (Alnus oblongifolia), Arizona sycamore (Platanus wrightii), Aravaipa woodfern (Thelypteris puberula var. sonorensis), watercress (Nasturtium officinale), scarlet monkeyflower (Mimulus cardinalis), cattail (Typha sp.)	None Recorded	None Recorded	None Recorded	None Recorded
May 2011	Water is present for 70 m in a series of small pools and seeps.	Aravaipa woodfern (Thelypteris puberula var. sonorensis)	None	chatterbox orchid (Epipactis gigantea), scarlet monkeyflower (Mimulus cardinalis), Aravaipa woodfern (Thelypteris puberula var. sonorensis), cardinal flower (Lobelia cardinalis), cattail (Typha sp.), sedge (Eleocharis sp.)	None Recorded	None Observed	None Recorded	None Recorded







Photo I. DC 4.1 E, view of Aravaipa woodfern, scarlet monkeyflower and cattails growing in surface flow, November 2002.



Photo 3. DC 4.1 E, view of pool in the channel below the spring with wetland plant watercress growing in pool, May 2011.





Photo 2. DC 4.1 E, view of seep in bedrock with scarlet monkey flower (Mimulus cardinalis) and cardinal flower, May 2011.



Photo 4. DC 4.1 E, view of sensitive, wetland plant Aravaipa woodfern growing on the canyon wall with cardinal flower growing below on the canyon floor, May 2011.

Photo 6. DC 4.1 E, view of wetland plants cattail, sedge, and scarlet monkeyflower with riparian overstory of velvet ash, May 2011.



# **SPRING DC 4.1 E Section 4: Photographs**





# SPRING DC 6.1 E Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION				
DC6.1E	Hanging Garden Spring	DC6.1E discharges from the Apache Leap Tuff on the east wall of Devils Canyon. above vitrophyre below the bottom pool of the Crater Tanks; boulder field at base of spring and seep surveys.				
COUNTY	CADASTRAL (40-acre)					
Pinal	(D-02-13)16db					
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND I			
U.S. Forest Service	Tonto National Forest	No				
GEOREFERENCE						
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE				
GPS	NAD83	12Z				
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR			
498067	3679738	3160 feet amsl	Estimated from USG			
ADMINISTRATIVE						
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?			
No	No	N/A	No			
HYDROLOGY						
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN			
Middle Gila	Devils Canyon	Southern Reach	Perennial/intermitter			
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		·			
150501000205	Devils Canyon					
GEOMORPHOLOGY		_				
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLO			
Contact	Apache Leap Tuff	Hanging garden	Apache Leap Tuff -			
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS				
Gravity	Spring dominated	None				
INFRASTRUCTURE						
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?			
None			No			
ACTIVELY USED?	USE?					
Yes	Wildlife					



Water seeps from megaspherulite zone of falls. Identified in 2002 during Resolution
D EDITIONS WHERE SHOWN
IRCE
SGS topo map
INCE
tent
LOGIC UNIT
- vitropphyre unit


## **SPRING DC 6.1 E** Section 2: Hydrological Observations

			Spri	ng Flow	Water Quality Parameters							
					Tommonotome	Electrical	Specific		Dissolved			
Data	Timo	Toom	Flow (gpm)	Mothod		Conductivity	Conductance	Turbidity	Oxygen		Sample	
	Time	Team	(gpm)	wiethod	(	(us/cm)			(mg/L)	рп	Collected ?	
11-2002		WRI										
5-Jun-03	8:44	GAI			71.4	309				7.8		
20-May-04	12:00	GAI	2	estimated	69.4		297	0.6	8.0	8.2	Yes	
23-Aug-04	10:05	GAI	0.8		70.7		296	0.0	7.6	8.0	Yes	
18-Nov-04	9:33	GAI	2	estimated	64.8		274	1.1	0.0	8.1	Yes	
28-Feb-05	10:31	GAI	0		66.0		374	0.4		7.8	Yes	
24-May-05	10:00	GAI	0.5	estimated	69.3		300	11.7		8.0	Yes	
23-Aug-05	12:30	GAI	0		76.5		302	163.5	6.3		Yes	
7-Aug-08	12:15	RC	1	estimated	72.7		299	1.9	<1.0	8.5	Yes	
6-Nov-08	11:30	RC	0		60.1		274	0.3	<1.0	8.2	Yes	
25-Feb-09	12:30	RC			68.9		291	0.9	<1.0	8.2	Yes	
20-May-09	12:00	RC	3		71.2		300	0.5	<1.0	8.0	Yes	
19-Mar-10	12:30	RC	1.5	estimated	62.4		287	0.5	8.4	8.2	Yes	Flowing more the
19-Oct-10	14:00	RC	5	estimated	72.3		332	1.1	8.3	7.3	Yes	
10-Nov-10	13:00	RC	80	estimated	59.4		246	1.0	8.7	7.4	Yes	
15-Aug-12	8:50	RC	0		79.0		212	26.0		9.0	Yes	
26-Nov-12	11:55	RC			55.9	339	339	8.0	8.3	7.9	No	
16-Dec-15	10:04	RC	1.5		66.9	300				6.9	Yes	Clear water; han
22-Mar-16	10:30	RC			70.2	291		0.3	7.0	7.4	Yes	Clear water with
19-Jul-16	11:00	RC	6	estimated	74.1	289		0.5	7.5	7.7	Yes	Clear; ~5-7GPM

WRI = WestLand Resources, Inc. GAI = Golder Associates, Inc. M&A = Montgomery & Associates RC = Resolution Copper --- = unknown

#### NOTE: Results of hydrochemical analysis for this spring are presented in the following reports:

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OBSERVATIONS
an usual.
ging garden closest to waterfall; series of seeps
strong flow.



# SPRING DC6.1E Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE	
West	East	15	Bedrock	
COMMENTS				

Issues from the east canyon wall of Devils Canyon and is a 200-meter-long complex of springs emerging from 10-meter-high walls above the canyon floor. Water from the springs flows down the exposed bedrock walls to the canyon floor and infiltrates unconsolidated subsurface materials, but reemerges near the end of the spring complex. Velvet ash (Fraxinus velutina) is the dominant tree with Fremont cottonwood (Populus fremontii) also occurring.

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
November 2002	Intermittent surface flows for approximately 60 m before going subsurface, then re- emerges with minimal surface flow approximately 230 m downstream.	None Recorded	None Recorded	chatterbox orchid (Epipactis gigantea), maidenhair fern (Adiantum capillus-veneris)	None Recorded	None Recorded	None Recorded	None Recorded







**Photo I.** DC 6.1 E, view of common maidenhair fern growing on wet vertical wall, June 2009.



**Photo 3.** DC 6.1 E, view of wetland plant chatterbox orchid growing along streambed below spring, May 2009.



**Photo 2.** DC 6.1 E, view of riparian overstory of velvet ash, Fremont cottonwood and willow below the vertical wall where the spring issues, June 2009.



**Photo 4.** DC 6.1 E, measuring water quality parameters, March 2004.



SPRING DC 6.1 E Section 4: Photographs



# SPRING DC 6.6 W Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION				
DC 6.6 W COUNTY Pinal	DCT 6.6 W; West Canyon CADASTRAL (40-acre)	DCT6.6W is located in an unnamed tributary to the west of Devils Canyon, appro is present in a series of small pools and seeps that emanate through the loamy s between Apache Leap Tuff and Whitetail Conglomerate.				
		7.5-minute USGS Quadrangle / Shown on guad?	LIST QUADS AND			
U.S. Forest Service	Tonto National Forest	No	N/A			
	DATUM					
SOURCE OF GEOREFERENCE DATA	DATOM	UTM ZONE				
GPS	NAD83	12Z				
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOU			
497395	3680077	3520 feet amsl	Estimated from US			
ADMINISTRATIVE						
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?			
No	No	N/A	No			
HYDROLOGY						
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTE			
Middle Gila	Devils Canyon	Southern Reach	Perennial/intermitt			
HYDROLOGIC UNIT CODE (HUC)	HUC Basin					
150501000205	Devils Canyon					
GEOMORPHOLOGY		_				
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL			
Contact	Apache Leap Tuff (Tal)/WhitetailConglomerate	e Rheocrene	Whitetail Conglom			
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS				
Gravity	Mixed runoff/spring dominated	NA				
INFRASTRUCTURE						
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?			
NA	NA	NA	small pools			
ACTIVELY USED?	USE?		• •			
Yes?	wildlife					



mately 200 meters above main stem. Water ostrate. Canyon bottom along contact

EDITIONS WHERE SHOWN

### RCE

GS topo map

NCE

ent

## OGIC UNIT

erate



# SPRING DC6.6W Section 2: Hydrological Observations

			Spri	ng Flow			Nater Quality Parame	eters				
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
11-2002		WRI									No	Intermittent surfa re-emerges with
29-May-03	9:21	RC	0.5		77.7		325	9.9	5.6	8.0	Yes	
3-Sep-03	9:22	RC	0.5		72.7		362	1.1	3.2	6.6	Yes	
4-Nov-03	9:23	RC	1.5	estimated	64.9		412	1.3	0.7	6.8	Yes	
18-Feb-04	14:20	RC	1.0		60.3		155	0.8	6.3	7.1	Yes	
5-May-04	8:30	RC	0.5	estimated	63.9		318	0.2	5.7	7.6	Yes	
19-Aug-04	7:20	RC	0.3		70.7		224	0.2	1.6	7.1	Yes	
29-May-03	14:30	RC	0.5		77.7		325	9.9	5.6	8.0	Yes	
3-Sep-03	8:30	GAI	0.5		72.7		362	1.1	3.2	6.6	Yes	
4-Nov-03	10:00	GAI	1.5	estimated	69.9		412	1.3	0.7	6.8	Yes	
18-Feb-04	14:20	GAI	1.0		60.3		155	0.8	6.3	7.1	Yes	
5-May-04	8:30	GAI	0.5	estimated	63.9		318	0.2	5.7	7.6	Yes	
19-Aug-04	7:20	GAI	0.3		70.7		224	0.2	1.6	7.1	Yes	
12-Nov-04	9:14	GAI	0.7		63.5		179	1.0	4.7	7.2	Yes	
16-Feb-05	10:15	GAI	32.5	1 " Flume	53.4		101	1.5	12.3	7.5	Yes	
17-May-05	8:20	GAI	0.5	estimated	64.6		303	0.5	2.4	7.3	Yes	
7-Sep-05	12:00	GAI	0		74.3		298	0.4	2.7	6.8	Yes	
05-2011		WRI									No	Water is present
4-May-12	11:30	RC	2	estimated	77.3		339			7.6	Yes	
27-Feb-14	13:15	RC	0.5		61.7	272		2.5		7.6	No	<1GPM; parame
25-Sep-14	12:36	RC	0.1		74.1	300		3.7		8.2	No	Small pools in sc
7-Nov-14	12:15	RC	1	estimated	64.0	267		2.2		7.9	No	Clear; muddy are



#### OBSERVATIONS

ace flows for approximately 60 meters before going subsurface, then minimal surface flow approximately 230 meters downstream.

for 70 meters in a series of small pools and seeps.

ters taken in small pool on muddy ground.

bil; clear; very low flow; pools in soil too small to measure DO.

ea; ~1GPM. Not enough water for DO measurement.



# SPRING DC6.6W Section 2: Hydrological Observations

ſ				Sprii	Spring Flow Water Quality Parameters								
	Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
	23-Nov-15	13:11	RC			60.6	221			8.5	7.1	Yes	Series of low flov dig out bigger po
	17-Feb-16	14:12	RC	0		65.2	204		2.0	1.9	6.5	Yes	Clear water; very
	23-Aug-16	13:48	RC			75.2	267		2.2		6.9	Yes	Clear water; very

WRI = WestLand Resources, Inc.

GAI = Golder Associates, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown

NOTE: Results of hydrochemical analysis for this spring are presented in the following reports:

Montgomery & Associates, 2010, Interim results of groundwater monitoring, Upper Queen Creek and Devils Canyon watersheds: Final report prepared for Resolution Copper Mining LLC, February 17, 2010.

Montgomery & Associates, 2012, **Results of hydrochemical characterization, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, March 9, 2012.

Montgomery & Associates, 2013, **Surface water baseline report, Devils Canyon, Mineral Creek, and Queen Creek watersheds:** Final report prepared fro Resolution Copper Mining LLC, May 16, 2013.

Montgomery & Associates, 2016, **Hydrochemistry addendum, groundwater and surface water, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, August 11, 2016.



#### OBSERVATIONS

w puddles - some with clear water; some are stagnant looking. Had to ools and wait for water to settle before collecting sample.

v little water (<<1gpm); series of seeps in muddy terrain; extracted

/ little water (<<1gpm); small pools with low flow</pre>



# SPRING DC6.6W Section 3: Biological Observation

### **GENERAL DESCRIPTION**

ASPECT	ASPECT SIDE OF CANYON		SUBSTRATE									
East	West	15	Bedrock									
OMMENTS												
Issues from a side can Arizona sycamore (Pla	Issues from a side canyon to the west of Devils Canyon. Water is present in a series of small pools and seeps that emanate through the loamy substrate. A canopy of Arizona sycamore (Platanus wrightii), Arizona walnut (Juglans major) and Fremont cottonwood (Populus fremontii) provides approximately 75% cover over the spring											
area.												

		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES	AQUATIC FAUNA	BIRD FAUNA	MAMMAL FAUNA
DATE	WATER PRESENCE	SPECIES	INVASIVE SPECIES	OBSERVED	OBSERVED	OBSERVED	OBSERVED	OBSERVED
November 2002	Intermittent surface flows for approximately 60 meters before going subsurface, then re-emerges with minimal surface flow approximately 230 meters downstream.	None Recorded	None	seepwillow (Baccharis salicifolia), Arizona sycamore (Platanus wrightii)	Not Recorded	Not Recorded	Not Recorded	Not Recorded
May 2011	Water is present for 70 meters in a series of small pools and seeps.	Thelypteris puberula var. sonorensis	None	maidenhair fern (Adiantum capillus- veneris), chatterbox orchid (Epipactis gigantea), swordleaf rush (Juncus ensifolius), grassleaf rush (J. marginatus), yellow monkeyflower (Mimulus guttatus), Arizona sycamore (Platanus wrightii), Aravaipa woodfern (Thelypteris puberula var. sonorensis)	hollyleaf buckthorn (Rhamnus crocea), canyon grape (Vitis arizonica)	None Observed	None Observed	None Observed







Photo I. DC 6.6 W, view of pool of water with substantial amount of leaf litter from the overstory of wetland plants Arizona alder and Arizona sycamore, October 2002.



