

# Appendix B: Spring Inventory Reports

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## 1. Alamo Spring Survey Summary Report, Site ID 12981

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Alamo Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 37' 59.95" latitude, - 110 39' 27.04" longitude in the Sonoita USGS Quad, measured using a Garmin GPS (NAD 83, 6 meters EPE). The elevation is approximately 1512 meters. Nick Deyo, Julia Fonseca, Bill Beaver, and Michael Stock surveyed the site on 7/21/2012 for 02:30 hours, beginning at 09:00, and collected data in 10 of 12 categories.



Fig 1.1 Alamo Spring.

**Physical Description:** Alamo Spring is a rheocrene spring that emerges from a shallow canyon surrounded by oak woodland habitat. The spring creates a cienega

habitat within a 6-meter wide alluvial floodplain. The microhabitat associated with the spring covers 510 m<sup>2</sup>.

The emergence environment is subaerial, with a gravity flow force mechanism. It is spring dominated. The distance to the nearest spring is 4382 meters. The site receives approximately 95% of available solar radiation, with 44481 Mj annually.

**Survey Notes:** The site appears to be in good ecological condition, with slight evidence of grazing. There is an old pipe .5 km from the spring.

**Water:** Flow was measured at 0.125 L/s with a volumetric method. Water quality was measured at a depth of 60 cm in a pool just downstream of a bedrock outcrop just NE of the GPS location.

**Table 1.1 Alamo Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.2
Specific Conductance uS/cm	525
Water Temperature °C	21.1
Dissolved Solids	

**Flora:** Surveyors identified 26 plant species at the site.

**Table 1.2 Alamo Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Agave	SC		
Amorpha fruticosa	SC	N	F
Arctostaphylos	SC		U
Baccharis salicifolia	SC	N	R
Ceanothus	SC	N	U
Chara sp	AQ		A
Cynodon dactylon	GC	I	WR
Cyperus	GC	N	W
Eleocharis	GC	N	W
Equisetum	GC	N	WR
Fraxinus velutina	TC	N	R
Juniperus	SC	N	U
Mimosa aculeaticarpa var. biuncifera		N	U
Muhlenbergia rigens	GC	N	U
Phaseolus			F
Polypogon monspeliensis	GC	I	WR
Populus fremontii	MC	N	R
Quercus	MC		U
Rhus aromatica	SC	N	
Rhus trilobata	SC	N	F
Rhus virens	SC	N	
Salix bonplandiana	TC	N	



Species	Cover Code	Native Status	Wetland Status
Salix gooddingii	TC	N	R
Toxicodendron rydbergii	SC	N	F
Typha angustifolia	GC	I	
Vitis arizonica	SC	N	R

**Fauna:** Surveyors collected or observed aquatic and terrestrial invertebrate specimens.

**Table 1.3 Alamo Spring Invertebrates.**

Species	Lifestage	Habitat	Method
COL Dytiscidae Thermonectus marmoratus	Ad	A	Spot
COL Gyrinidae	Ad	A	Spot
LEP Papilionidae Papilio multicaudata	Ad	T	Spot
ODO Aeshnidae Anax walsinghamsi	Ad	T	Spot
ODO Coenagrionidae Telebasis salva	Ad	T	Spot
ODO Libellulidae Libellula saturata	Ad	T	Spot

**Table 1.4 Alamo Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
flycatcher		obs	
canyon wren		obs	
Sonoran mud turtle	2	obs	
coyote		sign	track
Yellow-billed cuckoo	1	obs	
domestic cow		sign	tracks and scat
tadpole		obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores.

Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk.

Geomorphology condition is moderate with some restoration potential and there is negligible risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores.

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 1.5 Alamo Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.33	1.67
Geomorphology	3.60	1.60
Habitat	4.60	2.00
Biota	4.88	2.00
Human Influence	4.78	2.38
Administrative Context		
Overall Ecological Score	4.35	1.82

**Management Recommendations:** This site has high quality habitat and should be flagged for management and protection. Make sure that grazing is managed to preserve the ecological function of the spring, or consider installing fencing.