Photo 3. DC 6.6 W, view of sensitive wetland plant Aravaipa woodfern growing along surface water flow, May 2011



Photo 5. DC 6.6 W, view of pool along surface water flow, May 2011.



Photo 2. DC 6.6 W, view up side canvon that hosts spring. October 2003.



Photo 4. DC 6.6 W, view of sensitive wetland plant Aravaipa woodfern and common maidenhair fern growing at base of boulder, May 2011.



leaf litter, May 2011.



**SPRING DC 6.6 W** Section 4: Photographs



# SPRING DC 8.2 W Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
DC8.2W	Golder Spring 8.2	DC8.2W spring complex emanates from the west bank of I	Devils Canyon between H
COUNTY	CADASTRAL (40-acre)	spring complex noted in the canyon. 2 springs approximate emerges from under a large boulder and pools in several p	ely 20 meters apart, with f laces as flow continues
Pinal	(D-02-13)9ca	installed for several years until destroyed by flood.	
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
U.S. Forest Service	Tonto National Forest	No	
GEOREFERENCE			
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOU
497477	3681388	3540 feet amsl	Estimated from US
ADMINISTRATIVE			-
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	No	N/A	No
HYDROLOGY			
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTE
Middle Gila	Devils Canyon	Middle Reach	Perennial/intermitte
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000205	Devils Canyon		
GEOMORPHOLOGY			
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL
Fracture	Apache Leap Tuff	Hillslope	Apache Leap Tuff
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Spring dominated	No	
INFRASTRUCTURE			
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
No (flume briefly installed)	No		No
ACTIVELY USED?	USE?		
Yes	Wildlife		



Hackberry and Oak Canyons - largest single flow connection to main channel. Spring down to the main channel. Cutthroat flume

### **EDITIONS WHERE SHOWN**

### RCE

GS topo map

NCE

ent

LOGIC UNIT



# SPRING DC 8.2 W SPRING Section 2: Hydrological Observations

			Spring Flow			Water Quality Parameters						
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
11-2002		WRI									No	The spring forms
20-May-03	14:00	GAI	10.9	Cut-throat Flume	74.5		266	0.5	5.9	7.6	Yes	
21-Aug-03	8:00	GAI			74.1		229	0.3	5.9	7.2	Yes	
12-Nov-03	9:42	GAI	8.1	Cut-throat Flume	72.9		274	0.5	5.2	7.1	Yes	
17-Feb-04	13:10	GAI	10.9	Cut-throat Flume	73.0		244	0.8	6.3	7.2	Yes	
21-May-04	9:30	GAI	11.9	Cut-throat Flume	73.6		276	1.1	5.5	7.6	Yes	
16-Aug-04	8:55	GAI	9.0	Cut-throat Flume	73.9		274	0.3	6.1	7.4	Yes	
16-Nov-04	10:50	GAI	2.2	Cut-throat Flume	59.9		311	1.3	3.7	7.3	Yes	
15-Dec-04	9:31	GAI			53.2		286			7.3	No	
25-Feb-05	10:25	GAI	3	estimated	72.3		274	0.5	6.7	7.5	Yes	
30-Mar-05	10:49	GAI			72.5		270			7.4	No	
11-May-05	11:45	GAI	10	estimated	72.9		206	0.0	7.4	7.4	Yes	
28-Jun-05	10:01	GAI			73.8		229			7.4	No	
16-Aug-05	8:45	GAI	1	estimated	74.1		268	0.8	6.9	7.4	Yes	
19-Feb-08	13:30	M&A									Yes	
27-May-08	16:30	M&A					275			6.8	Yes	clear
6-Aug-08	9:30	M&A			74.3		264	0.2	6.2	7.6	Yes	
5-Nov-08	11:30	RC	1	estimated	70.9		282	0.0	3.1	7.3	Yes	
2-Dec-08	10:45	M&A			73.6		271			6.9	Yes	
24-Feb-09	15:30	RC			76.3		263	0.7	5.3	7.3	Yes	
03-2009		WRI									No	Pool flows into m
19-May-09	13:00	RC	10.0		76.6		243	0.8	5.3	6.9	Yes	
10-Nov-10	9:45	GAI	<1	estimated	68.2		260	0.9	7.1	7.2	Yes	



a 1 x 1 meter pool with a substantial amount of leaf litter

nain channel



# SPRING DC 8.2 W SPRING Section 2: Hydrological Observations

			Spri	ng Flow	Water Quality Parameters							
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
05-2011		WRI									No	A series of four p into the main cha
20-May-11	9:45	RC	0.1		72.1		312	0.9	7.1	7.6	No	
3-May-12	11:30	RC	5	estimated	73.1		245	4.4	5.5	7.3	Yes	
14-Jun-13	14:18	RC	5		75.2		278		2.7	7.5	No	
5-Aug-13	9:32	RC	12		73.5	270	280			7.7	No	Clear
27-Feb-14	15:01	RC	2		73.4	272		0.1		7.7	No	Water bubbles u
29-May-14	15:20	RC	2		74.3	289		0.2		8.0	No	Clear
3-Sep-14	12:27	RC	5			762		0.2	7.0	8.0	No	Clear; inflow sou
21-Nov-14	12:11	RC	5		72.9	254		1.5	7.5	7.5	No	Clear
14-Oct-15	12:03	RC	15		73.8	269			6.9	7.3	Yes	Clear water.
19-Feb-16	10:31	RC			72.2	259		0.3	6.5	7.3	Yes	Clear
21-Jun-16	11:12	RC			73.9	278		0.6	6.4	7.0		Clear; steady flo
23-Sep-16	10:15	RC	5	estimated	73.7	269		0.8	6.6	7.4		Clear; approx. 50

WRI = WestLand Resources, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

GAI = Golder Associates

--- = unknown

NOTE: Results of hydrochemical analysis for this spring are presented in the following reports:

Montgomery & Associates, 2010, Interim results of groundwater monitoring, Upper Queen Creek and Devils Canyon watersheds: Final report prepared for Resolution Copper Mining LLC, February 17, 2010.

Montgomery & Associates, 2012, **Results of hydrochemical characterization, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, March 9, 2012.

Montgomery & Associates, 2013, **Surface water baseline report, Devils Canyon, Mineral Creek, and Queen Creek watersheds:** Final report prepared fro Resolution Copper Mining LLC, May 16, 2013.

Montgomery & Associates, 2016, **Hydrochemistry addendum, groundwater and surface water, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, August 11, 2016.



WestLand Resources, Inc. Engineering and Environmental Consultants

### OBSERVATIONS

bools form from the source under a large boulder and flow 20 meters annel.

p clear from spring (1-3GPM). Algae on surface of pool.

nds like 5-7 GPM (under boulder).

w.

GPM.



# SPRING DC8.2W Section 3: Biological Observations

### **GENERAL DESCRIPTION**

	ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE				
East		West	15	Bedrock				
СОМ	COMMENTS							
The s	The source emerges from the west side of Devils Canyon from under a large boulder and pools in several places as flows continue down to the main channel under a							
large	large Arizona sycamore (Platanus wrightii). Arizona alder (Alnus oblongifolia), contributes to overstory cover and buttonbush (Cephalanthus occidentalis) is a common							

understory shrub.

		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES	AQUATIC FAUNA	BIRD FAUNA	MAMMAL FAUNA
DATE November 2002	WATER PRESENCE The spring forms a 1 x 1 meter pool with a substantial amount of leaf litter	SPECIES None Recorded	None	OBSERVED Arizona alder (Alnus oblongifolia), seepwillow (Baccharis salicifolia), Arizona sycamore (Platanus wrightii), Bonpland's willow (Salix bonplandiana)	, velvet ash (Fraxinus velutina)	OBSERVED No Records	OBSERVED No Records	OBSERVED Coatimundi (Nasua narica)
March 2009	A pools flows into the main channel.	Aravaipa woodfern (Thelypteris puberula var. sonorensis)	None	Arizona alder (Alnus oblongifolia)	No Records	No Records	No Records	No Records
May 2011	A series of four pools form from the source under a large boulder and flow 20 meters into the main channel.	Aravaipa woodfern (Thelypteris puberula var. sonorensis)	None	Arizona alder (Alnus oblongifolia), buttonbush (Cephalanthus occidentalis), yellow monkeyflower (Mimulus guttatus), Arizona sycamore (Platanus wrightii), Bonpland's willow (Salix bonplandiana), Aravaipa woodfern (Thelypteris puberula var. sonorensis)	, blackberry (Rubus sp.), western poison ivy (Toxicodendron rydbergii), , Virginia creeper (Parthenocissus quinquefolia)	No Records	No Records	No Records







Photo I. DC 8.2 W, view of pool of water with substantial amount of leaf litter from the overstory of wetland plant Arizona alder, October 2002.







Photo 2. DC 8.2 W, sensitive plant Aravaipa woodfern growing at base of boulder, March 2009.



Photo 4. DC 8.2 W, closeup view of sensitive plant Aravaipa woodfern growing at base of boulder with blackberry in the foreground, May 2011.



May 2011.



DC 8.2 W **Section 4: Photographs** 

Photo 5. DC 8.2 W, view of pool from source of spring. Riparian vegetation includes Arizona alder, Bonpland's willow and western poison ivy, May 2011.



# GIBSON WELL SPRING Section 1: General Information

### **GENERAL INFORMATION**

GEOREFERENCE			
GEODEEEDENCE			
U.S. Forest Service	Tonto National Forest	Superior, AZ / Yes	Superior AZ 7.5' (2
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
Pinal	(D-01-13)29cb		I
COUNTY	ce of Queen Creek and Oa		
Gibson Well Spring	Gibson Spring	Spring located in Oak Flat Wash immediately upstream of Streambed with damp banks supports high density of her	f confluence with Queen C baceous hydrophytic yege
SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
494442	3685746	3836 feet amsl	Handheld GPS

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	Yes	4A-486 (Integrity)	No

### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTE
Middle Gila	Queen Creek	Oak Flat Wash	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		

### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)		
Seepage or filtration	Alluvium	Rheocrene	Apache Leap Tuff	
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS		
Gravity	Mixed runoff/spring dominated	Hand dug well		

### INFRASTRUCTURE

FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
	Associated with Gibson well and upsream		
No	check dams only	Gibson hand-dug well nearby	No
ACTIVELY USED?	USE?		
Yes?	wildlife		



Creek. injust south of old hand-dug well. etation, suggesting shallow sub-surface water ak Flat wash appears to capture, store and

## **EDITIONS WHERE SHOWN**

2004)

RCE

NCE

OGIC UNIT



# GIBSON WELL SPRING Section 2: Hydrological Observations

		Spring Flow Water Quality Parameters					Water Quality Parameters					
					_	Electrical	Specific		Dissolved			
			Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
03/04-2017		WRI	0								No	Water present in
22-Mar-17	9:15	M&A	3-4	Estimated	55	133.7				6.82	No	Water clear, alga
19-Apr-17	15:00	M&A	trace		66.4	135				6.45	No	small flow; poole
10-May-17	14:40	M&A	3	Estimated	57.7	148.7			14.6	6.58	No	
19-May-17	14:40	M&A	2-Jan	Estimated	55.7	175.3			14.6	6.88	No	
06-2017		WRI	0								No	Water was obser No surface water
11-Jul-17	13:52	M&A	DRY									
3-Aug-17	15:55	M&A	25	Estimated	84.3	131			5.5	7.0	No	Oak Flat Wash is
25-Aug-17	11:01	M&A	0		80.4	186			3.6	6.7	No	No flow; surroun water has slight

WRI = WestLand Resources, Inc.

M&A = Montgomery & Associates RC = Resolution Copper

--- = unknown



#### OBSERVATIONS

well and water flowing in nearby pool

ae growth

d, flowing into another small pool

rved within the well approximately 1.5 meters below ground surface. r present. Dampness and algae along channel suggest recent flow.

s flowing into the spring - combined flow

ding area is damp upstream; vegetation very overgrown and green; red-brown color



# GIBSON WELL SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
West	Center	5	Gravel

### COMMENTS

South of the old well structure a streambed with damp banks supports high density of herbaceous hydrophytic vegetation, suggesting shallow sub-surface water table. The stream is lined with coyote willow (Salix exigua), desert broom (Baccharis sarothroides), false indigobush (Amorpha fruticosa), and netleaf hackberry (Celtis reticulata). A few Fremont cottonwood (Populus fremontii) and Arizona sycamore (Platanus wrightii) occur along the stream.

		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES	AQUATIC FAUNA	BIRD FAUNA	MAMMAL FAUNA
DATE	WATER PRESENCE	SPECIES	INVASIVE SPECIES	OBSERVED	OBSERVED	OBSERVED	OBSERVED	OBSERVED
March/April 2017	Water present in well and water flowing in nearby pool	None Recorded	Bromus rubens, Sonchus sp., Horehound (Marrubium vulgare)	Elliott's rush (Juncus elliottii), yellow monkeyflower (Mimulus guttatus), pale spikerush (Eleocharis macrostachya)coyote willow (Salix exigua), Arizona sycamore (Platanus wrightii)	None Recorded	None Observed	None Observed	None Recorded
June 2017	No surface water/source was observed, but dampness and algae along channel as evidence of recent flow. Well had some water at the bottom.	None Recorded	Bromus rubens, Sonchus sp., Horehound (Marrubium vulgare)	algae, Elliott's rush (Juncus elliottii), yellow monkeyflower (Mimulus guttatus), pale spikerush (Eleocharis macrostachya)coyote willow (Salix exigua), Arizona sycamore (Platanus wrightii)	deergrass (Muhlenbergia emersleyi), dock (Rumex sp.), oats (Avena sativa), desert broom (Baccharis sarothroides), false indigobush (Amorpha fruticosa), netleaf hackberry (Celtis reticulata), Fremont cottonwood (Populus fremontii), Emory oak (Quercus emoryi), coffeeberry (Rhamnus californica), manzanita (Arctostaphylos pungens), locust (Robinia neomexicana)	None Observed	None Observed	None Recorded







Photo I. Gibson Well Spring, discharging from alluvial materials with covered with mat of organic material, February 2017.



Photo 3. Gibson Well, view inside well showing water at near bottom, which is less than 10 feet deep, June 2017.





Photo 2. Gibson Well, view of well structure, June 2017.



Photo 4. Channel near Gibson Well, view of herbaceous vegetation along stream channel including deergrass and Elliott's rush, June 2017.



Photo 6. Stream channel near Gibson Well, evidence of recent flow along channel includes dampness and algae, June 2017.



# **GIBSON WELL SPRING Section 4: Photographs**



Photo 5. Channel near Gibson Well spring, view of high density of herbaceous vegetation along stream channel including deergrass, June 2017.



# HAPPY CAMP SPRING **Section 1: General Information**

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	<b>SITE DESCRIPTION</b> Happy Camp Spring is on the floor of Happy Camp Wash; concrete headwall/dam wall; seeps across the face and along the sides of the headwall; headwall is built of a failed and the weath and the weath and the weath a finance to a failed and the weath and the weath a finance to a failed and the weath and the weath a finance to a failed and the failed and the weath a failed and the faile						
Happy Camp Spring								
COUNTY	CADASTRAL (40-acre)	channel is cut to the Gila Conglomerate/Tertiary volcanics with intermittent pockets						
Pinal	(D-01-12)28cd							
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND					
U.S. Forest Service	Tonto National Forest	Picketpost, AZ / Yes	Superior AZ 15' (19					
GEOREFERENCE								
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE						
GPS	NAD83	12Z						
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR					
486883	3685613	2680 feet amsl	Estimated from US					

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
Yes	Yes	36-24051 (USFS)	No

#### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Queen Creek	Happy Camp Canyon	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		

### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL
Seepage or filtration	Older and younger alluvium	Rheocrene	QTg - Gila Conglom
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	mixed runoff/spring	Yes	

#### INFRASTRUCTURE

FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
			Stock pond at pipe
concrete headwall	Plastic piping from headwall to stock pond	Handdug well to west with pump and tubing	headwall
ACTIVELY USED?	USE?		
Yes?	Stock watering/wildlife?		



cross the wash with alluvium behind the cemented Gila Conglomerate; large deposit upstream from the headwall, but stream of modern alluvium

### **EDITIONS WHERE SHOWN**

48)Picketpost AZ 7.5' (2004, 2011, 2014)

### RCE

Estimated from USGS 7.5' Topo

NCE

### OGIC UNIT

nerate/Tv - Tertiary volcanics

outlet 200 meters downstream from



# HAPPY CAMP SPRING Section 2: Hydrological Observations

			Spri	ng Flow		l l l l l l l l l l l l l l l l l l l	Vater Quality Parame	eters				
					Tomporatura	Electrical	Specific		Dissolved		]	
Date	Time	Team	Flow (apm)	Method	(° F)	Conductivity	Conductance (uS/cm)	Turbidity (NTUs)	Oxygen (mg/L)	nН	Sample Collected?	
10-Aug-12	7:33	M&A	5	estimated	81.5		790			6.7	No	Flow from pipe a
18-Feb-13	12:30	M&A/RC	0.1	container & stop watch	74.3		800	0.0	3.5	7.3	Yes	No flow above co sample container
7-Aug-13	12:46	RC	0.1		93.2	1102	942		3.3	9.1	Yes	Small pools fed b
28-Oct-13	17:00	RC									No	Fingers of seepa with no flow (stag
4-Mar-14	12:50	RC	<1	estimated	74.7	895		2.4		8.4	Yes	Very low flow; cl
21-May-14	16:35	RC	0.1		60.4	796		4.6	7.3	8.9	No	Very low flow see
8-Aug-14	8:30	RC	0.1		70.2	741		1.6		8.5	No	Several fingers o take DO.
4-Nov-14	10:53	RC	0.1								No	5 distinct seeps ( parameters/sam
3-Mar-15	9:18	RC	0.5		44.7	904		0.8	12.4	7.8	No	Clear small pudd
13-May-15	9:05	RC	0.2		58.6	875		7.2	8.6	8.5	No	Clear with yellow puddle. Not eno
20-Oct-15	10:31	RC									No	Flow to low and p
12-Feb-16	13:30	RC	1		77.1	644		3.2	13.0	9.1	Yes	Clear water; yell multiple seeps flo
17-Mar-16	12:35	RC			73.6	799		3.7	12.5	8.5	Yes	Clear water with
28-Apr-16	11:30	RC									No	Water is clear to will not sample.
12-Jul-16	10:53	RC	0.5								No	Very minor seeps
11-Nov-16	13:30	RC	0.1								No	Very small pools
30-Mar-17	12:00	RC	0.5		77.1	695		0.8		8.3	Yes	parameters were
05-2017		WRI			69.8	730				9.1	No	Flow starts in dei there is damp sa

WRI = WestLand Resources, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown



#### OBSERVATIONS

t stock tank only; no flow from dam/headwall

oncrete headwall; weeping at headwall and along sides. Filled rs at pipe outlet into stockpond downstream from headwall.

by very minor flow

ge out of a spring leading to a 20 gallon puddle. Clear pools of water gnant).

lear pool of water near center flow from west and north hills.

eps. Not enough water to sample. Lots of algae.

of seepage from 3' wide area on weir. Not enough water to sample or

(<0.1 GPM), clear, minor algae, not enough water present for ple.

lles of water - some run-off and some spring water.

tint; seep flow is < 0.5 GPM; parameters taken from spring-fed ugh water to sample.

pools too shallow to sample or measure parameters

ow tint; minor algae; atypical 'high' flow for spring (<1 gpm) with owing; not enough water in pool for accurate DO measurement (not

minor floating debris; multiple seeps

slightly murky, brown tint in places. VERY cowy (lots of manure) - Seeps are flowing but too much cow manure for representative

s (<1GPM); too low flow to sample or take parameters

; only 1-3 seeps active; total flow is <0.1GPM. Not enough water for ample.

ample. owing; clear water; moderate amount of algae. Samples and taken from a pool in the spring discharge path (~10 ft from spring netream spiggot (in cattle tank) was submerged DO was omitted nse patch of vegetation just downstream from concrete dam, but and upstream from this. Flows from stream banks converge into



# HAPPY CAMP SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
Southwest	Center	2	Alluvium over bedrock
COMMENTS			•

Several seeps that occur in the contact between the bedrock strata maintain a channel of water that supports herbaceous plants. A few Goodding's willow (Salix gooddingii) and velvet mesquite (Prosopis velutina) form the overstory with canyon ragweed (Ambrosia ambrosiodes) present along the banks. An impoundment below the road holds water.

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
May 2017	Flow starts in dense patch of vegetation just downstream from concrete dam, but there is damp sand upstream from this. Flows from stream banks converge into stream bed and flow downstream for approximately 50 meters	None observed	Malta star thistle (Centaurea melitensis), Bermuda grass (Cynodon dactylon), sowthistle (Sonchus sp.), beardless rabbitsfoot grass (Polypogon monspeliensis)	toad rush (Juncus bufonius), grassleaf rush (Juncus marginatus), yellow monkeyflower (Mimulus guttatus), purple mat (Nama demisssa), beardless rabbitsfoot grass (Polypogon monspeliensis), speedwell (Veronica anagallis- aquatica)	false pennyroyal (Hedeoma sp.)	None Recorded	common raven (Corvus corax), Gambel's quail (Callipepla gambelii), greater roadrunner (Geococcyx californianus), white- winged dove (Zenaida asiatica)	None Recorded







Photo I. Happy Camp view downstream from above dam showing Goodding's willow and velvet mesquite, May 2017.



Photo 3. Happy Camp view of seepage along bedrock with yellow monkeyflower and beardless rabbitsfoot grass in the background, May 2017.



headwall/dam, August 2012.



Photo 2. Happy Camp view upstream showing Goodding's willow and dam, black poly tubing visible on right side of channel, May 2017.



Photo 4. Happy Camp view of saturated area by dam and herbaceous vegetation of beardless rabbitsfoot grass, May 2017.



2017.



**HAPPY CAMP SPRING Section 4: Photographs** 



Photo 5. Spring discharge pipe at stock pond 600 feet downstream from



Photo 6. View of stock pond below Happy Camp Spring headwall, May



# HIDDEN SPRING Section 1: General Information

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION				
Hidden Spring	May be same as "Bell Spring" from 1911- vintage GLO township map?	Hidden Spring discharges from Paleozoic carbonates west of the Apache Leap vertical galvanized steel culvert at mouth of small grotto and is piped to a meta				
COUNTY	CADASTRAL (40-acre)	-stream for approximately 5-meters. Travertine cave on slop	be to south may have bee			
Pinal	(D-02-12)14cb					
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND			
U.S. Forest Service	Tonto National Forest	Superior AZ / Yes	Superior AZ 7.5' (2			
GEOREFERENCE						
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE				
GPS	NAD83	12Z				
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOU			
491249	3679611	3040 feet amsl	Estimated from US			
ADMINISTRATIVE						
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?			
Yes	Yes	36-24052 (USFS)	No			
HYDROLOGY						
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTE			
Middle Gila	Queen Creek	Arnett Creek	Intermittent			
HYDROLOGIC UNIT CODE (HUC)	HUC Basin					
150501000401	Arnett Creek					
GEOMORPHOLOGY						
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL			
Contact and/or fracture spring	Martin Limestone (Dm) and Escabrosa Limestone (Me)	Rheocrene	Bolsa Quartzite (Ct			
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS				
Gravity	Mixed runoff/spring dominated	developed spring around a caisson				
INFRASTRUCTURE						
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?			
Water collects in an underground galvanized steel culvert	Fenced; piping from culvert to metal trough	NA	NA			
ACTIVELY USED?	USE?		•			
Yes?	Livestock/wildlife					



f outcrop belt. Water collects in a buried bugh, which overflows and forms a shallow en original spring.

### **EDITIONS WHERE SHOWN**

2011, 2014)

RCE

SGS 7.5' Topo

NCE

LOGIC UNIT

b)?



# HIDDEN SPRING Section 2: Hydrological Observations

			Spri	ng Flow			Nater Quality Parame	eters				
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
11-2002		WRI									No	Water present in
15-May-03	17:00	GAI	0		64.9		642	3.1	3.3	7.6	Yes	
20-Aug-03	8:45	GAI	0		73.6		710	2.1	0.2	7.4	Yes	
3-Nov-03	10:30	GAI	<0.1	estimated	64.4		767	3.2	0.5	7.4	Yes	
9-Feb-04	12:10	GAI	<0.1	estimated	52.7		485	1.2	7.3	8.0	Yes	
24-May-04	9:00	GAI	<0.1	estimated	63.7		716	1.0	17.8	7.4	Yes	
4-Aug-04	8:55	GAI	<0.1	estimated	73.9		342	5.2	0.1	7.8	Yes	
3-Nov-04	11:20	GAI	<0.1	estimated	60.1		694	1.4	0.6	7.4	Yes	
9-Feb-05	11:50	GAI	<0.1	estimated	58.8		709	4.1	5.6	7.5	Yes	
3-May-05	12:15	GAI	1	estimated	70.9		628	1.0	7.7	7.3	Yes	
3-Aug-05		GAI	2	estimated	73.0		663	0.6	4.0	7.1	Yes	
19-Aug-08	8:30	M&A	<0.1	estimated	76.1		678	1.6	4.4	7.2	Yes	
6-Nov-08	9:30	RC	<0.1	estimated	66.4		716	0.8	3.2	7.1	Yes	
10-Feb-09	13:00	RC	<0.1	estimated	66.9		637	0.3	5.5	7.4	Yes	
12-May-09	14:15	RC	<0.1	estimated	69.1		673	4.0	9.0	7.2	Yes	
4-Aug-09	9:00	RC					698			7.3	No	
12-Feb-10	9:30	RC	1.5	estimated	70.9		619	4.6	11.5	7.3	Yes	1-2 gpm coming
13-Jul-10	8:07	RC	2		74.1		638		10.2	9.8	No	Clear with brown
17-Jul-10	15:02	RC			78.4		667			6.8	Yes	Sample dipped f
9-Nov-10	10:45	RC	0.1	estimated	66.6		639	2.0	8.9	7.1	Yes	
14-Feb-11	10:55	RC	0.1								No	Trace Flow
05-2011		WRI									No	Water is present
13-May-11	10:25	RC	DRY								No	Dry



CALC CALCERTATIONS
right out of out crop
muddy bottom
rom pool
in caisson but none in drinker



# HIDDEN SPRING Section 2: Hydrological Observations

			Spri	ng Flow			Water Quality Parame	eters				
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
9-Nov-11	10:45	RC			66.6			2.0	8.9	7.1	No	
7-May-12	12:00	RC	DRY								No	Dry
06-2012		WRI									No	Moisture evident
5-Jun-14	11:14	RC	0.1		70.5	739		1.1	6.2	8.0	No	Unknown point c
22-Aug-14	10:25	RC	0		72.0	605		13.9	2.6	8.4	No	Greenish-tint; no
16-Oct-15	13:36	RC			72.0	689			1.8	7.5	Yes	Slightly murky wa
8-Mar-16	13:58	RC			61.7	586		5.4	2.0	7.4	Yes	Water is clear; c
6-Jun-16	14:40	RC	<1	estimated	81.9	630		5.1	15.6	8.2	Yes	Murky; water drip
4-Aug-16	11:00	RC			75.8	756		9.6	1.1	7.0	Yes	Water level in tro way. Evidence o parameters and clear. No visible
05-2017		WRI			69.4	733				7.7		Drinker is full and

WRI = WestLand Resources, Inc.

GAI = Golder Associates, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown

#### NOTE: Results of hydrochemical analysis for this spring are presented in the following reports:

Montgomery & Associates, 2010, Interim results of groundwater monitoring, Upper Queen Creek and Devils Canyon watersheds: Final report prepared for Resolution Copper Mining LLC, February 17, 2010.

Montgomery & Associates, 2012, **Results of hydrochemical characterization, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, March 9, 2012.

Montgomery & Associates, 2013, **Surface water baseline report, Devils Canyon, Mineral Creek, and Queen Creek watersheds:** Final report prepared fro Resolution Copper Mining LLC, May 16, 2013.

Montgomery & Associates, 2016, Hydrochemistry addendum, groundwater and surface water, Upper Queen Creek/Devils Canyon study area: Final report prepared for Resolution Copper Mining LLC, August 11, 2016.



### OBSERVATIONS

in the soil but no standing or flowing water.

of origin; clear; algal mats on surface (in tank).

algae floating in tank. No visible flow.

ater; sampeld from well under old metal top. Approx .5 feet of water.

overed by an old steel plate; sampled from hand dug well.

pping into trough from spiggot <1GPM.

bugh is very low - no flow to it. Upstream sump is filled approx. 1/2 f recent storm - everything is saturated; flow lines in mud. Took sample from sump. Syringed water from sump into bottles. Water is flow.

d overflowing forming shallow stream for about 5 meters



# HIDDEN SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
West	Center	5	Gravel

#### COMMENTS

A developed spring in a narrow canyon with a small riparian vegetation complex and one dominant netleaf hackberry around a caisson. The caisson occurs in a limestone cave, in which the limestone shows evidence of past water flow in the form of travertine deposits. Under a desert hackberry tree, a galvanized culvert forms a round spring box ~ 2 meters in diameter which is piped to a drinker. Where the drinker overflows herbaceous vegetation occurs along the streambed. A travertine cave across canyon from the springbox has no evident moisture. A patch of common garden Iris is present, probably a relict from when the area was homesteaded.

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
November 2002	Water present in caisson but none in drinker	None Observed	None Recorded	None Recorded	jojoba (Simmondsia chinensis), velvet mesquite (Prosopis velutina)	None Observed	Gambel's quail (Callipepla gambelii)	None Recorded
May 2011	Water present in caisson but none in drinker	None Observed	common garden iris (Iris sp.), horehound (Marrubium vulgare), London rocket (Sisymbrium irio), red brome (Bromus rubens), rabbitsfoot grass (Polypogon monspeliensis)	rabbitsfoot grass (Polypogon monspeliensis), Goodding's willow (Salix gooddingii), seepwillow (Baccharis salicifolia)	annual ragweed (Ambrosia artemisiifolia), netleaf hackberry (Celtis reticulata), catclaw acacia (Senegalia greggii), jojoba (Simmondsia chinensis), velvet mesquite (Prosopis velutina), wolfberry (Lycium sp.)	None Observed	None Observed	None Observed
May 2017	Drinker is full and overflowing forming shallow stream for ~ 5 meters.	None Observed	common garden iris (Iris sp.), red brome (Bromus rubens), rabbitsfoot grass (Polypogon monspeliensis), Johnson grass (Hordeum jubatum), London rocket (Sisymbrium irio)	yellow monkeyflower (Mimulus guttatus), dead Goodding's willow (Salix gooddingii)	globemallow (Sphaeralcea sp.), desert hackberry (Celtis pallida), catclaw acacia (Senegalia greggii), jojoba (Simmondsia chinensis), velvet mesquite (Prosopis velutina)	None Observed	None Observed	None Observed







Photo I. Hidden Spring, view of spring culvert with netleaf hackberry overstory, October 2002.







t



**Photo 2.** Hidden Spring, view of dry drinker with velvet mesquite and upland desert scrub in the background, October 2002.



Photo 4. Hidden Spring, view of nonnative common garden Iris, relict from when the spring was homesteaded, May 2011.



including rabbitsfoot grass, May 2017.



# **HIDDEN SPRING Section 4: Photographs**

P hoto 5. Hidden Spring, view of spring culvert with netleaf hackberry reetrunk visible in right foreground, May 2017.



# I BERRY SPRING Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
I Berry Spring	May possibly be same as "Fig Spring"	A well and drinker are present west of the road. Downstrea water seeps from several fractures and collects and flows. embedded in the bedrock and a 1.5 meter wide by 0.25 me	am from well and drinker At the upper end of the s eter high concrete dam is
COUNTY	CADASTRAL (40-acre)	development.	Ũ
Pinal	(D-01-12)14dc		
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
U.S. Forest Service	Tonto National Forest	No	

### GEOREFERENCE

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
490704	3688822	3610 feet amsl	Estimated from US

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	No	N/A	No

#### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW CONSISTE
Middle Gila	Queen Creek	Silver King Wash	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash - Queen Creek		

### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLO
Fracture spring	Cretaceous quartz diorite (Kqd)	Rheocrene	Diorite
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
gravity	mixed runoff/spring dominated	Yes	

### INFRASTRUCTURE

ſ	FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
		At the upper end of the seeps an open ended		
	Yes	horizontal pipe is embedded in the bedrock	1.5 meter wide by 0.25 meter high concrete dam is constructed	No
	ACTIVELY USED?	USE?		
	Yes?	Stock watering/wildlife?		



r, bedrock outcrops in stream channel and seeps an open ended horizontal pipe is s constructed, evidence of former spring

D EDITIONS WHERE SHOWN

### RCE

GS topo map

NCY

OGIC UNIT



# I BERRY SPRING Section 2: Hydrological Observations

			Spri	ng Flow		N	Nater Quality Parame	eters				
						Electrical	Specific		Dissolved			
			Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
05-2017		WRI									No	Surface water pr

WRI = WestLand Resources, Inc. M&A = Montgomery & Associates RC = Resolution Copper --- = unknown



resent

MONTGOMERY
& ASSOCIATES

# I BERRY SPRING Section 3: Biololgical Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
Southeast	Northeast	10	Bedrock

### COMMENTS

A well and galvanized drinker is present west of the road. Downstream of the well and drinker, bedrock intrudes across the streambed and water seeps from several cracks, collects and flows. The flows disappear downstream in sandy substrate. At the upper end of the seeps an open ended horizontal pipe is embedded in the bedrock and a 1.5 meter wide by 0.25 meter high concrete dam is constructed, evidence of former spring development. A disjunct lower reach is surrounded by herbaceous vegetation and flows and pools occur over 15 meters. Tadpoles are present in the pools. A large seepwillow is present between the reaches. No riparian vegetation overstory. Upland vegetation of desert scrub continues to edge of channel.

DATE		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES			
DATE	WATER PRESENCE	SPECIES	INVASIVE SPECIES	OBSERVED	OBSERVED	OBSERVED	OBSERVED	OBSERVED
May 2017	Surface water present	None Observed	None Observed	algae, yellow monkeyflower (Mimulus guttatus), seepwillow (Baccharis salicifolia)	oats (Avena sp.)	tadpoles	None Observed	None Observed







**Photo I.** I Berry Spring, view of well and drinker, May 2017.



Photo 3. I Berry Spring, view of open ended horizontal pipe embedded in the bedrock at the upper end of the seeps. Yellow monkeyflower, oats and algae are present around the water that drips from the pipe, May 2017.

May 2017.



Photo 2. I Berry Spring, view of bedrock intrusion across streambed and small concrete dam. Yellow monkeyflower and algae are present around the water collected around the dam, May 2017.



Photo 4. I Berry Spring, view of disjunct lower reach surrounded by herbaceous vegetation including yellow monkeyflower and deergrass, May 2017.



2017.



# **I BERRY SPRING Section 4: Photographs**



Photo 5. I Berry Spring, view of large seepwillow present between the reaches,



# KANES SPRING Section 1: General Information

### GENERAL INFORMATION

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
		Kanes Spring discharges from Paleozoic carbonates west	of the Apache Leap Escal
Kanes Spring	Kane Spring	disappearing in sandy alluvium in streambed. Spring box	iow the seeps, and some to with several generations of
COUNTY	CADASTRAL (40-acre)		
Pinal	(D-02-12)24bc		
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
U.S. Forest Service	Tonto National Forest	Teapot Mountain, AZ / Yes	Teapot Mountain A
GEOREFERENCE			
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
493036	3678400	3160 feet amsl	Estimated from US(
ADMINISTRATIVE			
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
Yes	Yes	36-24048 (USFS)	No
HYDROLOGY			
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Queen Creek	Arnett Creek	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000401	Arnett Creek		
GEOMORPHOLOGY			
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL
Contact and/or fracture spring	Paleozoic limestone	Rheocrene	Limestone
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Mixed runoff/spring dominated	small pool and springbox	
INFRASTRUCTURE			
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
	Several generations of pipeline from springs		Flow is retained in a
Spring box at head of spring	box leading down canyon		below the spring
ACTIVELY USED?	USE?		
Yes	Stock and wildlife		



rpment. Spring flows from contact between flow continues down the bedrock before f outlet piping evident.

### EDITIONS WHERE SHOWN

Z 7.5' (2011, 2014)

### RCE

GS 7.5' Topo

ICE

OGIC UNIT

a series of small rock pools in bedrock



# KANES SPRING Section 2: Hydrological Observations

			Spri	ng Flow	Water Quality Parameters							
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
10-2002		WRI									No	Water present in
15-May-03	15:00	GAI	0		81.9		397	4.7	11.5	8.5	Yes	
20-Aug-03	8:00	GAI	0		72.9		790	4.0	3.0	8.1	Yes	
3-Nov-03	8:50	GAI	<0.1		58.3		903	5.3	3.8	8.1	Yes	
9-Feb-04	10:00	GAI	<0.1		39.6		771	0.7	7.0	7.6	Yes	
4-Aug-04		GAI			76.1		785	10.4		8.1	No	
3-Nov-04	8:50	GAI			44.4		757	0.8	6.7	8.2	Yes	
9-Feb-05	10:02	GAI	<0.1		44.4		698	5.3	10.4	8.3	Yes	
3-May-05	10:05	GAI	0.5	estimated	60.4		752	0.5	12.5	8.1	Yes	
3-Aug-05	8:05	GAI	0.1	estimated	72.9		1019	18.8	5.9	7.8	Yes	
29-Aug-08	10:00	M&A	<0.1		74.7		707	0.0	7.2	7.9	Yes	
5-Nov-08	16:15	RC	0.1		69.3		654	0.6	5.8	7.0	Yes	
10-Feb-09	15:30	RC	0.6		69.3		613	0.3	6.6	7.4	Yes	
13-May-09	9:30	RC	0.4		71.2		650	3.2	7.0	7.3	Yes	
4-Aug-09	7:48	RC			83.1		668			8.1	No	~12ft of ground s
12-Feb-10	11:15	RC	0.5	Bucket & Stop Watch	65.5		653	11.0	9.0	7.5	Yes	clean but site in
13-Jul-10	9:40	RC	0.01	Bucket & Stop Watch	76.8		761		6.4	7.5	No	
17-Jul-10	17:08	RC			75.9		730			7.4	No	Dipped out of poo
9-Nov-10	9:23	RC	0.2	Bucket & Stop Watch	68.5		318	0.5	12.1	6.7	Yes	
14-Feb-11	9:30	RC	1	Bucket & Stop Watch	68.4		700			7.5	No	SC parameter tal
13-May-11	8:40	RC	0.03	Bucket & Stop Watch	69.1		667			7.3	No	
7-May-12	10:10	RC	0		68.2		562	7.8	7.1	7.4	Yes	New pipe connec
2-Jun-14	10:00	RC	0.1		77.5	630		3.9	9.8	9.0	No	Very low flow from
22-Aug-14	9:21	RC	0.1		72.0	690		10.4	10.6	8.7	No	Green tint; 4 disti
	and the second se											

WestLand Resources, Inc. Engineering and Environmental Consultants

2.5 meter x 1 meter pool on bedrock below steep travertine drops
saturation in a line trending down hill
shade ~60 degrees
ol
ken from spring box
cted
m predominantly two seeps in wall.
inct seeps that flow into small pool (~5 gal); flow is <0.1 GPM.



# KANES SPRING Section 2: Hydrological Observations

			Spri	ng Flow	Water Quality Parameters							
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
24-Nov-14	12:34	RC	0.1		44.2	662		0.9		8.3	No	Very low flow; m
16-Oct-15	12:18	RC	<0.1		71.5	446			26.3	9.2	Yes	Clear water; ver out into alluvium
8-Mar-16	12:30	RC			54.0	508		2.7	15.6	8.6	Yes	Minor algae; mu low flow <<1 gpr
6-Jun-16	12:57	RC	<1	estimated	88.9	744		6.2	3.1	8.0	Yes	<1GPM; ~3 acti
28-Jul-16	11:30	RC	0.5		95.3	433		4.7		9.0	Yes	Multiple seeps fleen enough water to
05-2017		WRI			68.5					7.7	No	Flows, seeps, ar

WRI = WestLand Resources, Inc.

GAI = Golder Associates, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown

NOTE: Results of hydrochemical analysis for this spring are presented in the following reports:

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Montgomery & Associates, 2013, **Surface water baseline report, Devils Canyon, Mineral Creek, and Queen Creek watersheds:** Final report prepared fro Resolution Copper Mining LLC, May 16, 2013.

Montgomery & Associates, 2016, **Hydrochemistry addendum, groundwater and surface water, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, August 11, 2016.



#### OBSERVATIONS

ultiple seeps flowing into pool; minor algae.

ry low flow; lots of algae; 3 small seeps flowing into a pool that flows ; <0.1 gpm; very trace flow.

Itiple seeps along face of waterfall; sampled from pool (seeps too n).

ve seeps

owing; minor amount of bright green algae; <1GPM of flow. Not collect for DO measurement

nd pools present



# KANES SPRING Section 3: Biological Observations

### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE							
East	West	20	Limestone bedrock							
COMMENTS										
Kane's Spring in the stimestone strata, Flow	Kane's Spring in the steep terrain of Kane's Canyon consists of a small pool of water, and a springbox with a pipe leading down the canyon. Seeps occur between the									
arizonica) covers the	slope above the spring.		scrook below the opting. A							

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
October 2002	Approximately 2.5m x 1m pool on bedrock below steep travertine drops	None Observed	None Observed	rush (Juncus sp.), seep willow (Baccharis salicifolia)	netleaf hackberry (Celtis reticulata),desert broom (Baccharis sarothroides), brickelbush (Brickellia sp.)	Water boatman and unidentified aquatic beetle	Gambel's quail (Callipepla gambelii)	None Recorded
May 2017	Flows, seeps and pools present	None Observed	None Observed	yellow monkeyflower (Mimulus guttatus), grassleaf rush (Juncus marginatus)	globemallow (Sphaeralcea sp.), desert hackberry (Celtis pallida), catclaw acacia (Senegalia greggii), jojoba (Simmondsia chinensis), velvet mesquite (Prosopis velutina)	None Observed	Northern cardinal (Cardinalis cardinalis)	None Observed







Photo I. Kanes Spring, view from upstream of spring box, July 2010.



Photo 3. Kanes Spring, spring box, July 2010





Photo 2. Kanes Spring, view of flow leading to pools in bedrock below. Wetland plant yellow monkeyflower is visible at lower left foreground, May 2017



Photo 4. Kanes Spring, view of pool in bedrock with canyon grape in the center of the background, November 2002.



Photo 6. Kanes Spring, view of pool in bedrock with wetland plant swordleaf rush visible in the center of the background, May 2017.



# **KANES SPRING Section 4: Photographs**



Photo 5. Kanes Spring, view of south wall, May 2017.



# LOWER RAILROAD SPRING Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
Lower Railroad Spring	None	Spring has not been located. First shown on 2011 7.5 spring or developed infrastructure found other than sto	-minute USGS quadrangle; a ck tank 350 feet to northwest
COUNTY	CADASTRAL (40-acre)		
Pinal	(D-02-12)6bc		
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND ED
USFS	Tonto National Forest	Picketpost, AZ / Yes	Picketpost AZ 7.5

#### GEOREFERENCE

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	]
ALRIS/WestLand	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOURCE
485172	3683210	2470	Estimated from top

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
Yes	Yes	36-80840 (USFS) 36-390303 (Martin)	No

#### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTENCE
Middle Gila	Queen Creek	Happy Camp Canyon	Unknown
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		

### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLOGI
	Unknown; older alluvium (Qoa)present in		
	bottom land; Gila conglomerate (QTg) in		
Unknown	canyon walls	Unknown	Unknown
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Unknown	Unknown	No	

### INFRASTRUCTURE

FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
Unknown	No	NA	No
ACTIVELY USED?	USE?		
No	Unknown		



ppears in ALRIS database; no evidence of

#### DITIONS WHERE SHOWN

(2011, 2014)

o map


# LOWER RAILROAD SPRING Section 2: Hydrological Observations

		Spring Flow		Water Quality Parameters					Flow Water Quality Parameters							
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?					
05-2011		WRI									No	Dry; no standir				
05-2017		WRI									No	No surface wa				

WRI = WestLand Resources, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown



ng water or flow observed

ter present



# LOWER RAILROAD SPRING Section 3: Biological Observations

### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE						
West	East	5	Alluvium						
COMMENTS									
No evidence of spring or developed infrastructure observed, other than stock tank 300 feet to the northwest. Vegetation is xero-riparian with no herbaceous wetland species observed.									

### **BIOLOGICAL OBSERVATIONS**

		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES	AQUATIC FAUNA	BIRD FAUNA	MAMMAL FAUNA
DATE	WATER PRESENCE	SPECIES	INVASIVE SPECIES	OBSERVED	OBSERVED	OBSERVED	OBSERVED	OBSERVED
May 2011	No surface water present	None observed		seepwillow (Baccharis salicifolia), saltcedar (Tamarix sp.)	None Recorded	N. A.	common raven (Corvus corax), Gambel's quail (Callipepla gambelii), greater roadrunner (Geococcyx californianus), white- winged dove (Zenaida asiatica)	None Observed
May 2017	No surface water present	None observed	Bermuda grass (Cynodon dactylon)	None Observed	catclaw acacia (Acacia greggii), beebush (Aloysia wrightii), canyon ragweed (Ambrosia ambrosiodes), desert broom (Baccharis sarothroides), sweetbush (Bebbia sp.), desert hackberry (Celtis pallida), desert willow (Chilopsis linearis), singlewhorl burrobush (Hymenoclea monogyra), wolfberry (Lycium sp.), velvet mesquite (Prosopis velutina), cliffrose (Purshia stansburiana), jojoba (Simmondsia chinensis)	N.A.	common raven (Corvus corax), Gambel's quail (Callipepla gambelii), white-winged dove (Zenaida asiatica)	None Observed







**Photo I.** Lower Railroad, view downstream from reported spring location (as shown on topographic map) showing xero-riparian vegetation of singlewhorl burrobush and catclaw acacia, May 2011.



**Photo 3.** Lower Railroad, view downstream from reported spring location (as shown on topographic map) showing xero-riparian vegetation of single whorl burrobush in active channel, May 2017.



**Photo 5.** Lower Railroad, view around reported spring location (as shown on topographic map) showing xero-riparian vegetation, May 2017.



**Photo 2.** Lower Railroad, view upstream from reported spring location (as shown on topographic map) showing xero-riparian vegetation of catclaw acacia and velvet mesquite, May 2011



**Photo 4.** Lower Railroad, view around reported spring location (as shown on topographic map) showing xero-riparian vegetation of velvet mesquite, May 2017.



**Photo 6.** Lower Railroad, view upstream from reported spring location (as shown on topographic map) showing xero-riparian vegetation of catclaw acacia, velvet mesquite and singlewhorl burrobush, May 2017.



LOWER RAILROAD SPRING Section 4: Photographs



## NO NAME SPRING Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
No Name Spring	None	Several seeps occur at contacts along stream channel where salt deposits are present. Flow disappears into	el between quartzite and shale stream channel in sandier are
COUNTY	CADASTRAL (40-acre)	Teaches. Some pooling.	
Pinal	(D-01-12)20dc		
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND ED
USFS	Tonto National Forest	Picketpost Mountain / NO	NA

#### GEOREFERENCE

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	]
Handheld GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOURCE
485964	3687153	2600 feel amsl	Estimated from US

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	Yes	36-24039 (USFS)	No

#### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTENCE
Middle Gila	Queen Creek	Whitford Canyon	unknown
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000403	Potts Canvon		

### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLOGIC
	pCy - Dripping Springs Quartzite; Qal -		
Contact spring	Alluvium	Rheocrene	pCy - Pioneer Shale
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Mixed runoff/spring dominated	none observed	

### INFRASTRUCTURE

FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
none observed	none observed	NA	none observed
ACTIVELY USED?	USE?		
unknown	unknown		



le. Also evidence of seepage from banks reas and then reappears in gravelly, bedrock

DITIONS WHERE SHOWN

GS 7.5' topo

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# NO NAME SPRING Section 2: Hydrological Observations

						Spring Flow		Water Quality Parameters							
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?				
05-2017		WRI			75.0					8.0	No	Flow for approxi			
22-Jun-17	7:05	M&A	2-3 gpm	Estimated	71.1		1131	0.0	2.5	7.5	Yes	Clear; flow for ap			

WRI = WestLand Resources, Inc. M&A = Montgomery & Associates RC = Resolution Copper --- = unknown



ο	BS	ER	VA	TIC	NS
_					

mately 500 meters.

pproximately 1000 feet below spring



# NO NAME SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE								
Southwest	Center	2	Alluvium over bedrock								
COMMENTS											
Several seeps occu disappears into stre whorl burrobush (A	ur at contacts along the strear eam channel in sandier areas mbrosia monogyra), Fremont	n channel between sar and then reappears in cottonwood (Populus	ndstone and mudstone. Also ev gravelly, bedrock reaches. Stra fremontii),velvet mesquite (Pros	idence of seepage from banks where salt deposits are present. Flow and vegetation includes canyon ragweed (Ambrosia ambrosioides), single sopis velutina) and catclaw acacia (Senegalia greggii).							

#### **BIOLOGICAL OBSERVATIONS**

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVE	BIRD FAUNA OBSERVED*	MAMMAL FAUNA OBSERVED*
May 2017	Flow for approximately 500 meters	None observed	Bermuda grass (Cynodon dactylon), barnyard grass (Echinochloa crus-galli), clover (Melilotus sp.), beardless rabbitsfoot grass (Polypogon monspeliensis)	Algae – filamentous and crustose, seepwillow (Baccharis salicifolia), toadrush (Juncus bufonius), purplemat (Nama demisssa), yellow monkeyflower (Mimulus guttatus), saltcedar (Tamarix sp.), cattail (Typha latifolia), centaury (Zeltnera calycosa)	oats (Avena sativa)	Aquatic invertebrates are present including water boatmen, water striders, starburst beetles. Tadpoles and metamorphs, are also present.	cactus wren (Campylorhynchus brunneicapillus), Gambel's quail (Callipepla gambelii), Gila woodpecker (Melanerpes uropygialis), greater roadrunner (Geococcyx californianus), mourning dove (Zenaida macroura),pyrrhuloxia	cottontail (Sylvanus audubonii), coyote (Canis latrans), gray fox (Urocyon cinereoargenteus), hognosed skunk (Conepatus leuconotus), javelina (Tayassu tajacu), mule deer (Odocoileus hemionus), ringtail (Bassariscus astutus), rock squirrel (Spermophila variegatus), whitetail deer (Odocoileus virginianus),

\*Incidental Observations on date of visit and wildlife camera observations May 2014 - March 2016







Photo I. No Name Spring, view of contact between sandstone and mudstone bedrock strata, June 2017.



Photo 3. No Name Spring, view of surface water along channel with crustose algae, June 2017.







Photo 2. No Name Spring, view of riparian vegetation including Fremont cottonwood and saltcedar along channel, June 2017.



**Photo 4.** No Name Spring, view of seepage along edge of channel, June 2017.

2017.



**NO NAME SPRING** Section 4: Photographs



Photo 6. No Name Spring, view of salt deposits along edge of channel, June



## PERLITE SPRING Section 1: General Information

#### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION				
		Impoundment at the base of an excavated perlite quarry.	No evidence of source app			
Perlite Spring	None	haulage; reportedly local rancher deepened a portion of t	he quarry and fills the pond			
COUNTY	CADASTRAL (40-acre)	for livestock watering. Several smaller excavated ponds a natural spring.	nd quarry workings upstrea			
Dinel	(D 01 12)10dd					
		7 5-minute USGS Quadrangle / Shown on guad?				
U.S. Forest Service	Tonto National Forest	Picketpost, AZ / Yes	Picketpost AZ 7.5' (2			
GEOREFERENCE						
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE				
GPS	NAD83	12Z				
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR			
484483	3686996	2620 feet amsl	Estimated from US			
ADMINISTRATIVE						
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?			
Yes	Yes	36-24044 (USFS)	No			
HYDROLOGY						
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN			
Middle Gila	Queen Creek	Bear Tank Canyon	no flow observed			
HYDROLOGIC UNIT CODE (HUC)	HUC Basin					
150501000405	Alamo Canyon - Queen Creek					
GEOMORPHOLOGY						
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLO			
NA	perlitic rhyolite	Anthropogenic	perlitic rhyolite			
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS				
Gravity	Runoff dominated	man-made structure				
INFRASTRUCTURE						
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?			
	several impoundments maintained by					
excavated impoundment	rancher	rancher fills impoundment on occasion	yes			
ACTIVELY USED?	USE?					
yes	livestock and wildlife watering					



parent other than runoff and rancher d when surface water flow is not adequate am from main impoundment; no evidence of

### EDITIONS WHERE SHOWN

2004, 2011, 2014)

RCE

SGS 7.5' Topo

ICE

OGIC UNIT



## PERLITE SPRING Section 2: Hydrological Observations

			Spri	ng Flow	Water Quality Parameters							
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
19-Feb-13	11:20	M&A/RC	0		49.6		268			7.2	No	Pool in manmader evidence of flow
26-Jun-13	13:31	RC	0		90.9		1321		2.2	7.6	Yes	Stagnant
7-Aug-13	12:02	RC	0		82.8	209	200		2.4	8.3	Yes	Medium pool; ru
28-Oct-13	15:54	RC	<1		61.6	384		16.1	7.8	8.2	Yes	>2000 gallons in
4-Mar-14	12:45	RC	0		65.3	314		12.6	3.0	9.0	Yes	No flow detected
19-Mar-14	10:50	RC	0								No	No flow
21-May-14	10:57	RC	0		81.9	601		16.0	2.3	8.4	Yes	Murky; stagnant;
14-Aug-14	7:53	RC	0		76.3	468		23.9	0.9	7.9	Yes	Murky; no visible
4-Nov-14	11:30	RC	0		56.8	222		17.7	5.3	8.0	Yes	Murky; no visible
4-Mar-15	10:15	RC	0		51.3	204		22.2	8.9	6.0	Yes	Murky; no visible
13-May-15	10:00	RC	0		60.4	337		36.0	4.3	7.9	Yes	No visible flow; g
05-2017		WRI			75.4	355				9.0	No	Pool at base of r

WRI = WestLand Resources, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown



#### OBSERVATIONS

le quarry; three pools in quarried areas upstream from main pool; no v into pool; evidence of cattle; oily sheen on water surface at upper

sty color

pool. Dark water.

l; brown/murky

no evidence of flow. Sample from pool.

flow.

e flow; water level higher than usual - due to recent precip.

flow.

reenish; murky

ock overhang, approximately 15 by 20 meters and one meter deep.



# PERLITE SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE								
Southwest	Center	2	Alluvium over bedrock								
COMMENTS											
Impoundment at ba (Celtis pallida) and which hold water s	ase of rock outcrop holds wate canyon ragweed (Ambrosia a easonally.	er seasonally. No evide ambrosiodes) present a	ence of source apparent. A singlaround the perimeter of the impo	e Goodding's willow (Salix gooddingii) is present with desert hackberry oundment. North of the spring there are several manmade impoundments							

#### **BIOLOGICAL OBSERVATIONS**

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVE	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED*
May 2017	Pool at base of rock overhang, approximately 15 by 20 meters wide and one meter deep	None observed	red brome (Bromus rubens), Bermuda grass (Cynodon dactylon), stinkgrass (Eragrostis cilianensis), canary grass (Phalaris canariensis), beardless rabbitsfoot grass (Polypogon monspeliensis)	Algae – filamentous and crustose, yellow monkeyflower (Mimulus guttatus)	Amaranthus palmeri, oats (Avena sativa), pepperweed (Descurainia sp.), rye (Elymus sp.), desert lavender (Hyptis emoryi), Gila rockdaisy (Perityle gilensis), London rocket (Sisymbrium irio), cocklebur (Xanthium strumarium)	Aquatic invertebrates, including boatmen, backswimmers, snails, water scorpion, and black-necked garter snake (Thamnophis cyrtopsis)	None Observed	coatimundi (Nasua narica), Western canyon bat (Parastrellus hesperus), cave myotis (Myotis velifer), big brown bat (Eptesicis fuscus), pallid bat (Antrozous pallidus), California leaf-nosed bat (Macrotus californicus), western mastiff bat (Eumops perotis)







Photo I. Perlite Spring, view to north of pool at base of rock overhang, May 2017.



Photo 3. Perlite Tank, view of impoundment north of Perlite Spring, May 2017.





Photo 2. Perlite Spring, view to west of pool showing Goodding's willow, May 2017.



Photo 4. Perlite Tank, view of snails embedded in mud of impoundment, May 2017.



Photo 6. View of velvet mesquite and Gila rock daisy (Growing on bedrock at right of photo), May 2017.



**PERLITE SPRING** Section 4: Photographs

Photo 5. Perlite Tank, view of blacknecked gartersnake observed, May 2017.



## PUMP STATION SPRING Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
Pump Station Spring	QC30.7C	Pump Station Spring is located in Queen Creek channel at	t the downstream extent o
COUNTY	CADASTRAL (40-acre)	Tertiary rhyolite and Apache Leap Tuff. The most upstrea channel. The most downstream surface water is a one by	m water is the first of a str 10-meter rock tinaja.
Pinal	(D-01-13)17dcb		
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
U.S. Forest Service	Tonto National Forest	Superior, AZ / Yes	Superior AZ 7.5' (1
GEOREFERENCE			
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOU
494041	3689017	4390 feet amsl	Estimated from US
ADMINISTRATIVE			
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring/ADV
Yes	Yes	4A-493 (Integrity); 36-23982 (USFS)	No / 55-609674 (In
HYDROLOGY			
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTE
Middle Gila	Queen Creek	Queen Creek Headwaters	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		
GEOMORPHOLOGY			
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL
Seepage or filtration	Alluvium (Qal)	Rheocrene	Tertiary Rhyolite (T
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Mixed runoff/spring dominated	No	
INFRASTRUCTURE			
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
None apparent	Stock trough and some piping evident	Vertical pipe near spring may have been a well	No
ACTIVELY USED?	USE?		
Yes?	Livestock/wildlife watering?		



of a large deposit of alluvium resting on tring of five small pools along the stream

### EDITIONS WHERE SHOWN

948) 981, 2004, 2011, 2014)

### RCE

GS 7.5' Topo

### NR 55 Registry?

tegrity)

NCE

OGIC UNIT

Tov)/Apache Leap Tuff(Tal)



# PUMP STATION SPRING Section 2: Hydrological Observations

Spring Flow				ng Flow		١	Nater Quality Parame	eters				
					_	Electrical	Specific		Dissolved			
		_	Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
10-2002		WRI									No	Water present in
15-May-03	10:40	GAI	3.2		58.6		746	0.8	7.5	7.6	Yes	
11-Jun-03	9:35	GAI			64.4	858				7.5	No	
4-Sep-03	9:40	GAI	1.5		65.7		770	1.6	2.8	7.4	Yes	
3-Nov-03	14:00	GAI	1.5		56.5		872	1.3	6.9	7.5	Yes	
9-Feb-04	15:40	GAI	1.5	estimated	48.7		820	0.9	5.1	7.4	Yes	
25-May-04	10:10	GAI	1	estimated	62.2		845	2.0	5.7	7.3	Yes	
3-Aug-04	9:50	GAI	<0.1		64.4		830	0.0	2.9	7.7	Yes	
30-Nov-04	16:10	GAI	0.25	estimated	54.1		857	0.9	4.9	7.3	Yes	
8-Feb-05	10:30	GAI	46	1 " Flume	48.2		634	6.1	9.2	7.9	Yes	
16-Mar-05	9:57	GAI			47.8		595			8.1	No	
4-May-05	10:05	GAI	20.3		61.3		710	0.7	12.2	7.9	Yes	
8-Aug-05	8:05	GAI	5	estimated	70.3		832	0.9	6.6	7.5	Yes	
24-Sep-05	9:35	GAI			60.4		779		2.8	6.9	No	
5-Aug-08	9:00	RC	<0.1		68.9		851	1.5	3.6	7.5	Yes	
4-Nov-08	14:00	RC	<0.1		58.5		891	0.0	2.8	7.1	Yes	
17-Feb-09	11:00	RC			48.4		147	134.0	10.3	8.2	Yes	
19-Feb-09	9:53	RC				760			2.5	7.4	No	
12-May-09	10:45	RC	1	estimated	61.7		8.4	7.4	10.6	7.3	Yes	
11-Aug-09	9:00	RC	0								No	3 gallons (stagna
16-Feb-10	11:30	RC	15	estimated	52.9		375	0.7	6.8	7.7	Yes	
15-Jul-10	10:30	RC	10.42	1 " Flume	68.2		829	7.7	15.3	7.6	No	95% Capture
22-Feb-11	11:00	RC			10.1		705			7.1	No	
05-2011		WRI									No	Water present in
17-May-11	10:30	RC	0		54.9		876	3.5	5.9	7.3	Yes	30 gallons (stagn



OBSERVATIONS
intermittent flow.
nt)
pools and damp streambed.
ant); some algae; no flow; muddy



## PUMP STATION SPRING Section 2: Hydrological Observations

				eters	Vater Quality Parame	V		ng Flow	Spring Flow					
	Sample Collected?	рН	Dissolved Oxygen (mg/L)	Turbidity (NTUs)	Specific Conductance (uS/cm)	Electrical Conductivity (uS/cm)	Temperature (° F)	Method	Flow (gpm)	Team	Time	Date		
20 gallons (stag	Yes	7.1	4.0	6.8	540		56.9		0	RC	11:15	9-May-12		
Dry	No								DRY	RC	11:39	14-May-14		
Dry	No								DRY	RC	11:20	26-Aug-14		
Dry	No								DRY	RC	9:30	17-Nov-14		
Still no clear evid black pvc pipe (†	No								DRY	RC	9:35	27-Sep-16		
Water present ir	No	7.6 8.0				838 861	66.6 74.5			WRI		05-2017		

WRI = WestLand Resources, Inc.

GAI = Golder Associates, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown

NOTE: Results of hydrochemical analysis for this spring are presented in the following reports:

Montgomery & Associates, 2010, Interim results of groundwater monitoring, Upper Queen Creek and Devils Canyon watersheds: Final report prepared for Resolution Copper Mining LLC, February 17, 2010.

Montgomery & Associates, 2012, **Results of hydrochemical characterization, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, March 9, 2012.

Montgomery & Associates, 2013, **Surface water baseline report, Devils Canyon, Mineral Creek, and Queen Creek watersheds:** Final report prepared fro Resolution Copper Mining LLC, May 16, 2013.

Montgomery & Associates, 2016, **Hydrochemistry addendum, groundwater and surface water, Upper Queen Creek/Devils Canyon study area:** Final report prepared for Resolution Copper Mining LLC, August 11, 2016.



#### OBSERVATIONS

nant)

dence of exact location. Found old 3" steel stand pipe next to 3" narker?). Queen Creek is dry.

pools and damp streambed.



## **PUMP STATION SPRING Section 3: Biological Observations**

#### **GENERAL DESCRIPTION**

E		Genter	10	Doulders and Cobbles
	Southeast	Center	10	Boulders and Cobbles
	ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE

#### COMMENTS

A canopy cover of riparian vegetation shades a narrow streambed with seeps present along the banks. Further downstream several tinajas are present. Riparian trees include Goodding's willow (Salix gooddingii), Arizona walnut (Juglans major), Arizona sycamore (Platanus wrightii), Fremont cottonwood (Populus fremontii), hoptree (Ptelea trifoliata), and netleaf hackberry (Celtis reticulata). Shrubs include jojoba (Simmondsia chinensis), velvet mesquite (Prosopis velutina), coffeeberry (Rhamnus californica), catclaw acacia (Senegalia greggii), manzanita (Arctostaphylos sp.), barberry (Berberis sp.), mountain mahogany (Cercocarpus montanum), oneseed juniper (Juniperus monosperma), sugar sumac (Rhus ovata), mulberry (Morus sp.), lemonade bush (Rhus trilobata), elderberry (Sambucus neomexicana)

#### **BIOLOGICAL OBSERVATIONS**

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
November 2002	Water intermittent for about 100 meters	None Observed	None Observed	cattail (Typha sp.), seepwillow (Baccharis salicifolia), Arizona sycamore (Platanus wrightii),	deergrass (Muhlenbergia rigens)	None Observed	Hermit thrush (Catharus guttatus), Gila woodpecker (Melanerpes uropygialis),Mexican jay (Aphelocoma wollweberi)	Deer (Odocoileus sp.)
May 2011	Water present in pools and damp streambed	None Observed	None Observed	pale spikerush (Eleocharis macrostachya), yellow monkeyflower (Mimulus guttatus), Bonpland's willow (Salix bonplandiana)	deergrass (Muhlenbergia rigens), canyon grape (Vitis arizonica), western poison ivy (Toxicodendron rydbergii)	None Observed	None Observed	None Observed
May 2017	Five small pools are strung along the channel with patches of damp sand and algae in between. A 10 x 1 meter pool at the end of the reach holds water.	None Observed	None Observed	pale spike rush (Eleocharis macrostachya), red trumpet (Epilobium canum), mint (Mentha sp.), yellow monkeyflower (Mimulus guttatus), toadrush (Juncus bufonius), Elliott's rush (J. elliottii), swordleaf rush (J. ensifolius), speedwell (Veronica anagallis- aquatica)	geranium (Geranium caespitosum), deergrass (Muhlenbergia rigens), wood sorrel (Oxalis sp.), penstemon (Penstemon sp.), scarlet hedgenettle (Stachys coccinea), canyon grape (Vitis arizonica), western poison ivy (Toxicodendron rydbergii)	Water striders, boatmen	Hermit thrush (Catharus guttatus),Mexican jay ( Aphelocoma wollweberi), Zone-tailed hawk (Buteo albonotatus)	Black-tailed rattlesnake (Crotalus molossus), Deer (Odocoileus sp.),







Photo I. Pump Station Spring, view downstream showing canopy of riparian trees including Goodding's willow, Arizona walnut, Arizona sycamore, and Fremont cottonwood, October 2002.



Photo 3. Pump Station Spring, view downstream showing canopy of riparian trees including Goodding's willow, Arizona walnut, Arizona sycamore, and Fremont cottonwood, May 2011.



Photo 5. Pump Station Spring, view downstream showing canopy of riparian trees including Goodding's willow, Arizona walnut, Arizona sycamore, and Fremont cottonwood, June 2017.





Photo 2. Pump Station Spring, view of pool and associated herbaceous vegetation, October 2002.



Photo 4. Pump Station Spring, view showing canopy of riparian trees including Goodding's willow, Arizona walnut, Arizona sycamore, and Fremont cottonwood. June 2011.

**PUMP STATION SPRING Section 4: Photographs** 



**Photo 6.** Pump Station Spring, view of pool at end of reach. June 2017.



# SPRING QC 22.6 E (KARST SPRING) Section 1: General Information

### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION					
QC 22.6 E	Karst Spring	Solution void in limestone on east bank of Queen Creek (	Solution void in limestone on east bank of Queen Creek (about 2 meters from che				
COUNTY	CADASTRAL (40-acre)	highway bridge; only flows during wet periods. First identi	fied by RC (Golder) in Api				
Pinal	(D-01-12)36cb						
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND				
U.S. Forest Service	Tonto National Forest	No					

#### GEOREFERENCE

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
491659	3684231	2940 feet amsl	Estimated from US

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	No	N/A	No

#### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Queen Creek	Canyon Reach	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		

### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL
Tubular Spring	Limestone	Cave	Limestone
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Mixed runoff/ spring dominated	None	

### INFRASTRUCTURE

FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
No	No	NA	No
ACTIVELY USED?	USE?		
Unknown	Unknown		



nnel); immediately upstream from old US60 ril 2004.

## D EDITIONS WHERE SHOWN

## IRCE

GS topo map

ICE

LOGIC UNIT



# SPRING QC 22.6 E (KARST SPRING) Section 2: Hydrologic Observations

		Spring Flow Water Quality Parameters					Water Quality Parameters					
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
8-Feb-05	8:00	GAI	29.2	?	59.4		366	0.9	4.4	7.5	Yes	
16-Mar-05	10:03	GAI	8	estimated	54.7		288			8.1	No	
28-Aug-08	9:00	RC	30.8		66.9		570	1.1	4.1	7.1	Yes	
11-Feb-09	16:00	RC	52.0		62.6		392	1.4	3.5	7.3	Yes	
13-Feb-10	14:00	RC	10								No	
27-Feb-12	10:25	RC	3	estimated	63.7		445	7.3	6.7	7.9	Yes	
27-Nov-12	11:09	RC	0								No	
17-Dec-12	13:20	RC	5	estimated	65.5		376		6.6	7.3	Yes	
29-Jan-13	13:00	RC	40	estimated	59.5		310			7.4	Yes	
13-Mar-13	9:45	RC	30	estimated	58.5		357		2.9	7.7	Yes	
4-Mar-14	14:43	RC	0.1								No	<0.5 GPM; not
5-Jun-14	10:15	RC	DRY								No	Dry
21-Aug-14	12:20	RC	DRY								No	Dry
3-Nov-14	12:24	RC	DRY								No	Dry
22-Oct-15	15:15	RC	DRY								No	Dry
12-Jan-16	11:50	RC	0.1								No	Flowing; very lov
8-Jun-16	13:04	RC	DRY								No	Dry
14-Jul-16	13:52	RC	DRY								No	Dry
06-2017		WRI	DRY								No	No surface wate

WRI = WestLand Resources, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown



OBSERVATIONS
enough water to sample (for opp. sampling). Photos and video taken.
v discharge (0.1-0.5GPM). Too low flow for sample/parameters.
r present



# QC 22.6E (KARST SPRING) Section 3: Biological Observations

### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE				
		4.5					
Southwest	Northeast	15	Limestone				
COMMENTS							
Solution void in limestone on east bank of Queen Creek. Density of wetland species, yellow monkeyflower, around cave entrance suggests increased moisture is							
present.							

#### **BIOLOGICAL OBSERVATIONS**

		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES	AQUATIC FAUNA	BIRD FAUNA	MAMMAL FAUNA	
DATE	WATER PRESENCE	SPECIES	INVASIVE SPECIES	OBSERVED	OBSERVED	OBSERVED	OBSERVED	OBSERVED	
June 2017	No surface water present	None Observed	fountain grass	yellow monkeyflower (Mimulus	catclaw acacia (Senegalia	None Observed	None Observed	None Observed	
			(Pennisetum setaceum)	guttatus)	greggii), brickel bush (Brickellia				
					sp.)				







**Photo I.** Spring QC22.6E (Karst Spring), view showing wetland plant yellow monkeyflower in the foreground and catclaw acacia obscuring the cave, June 2017.



**Photo 2.** View into solution cavity at Spring QC 22.6 E (Karst Spring), estimated flow 20 gpm, April 2004.



**Photo 3.** Karst Spring, view showing cave with wetland plant yellow monkeyflower in the foreground and invasive plant Fountain grass in the background, June 2017.



SPRING QC22.6E (KARST SPRING) Section 4: Photographs



## QUEEN SEEPS Section 1: General Information

## **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION					
Queen Seeps	QC25.6E	Complex of seeps along south side of Queen Creek canv	Complex of seeps along south side of Queen Creek canvon below No.9 shaft: ab				
COUNTY	CADASTRAL (40-acre)	reach. Majority of vegetation is within 50 meters of channel; no standing war measurable center; soil on the hillslope is moist.					
Pinal	(D-01-13)21cd						
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AN				
U. S. Forest Service	Tonto National Forest	Superior, AZ / No	None				

#### GEOREFERENCE

SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUF
493857	3685619	3800 feet amsl	Estimated from U.S

#### ADMINISTRATIVE

INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	None	NA	No

#### HYDROLOGY

BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Queen Creek	Canyon Reach	Intermittent/epheme
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		

#### GEOMORPHOLOGY

SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLO
Seepage or infiltration	Apache Leap Tuff	Hillslope	Apache Leap Tuff
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Seep dominated	None	

#### INFRASTRUCTURE

FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
None	None	NA	No
ACTIVELY USED?	USE?		
Unknown	Unknown		



Indant riparian vegetation for ~300 meter served; some flow observed on occasion; no

## ID EDITIONS WHERE SHOWN

### RCE

G.S. Topo map

NCE

eral

OGIC UNIT



## QUEEN SEEPS Section 2: Hydrological Observations

		Spring Flow Water Quality Parameters				Water Quality Parameters						
						Electrical	Specific		Dissolved			
			Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample	
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?	
10-2002		WRI									No	No water presen
02-2009		WRI									No	No water presen
05-2011		WRI									No	No water observ overgrowth
05-2017		WRI									No	No water observ overgrowth

WRI = WestLand Resources, Inc. M&A = Montgomery & Associates RC = Resolution Copper --- = unknown



#### OBSERVATIONS

t; staining on south slope is evidence of water seepage

t; staining on south slope is evidence of water seepage

ed; north facing slope is saturated and has dense vegetation

ed; north facing slope is saturated and has dense vegetation



## QUEEN SEEPS Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
North	South	25	Soil and Bedrock

#### COMMENTS

A dense thicket of shrubbery blankets the south slope of Queen Creek below the No. 9 shaft. Surface water is not present but the soil on the hillslope is moist. Riparian trees shade the streambed below the hillslope and include Arizona walnut (Juglans major), Arizona sycamore (Platanus wrightii), Fremont cottonwood (Populus fremontii), velvet ash (Fraxinus velutina) and netleaf hackberry (Celtis reticulata). Shrubs include coffeeberry (Rhamnus californica), mulberry (Morus sp.), lemonade bush (Rhus trilobata), elderberry (Sambucus neomexicana), canyon grape (Vitis arizonica), and desert honeysuckle (Anisacanthus thurberi).

#### **BIOLOGICAL OBSERVATIONS**

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
October 2002	No surface water observed, staining on south slope is evidence of water seepage	None Observed	None Recorded	Arizona sycamore (Platanus wrightii) Goodding's willow (Salix gooddingii)	None Recorded	None Observed	None Recorded	None Recorded
February 2009	No surface water observed, staining on south slope is evidence of water seepage	None Observed	None Recorded	Arizona sycamore (Platanus wrightii) Goodding's willow (Salix gooddingii)	coastal woodfern (Dryopteris arguta), California figwort (Scrophularia californica), Himalayan blackberry (Rubus discolor), bigtooth maple (Acer grandidentatum)	None Observed	None Recorded	None Recorded
May 2011	No surface water observed, north facing slope is saturated zone with dense overgrowth	None Observed	None Observed	Arizona sycamore (Platanus wrightii) Goodding's willow (Salix gooddingii)	, coastal woodfern (Dryopteris arguta), Himalayan blackberry (Rubus discolor)	None Observed	None Observed	None Observed
May 2017	No surface water observed, north facing slope is saturated zone with dense overgrowth	None Observed	None Observed	yellow monkeyflower (Mimulus guttatus), Arizona sycamore (Platanus wrightii), Goodding's willow (Salix gooddingii), distant scorpionweed (Phacelia distans)	coastal woodfern (Dryopteris arguta), Himalayan blackberry (Rubus discolor), scarlet hedgenettle (Stachy coccinea)	None Observed	None Observed	None Observed







Photo I. Queen Seeps, view of dense thicket of shrubbery, including canyon grape and blackberry, blanketing the south slope, October 2002.



Photo 3. Queen Seeps, view of wild grape, elderberry, mulberry, coffeeberry and blackberry thicket on south slope, May 2011.



Photo 5. Queen Seeps, view of wild grape, elderberry, mulberry, coffeeberry and blackberry thicket on south slope, June 2017.



Photo 2. Queen Seeps, view of coastal woodfern, February 2009.



Photo 4. Queen Seeps, view of riparian trees shading the streambed below the hillslope including Arizona walnut, Arizona sycamore and velvet ash, June 2017.





## **QUEEN SEEPS Section 4: Photographs**



Photo 6. Queen Seeps, view of coastal woodfern, June 2017.



## RANCHO RIO SPRING Section 1: General Information

#### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
		Rancho Rio Spring is located at the head of a bedrock-dor	minated reach of Rancho F
Rancho Rio Spring	Upstream of RR1.0C	with Devils Canyon. A series of tinajas below the spring r	nay hold runoff water for m
COUNTY	CADASTRAL (40-acre)	discharge from alluvial deposits located west of the Ranch deposits. No discreet discharge point evident. Spring flow	o Rio fault. A stcck pond h occurs via disbursed disch
Pinal	(D-02-13)5bd		
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
U.S. Forest Service	Tonto National Forest	Superior, AZ / No	
GEOREFERENCE			
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
495955	3682970	3920 feet amsl	Estimated from US
ADMINISTRATIVE			
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	GWSI Spring?
No	Yes	36-24139 (Integrity)	No
HYDROLOGY			
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Devils Canyon	Rancho Rio	Intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000205	Devils Canyon		
GEOMORPHOLOGY			
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	
Seepage or filtration	Alluvium	Rheocrene	Apache Leap Tuff
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Mixed runoff/spring dominated	Stock pond excavated into alluvial source	
INFRASTRUCTURE			
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
Stock pond excavated into alluvium at hea	ad None syldert		Deele
ACTIVELY USED?			120018
Yes?	Wildlife		



Rio creekabout 1 mile above the confluence nost of the year. Spring represents has been excavated from the alluivial harge to bedrock channel below alluvium.

### EDITIONS WHERE SHOWN

## RCE

GS 7.5' topo

## NCE

## OGIC UNIT



## RANCHO RIO SPRING Section 2: Hydrological Observations

			Spring Flow Wa			Water Quality Parameters		ter Quality Parameters				
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
19-Aug-08	17:00	GAI	<0.1		89.1		168	4.3	12.8	9.7	Yes	
5-Nov-08	16:00	GAI	0.1	estimated	58.6		1637	0.9	4.4	7.6	Yes	
26-Feb-09	9:30	GAI	29.2		59.2		89	5.0	9.5	6.8	Yes	
21-May-09	10:30	GAI	3	estimated	66.4		137	3.2	4.0	6.2	Yes	
10-Aug-09	13:38	RC	3		67.3		120			5.7	No	
18-Feb-10	14:00	RC	8.5	1-inch flume	59.7		89	2.3	12.6	6.9	Yes	90 percent captu
2-Nov-10	17:00	RC	0	NA	62.8		115	8.1	10.0	7.6	Yes	
05-2011		WRI									No	A series of 17 pc
28-Jun-11	11:43	RC	3.4	1-inch flume							No	95 percent captu
9-Dec-11	8:30	RC	2.5	estimated	40.6		103	5.9	7.4	7.0	Yes	
5-Mar-12	12:05	RC	2.7	1-inch flume							No	100 percent cap
27-Apr-12	13:40	RC	5	estimated	72.0		139	8.8	5.7	6.5	Yes	
27-Aug-12	11:15	RC	0.1	estimated	90.1			34.0	8.3	6.8	Yes	
12-Nov-12	13:07	RC	0								No	
12-Feb-13	15:00	RC	15	estimated							No	
6-Jun-13	13:05	RC	0.3		86.4		127			7.1	No	
1-Nov-13	13:29	RC	0								No	Dry
20-Feb-14	15:20	RC	1	estimated	63.3	143			3.0	8.7	No	
22-May-14	12:35	RC	2	estimated	80.8	149		1.4	10.7	7.7	Yes*	*Sampled for low
26-Sep-14	12:35	RC	1	estimated	84.6	147		2.1	10.9	8.1	No	Semi-clear; alga
19-Nov-14	13:35	RC	3	estimated	60.0	174		1.5	8.0	7.2	No	Clear with sectio
2-Mar-15	10:44	RC	2.5	estimated	55.9	129		0.7	8.9	7.0	No	Clear; abundant
22-May-15	14:26	RC	1	estimated	77.5	149			8.3	6.6	No	Low flow; slightly
28-Oct-15	9:24	RC	Dry	NA							No	Dry
23-Feb-16	12:00	RC	4.7	1-inch flume	56.5	89			8.3	6.6	Yes	Clear; minor alga



-

OBSERVATIONS
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ure for flow measurement; green algae present on stream bottom

ols with water

ure for flow measurement

ture for flow measurement

v level Hg at 12:35

l mats

ons of stagnation and brown-orange algal mats

green algal mats

/ murky; lots of algae

ae



## RANCHO RIO SPRING Section 2: Hydrological Observations

			Spri	ng Flow	Water Quality Parameters							
Date	Time	Team	Flow (gpm)	Method	Temperature (° F)	Electrical Conductivity (uS/cm)	Specific Conductance (uS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	рН	Sample Collected?	
11-Apr-16	14:31	RC	2	estimated	72.1	114		1.3	11	5.9	Yes	Clear; low flow; n
13-Sep-16	13:17	RC	Dry	NA							No	Dry
20-Dec-16	8:54	RC	0	estimated							No	Pooled water foll
05-2017		WRI									No	Water present in

WRI = WestLand Resources, Inc.

GAI = Golder Associates, Inc.

M&A = Montgomery & Associates

RC = Resolution Copper

--- = unknown



### OBSERVATIONS

moderate algae

lowing recent rain; water is slightly murky

a series of pools for approximately 145 meters



## RANCHO RIO SPRING Section 3: Biological Observations

### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
East	West	7	Bedrock

## COMMENTS

Rancho Rio Creek is a tributary that flows into Devils Canyon from the west. About 1.0 mile from the confluence is a series of tinajas that may hold runoff water for most of the year. At the head of the tinajas a small seep is present.

#### **BIOLOGICAL OBSERVATIONS**

		SPECIAL STATUS	INVASIVE	WETLAND SPECIES	OTHER PLANT	AQUATIC FAUNA	BIRD FAUNA	MAMMAL FAUNA
DATE	WATER PRESENCE	SPECIES	SPECIES	OBSERVED	SPECIES OBSERVED	OBSERVED	OBSERVED*	OBSERVED*
May 2011	A series of 17 pools held water.	None Observed	beardless rabbitsfoot grass (Polypogon monspeliensis)	buttonbush (Cephalanthus occidentalis), yellow monkeyflower (Mimulus guttatus), Goodding's willow (Salix gooddingi), pale spikerush (Eleocharis macrostachya), pondweed (Potamageton sp.), swordleaf rush (Juncus ensifolius), grassleaf rush (J. marginatus), false indigobush (Amorpha fruticosa)	deergrass (Muhlenbergia rigens), netleaf hackberry (Celtis reticulata)	Sonora mud turtle (Kinosternon sonoriense), macroinvertebrates, phytoplankton, periphyton, zoo plankton	American robin (Turdus migratorius), black- headed grosbeak (Pheucticus melanocephalus), canyon towhee (Melozone fusca), Bewick's wren (Thryomanes bewickii), Greater roadrunner (Geococcyx californianus), Western scrub jay (Aphelocoma californica), Gambel's quail (Callipepla gambelii), curve- billed thrasher (Toxostoma curvirostre), turkey vulture (Cathartes aura), cactus wren (Campylorhynchus brunneicapillus), whitewinged dove (Zenaida asiatica), mourning dove (Zenaida macroura), Gila woodpecker (Melanerpes uropygialis), Great blue heron (Ardea herodias)	bobcat (Lynx rufus), coatimundi (Nasua narica), coyote (Canis latrans), black bear (Ursus americanus), mountain lion (Puma concolor), rock squirrel (Spermophila variegatus), hognosed skunk (Conepatus mesoleucus), hooded skunk (Mephitis macroura), gray fox (Urocyon cinereoargenteus), rock squirrel (Spermophila variegatus), whitetailed deer (Odocoilus virginianus), cottontail (Sylvilagus audubonii), javelina (Tayassu tajacu), ringtail (Bassariscus astutus), cliff chipmunk (Tamias dorsalis), raccoon (Procyon lotor), white-throated woodrat (Neotoma albigula), striped skunk (Mephitis mephitis)
May 2017	Water present in a series of pools for approximately 145 meters	None Observed	beardless rabbitsfoot grass (Polypogon monspeliensis), saltcedar (Tamarix sp.	false indigobush (Amorpha fruticosa), cattail (Typha sp.), beardless rabbitsfoot grass (Polypogon monspeliensis)	netleaf hackberry (Celtis reticulata), Goodding's willow (Salix gooddingii), Fremont cottonwood (Populus fremontii)	Sonora mud turtle (Kinosternon sonoriense), canyon tree frog (Hyla arenicolor)	American robin (Turdus migratorius), black- headed grosbeak (Pheucticus melanocephalus), canyon towhee (Melozone fusca), Bewick's wren (Thryomanes bewickii), Greater roadrunner (Geococcyx californianus), Western scrub jay (Aphelocoma californica), Gambel's quail (Callipepla gambelii), curve- billed thrasher (Toxostoma curvirostre), turkey vulture (Cathartes aura), cactus wren (Campylorhynchus brunneicapillus), whitewinged dove (Zenaida asiatica), mourning dove (Zenaida macroura), Gila woodpecker (Melanerpes uropygialis), Great blue heron (Ardea herodias)	bobcat (Lynx rufus), coatimundi (Nasua narica), coyote (Canis latrans), black bear (Ursus americanus), mountain lion (Puma concolor), rock squirrel (Spermophila variegatus), hognosed skunk (Conepatus mesoleucus), hooded skunk (Mephitis macroura), gray fox (Urocyon cinereoargenteus), rock squirrel (Spermophila variegatus), whitetailed deer (Odocoilus virginianus), cottontail (Sylvilagus audubonii), javelina (Tayassu tajacu), ringtail (Bassariscus astutus), cliff chipmunk (Tamias dorsalis), raccoon (Procyon lotor), white-throated woodrat (Neotoma albigula), striped skunk (Mephitis mephitis)

\*Incidental Observations on date of visit, from focused surveys, and wildlife camera observations July 2012, February 2014 - March 2016







Photo I. View of stock pond at Rancho Rio Spring. Pond is excavated from alluvial deposit west of Rancho Rio fault, April 2017.



Photo Rancho Rio tinajas downstream from spring, view of bedrock strata **3**nd area that holds pool of water seasonally, May 2011.







Photo 2. Rancho Rio, view of stream and upland desert scrub adjacent to the spring area below stock pond in Photo 1 and above tinajas in subsequent photos, May 2011.



Photo 4. Rancho Rio, view of bedrock tinaja with vegetation including saltcedar, Fremont cottonwood and willows, mid-July 2017.



Photo 6. Rancho Rio, view of same bedrock tinaja as Photo 4. Two weeks later the tinaja is full and overflowing, late July 2017.



## **RANCHO RIO SPRING Section 4: Photographs**

Photo 5. Rancho Rio, view of tinajas where a Sonoran mud turtle was



## THE GROTTO Section 1: General Information

#### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION	
		Grotto formed in boulder breakdown at head of KP canyor	west of former CCC camp
The Grotto	Oak Flat Spring	walls comprised of Apache Leap Tuff blocks with alluvial v	eneers and bedrock pools
COUNTY	CADASTRAL (40-acre)	captured, stored and slowly released into grotto through ce	eiling fractures after rainy p
Pinal	(D-01-13)33bc	Igrotto and collects on the floor in small pools. Highly sease	onal presence of water, but
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND
U.S. Forest Service	Tonto National Forest	Superior, AZ / No	N/A
GEOREFERENCE			
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE	
GPS	NAD83	12Z	
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUR
495254	3684717	3936 feet amsl	Handheld GPS
ADMINISTRATIVE			
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	ADWR 55 REGISTR
No	No	N/A	No
HYDROLOGY			
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN
Middle Gila	Queen Creek	Shaft 9 Wash	intermittent
HYDROLOGIC UNIT CODE (HUC)	HUC Basin		
150501000402	Silver King Wash-Queen Creek		
GEOMORPHOLOGY			
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOLO
Seepage or filtration seep	Alluvium	Hanging garden	Apache Leap Tuff
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	
Gravity	Runoff dominated	None	
INFRASTRUCTURE			
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?
None	None		Natural pools above
ACTIVELY USED?	USE?		
Yes	Wildlife		



p in Oak Flat. Breakdown blocks and grotto s upstream fro grotto. Surface water runoff is periods. Water seeps down the walls of it protected, cool, and dark all year.

#### EDITIONS WHERE SHOWN

RCE

RY/NUMBER

ICE

OGIC UNIT

e grotto



# THE GROTTO Section 2: Hydrological Observations

			Spring Flow			Water Quality Parameters							
							Electrical	Specific		Dissolved			
			Flow		Temperature	Conductivity	Conductance	Turbidity	Oxygen		Sample		
Date	Time	Team	(gpm)	Method	(° F)	(uS/cm)	(uS/cm)	(NTUs)	(mg/L)	рН	Collected?		
12-Apr-16	16:55	M&A	DRY								No	Dry walls and flo	
22-Mar-17	10:52	M&A	Flow, dripping		53	102.6				6.88	No	Dripping on mair	
17-Apr-17	10:59	M&A	Minor flow									Not enough flow wall dry surround	
26-Apr-17	10:38	M&A	Minor flow									One or two small visit; not enough	
5-May-17	12:15	M&A	Damp									Rattlesnake four	
23-Jun-17	9:51	M&A	DRY										
14-Jul-17	10:00	M&A	DRY										
27-Jul-17	9:40	M&A	Flowing		72.3	60.7				7.61	No	Drips/flow from to	
4-Aug-17	12:03	M&A	Flowing		72.3	139.7				7.5	No	Small pool at bas	
24-Aug-17	9:45	M&A	Wet									4-5 drips; base o	

WRI = WestLand Resources, Inc. M&A = Montgomery & Associates RC = Resolution Copper --- = unknown



#### OBSERVATIONS

or of cave

wall with 1 gallon in pool at base of wall

for parameters; slow drip in 3-4 places; moss has light green color; ding moss

I drips from top of wall; moss has light green color, same as previous flow for parameters

nd, no flow

op opf wall and pooled at base

se of wall

of wall damp



# THE GROTTO Section 3: Biological Observations

### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE
Southeast	Northeast	10	Bedrock
COMMENTS			
Water flows down the w	alls of a cave and collects on	the floor in pools.	

#### **BIOLOGICAL OBSERVATIONS**

		SPECIAL STATUS		WETLAND SPECIES	OTHER PLANT SPECIES	AQUATIC FAUNA	BIRD FAUNA	MAMMAL FAUNA
DATE	WATER PRESENCE	SPECIES	INVASIVE SPECIES	OBSERVED	OBSERVED	OBSERVED	OBSERVED	OBSERVED
March - June 2017	Surface water present	None Observed	Bermuda grass	rush (Juncus sp.)	lip ferns (Cheilanthes sp.), Emory	tadpoles	None Observed	bat colony
			(Cynodon dactylon)		oak (Quercus emoryi)			







Photo I. The Grotto, view showing seeps along the wall of the cave, September 2017.



Photo 3. The Grotto, closeup view showing algae and moss growing on the seeps along the wall of the cave, July 2017.



Photo 5. The Grotto, view showing seeps flowing into pools on the floor of the cave, July 2017.



Photo 2. Boulder breakdown above the Grotto where several pools are located, with check dam further upstream, September 2017.



Photo 4. The Grotto, view showing bat colony in a crevice of the cave wall, July 2017.



July 2017.



## **THE GROTTO Section 4: Photographs**



## WALKER SPRING Section 1: General Information

#### **GENERAL INFORMATION**

SPRING IDENTIFIER	ALTERNATE IDENTIFIERS	SITE DESCRIPTION				
		Walker Spring occurs as seeps along the channel banks in	a tributary to Happy Car			
Walker Spring	None	conglomerate ledge in streambed. Banks are saturated and	d seeping on both sides o			
COUNTY	CADASTRAL (40-acre)					
Pinal	(D-01-12)32da					
LAND OWNERSHIP	LAND OWNERSHIP - DETAIL	7.5-minute USGS Quadrangle / Shown on quad?	LIST QUADS AND			
U.S. Forest Service	Tonto National Forest	Picketpost Mountain, AZ / No				
GEOREFERENCE			-			
SOURCE OF GEOREFERENCE DATA	DATUM	UTM ZONE				
GPS	NAD83	12Z				
UTM Easting	UTM Northing	ELEVATION	ELEVATION SOUF			
486361	3684216	2565 feet amsl	Estimated from US			
ADMINISTRATIVE						
INCLUDED IN ALRIS DATABASE?	ADWR SURFACE WATER RIGHT FILING?	ADWR SURFACE WATER RIGHT FILING NUMBER	ADWR 55 REGIST			
No	None	NA	NA			
HYDROLOGY						
BASIN	SUB-BASIN	LOCAL DRAINAGE	FLOW PERSISTEN			
Middle Gila	Queen Creek	Happy Camp Canyon	Intermittent			
HYDROLOGIC UNIT CODE (HUC)	HUC Basin					
150501000402	Silver King Wash - Queen Creek					
GEOMORPHOLOGY						
SOURCE GEOMORPHOLOGY	HOST GEOLOGIC UNIT	SPRING TYPE (Discharge Sphere)	PERCHING GEOL			
Seepage or filtration	bedding planes in Gila conglomerate (QTg)	Rheocrene	Gila Conglomerate			
FLOW FORCE MECHANISM	CHANNEL DYNAMICS	ANTHROPOGENIC CONTROLS	v			
Gravity	Mixed runoff / spring dominated	None				
INFRASTRUCTURE						
FLOW MODIFICATION?	PIPING or other DIVERSION?	OTHER	POND?			
None	None		No			
ACTIVELY USED?	USE?					
unknown	unknown					



amp Canyon. Flow starts just below of the stream.

EDITIONS WHERE SHOWN

### RCE

GS Topo

#### RY/NUMBER

NCE

## OGIC UNIT



# WALKER SPRING Section 2: Hydrological Observations

				Spring Flow		Water Quality Parameters						
					Tomporature	Electrical	Specific		Dissolved			
Date	Timo	Toom	Flow (apm)	Method		Conductivity	Conductance		Oxygen (mg/L)	nH	Sample	
Date	Time	Team	(gpm)	wethou	(		(uo/ciii)		(IIIg/L)	рп	Collected?	Flow starts just b
1-May-17		WRI			78.8	1360				8.7	No	seeping on both approximately 3
30-Aug-17	14:30	M&A	0.2		94.1		1243	44.0		7.9	Yes	Clear; very light

WRI = WestLand Resources, Inc. M&A = Montgomery & Associates RC = Resolution Copper --- = unknown



#### OBSERVATIONS

below conglomerate ledge in streambed. Banks are saturated and a sides of the stream. Seeps, flows and pools present for 30 meters;

yellow



# WALKER SPRING Section 3: Biological Observations

#### **GENERAL DESCRIPTION**

ASPECT	SIDE OF CANYON	SLOPE %	SUBSTRATE	
West	Center	5	Alluvium over bedrock	
COMMENTS				

Occurs as seeps along banks in tributary to Happy Camp Canyon. One large dead Fremont cottonwood (Populus fremontii) occurs at upper end of wet area where conglomerate bedrock ledge intrudes across streambed.

#### **BIOLOGICAL OBSERVATIONS**

DATE	WATER PRESENCE	SPECIAL STATUS SPECIES	INVASIVE SPECIES	WETLAND SPECIES OBSERVED	OTHER PLANT SPECIES OBSERVED	AQUATIC FAUNA OBSERVED	BIRD FAUNA OBSERVED	MAMMAL FAUNA OBSERVED
May 2017	Flow starts just below conglomerate ledge in streambed. Banks are saturated and seeping on both sides of the stream. Seeps, flows and pools present for approximately 30 meters.	None observed	red brome (Bromus rubens), Bermuda grass (Cynodon dactylon), clover (Melilotus sp.)	seepwillow (Baccharis salicifolia), purple mat (Nama demisssa), speedwell (Veronica anagallis- aquatica)	canyon ragweed (Ambrosia ambrosiodes)	Aquatic invertebrates are present including water boatmen, water striders, starburst beetles. Tadpoles and metamorphs, are also present.	None Observed	None Observed






**Photo I.** Walker Spring, view of conglomerate bedrock ledge across streambed, May 2017.



**Photo 3.** Walker Spring, view of seeps along banks, May 2017.

**Photo 5.** Wa June 2017.



**Photo 2.** Walker Spring, view of wetland plant purple mat growing in wet area along channel, May 2017.



**Photo 4.** Walker Spring, view of surface water along edge of channel, May 2017.



**Photo 6.** Walker Spring, pocket of moisture along edge of channel excavated by wildlife, June 2017.



## WALKER SPRING Section 4: Photographs



Photo 5. Walker Spring, view of previously moist channel that is now dry,