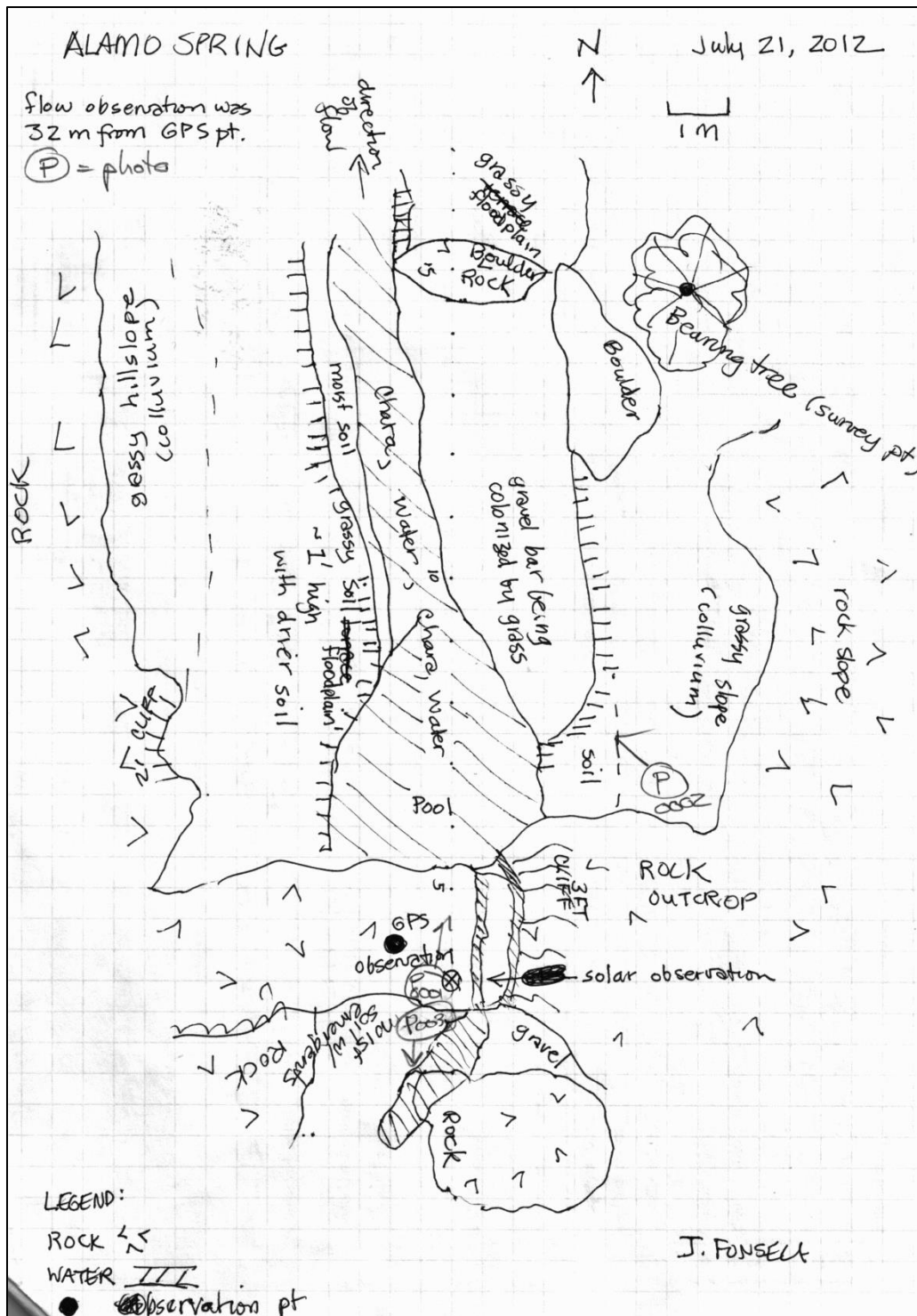


Fig. 1.2 Alamo Spring Sketchmap.

## 2. Aliso Spring Survey Summary Report, Site ID 17073

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Aliso Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 44' 7.494" latitude, -110 48' 9.05" longitude in the Mount Wrightson USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 5 meters EPE). The elevation is approximately 1780 meters. Julia Fonseca, John Stansberry, Dale Turner surveyed the site on 5/19/2012 for 00:14 hours, beginning at 16:16, and collected data in 6 of 12 categories.

**Fig 2.1 Aliso Spring.**



**Physical Description:** Aliso Spring is a rheocrene spring, boxed spring that is located at a well used campsite.

The distance to the nearest spring is 1069 meters.

**Survey Notes:** The surrounding campsite is heavily used and denuded and campers were present. Water is located in the a concrete tank with moist soil around it.

**Water:** Flow was measured at 0.012 L/s with a volumetric method. Surveyors did not measure water quality at the site.

**Flora:** Surveyors identified one plant species at the site, a *Carex* sp.

**Fauna:** Surveyors did not note any invertebrate or vertebrate species.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 10 null condition scores, and 10 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is moderate risk.

Geomorphology condition is very poor with very limited restoration potential and there is very high risk.

Habitat condition is poor with limited restoration potential and there is very high risk.

Biotic integrity is poor with limited restoration potential and there is extreme risk.

Human influence of site is moderate with some restoration potential and there is very high risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is very high risk.

**Table 2.6 Aliso Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.40	3.20
Geomorphology	0.80	5.60
Habitat	1.80	5.60
Biota	2.38	6.00
Human Influence	3.00	5.71
Administrative Context		
Overall Ecological Score	2.09	5.1

**Management Recommendations:** Steam is flowing nearby, but not next to the site. There are interrupted segments of flow (ephemeral reaches), but surveyors were unable to determine origin of flow coming out of pipe as there is no evidence of a pipe in the stream.



### 3. Apache Spring Survey Summary Report, Site ID 12938

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Apache Spring ecosystem is located in Pima County in the Rillito, Arizona 8-digit HUC managed by the US Bureau of Land Management. The spring is located at 31.836 latitude and -110.4909 longitude in the Apache Peak USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 6 meters EPE). The elevation is approximately 1466 meters. Nick Deyo, Bill Beaver, John Stansberry, Sue Quashu, Tim Allen, Keth Shareloss surveyed the site on 3/16/2013 for 01:27 hours, beginning at 15:03, and collected data in 9 of 12 categories.



**Fig 3.1 Apache Spring.**

**Physical Description:** Apache Spring is a helocrene spring with a shallow water table accessed with a 3 ft. Culvert pipe. There is a cabin directly adjacent to the well, piped to larger holding tanks. The microhabitat associated with the spring covers 447 m<sup>2</sup>. The distance to the nearest spring is 3453 meters. The site receives approximately 100% of available solar radiation.

**Survey Notes:** Water is completely below ground level. The site is completely developed with all water piped to holding tanks and drinkers. There is a large stand of *Fraxinus velutina* next to the well. The site is heavily grazed. There is a distance of 3 ft and 9 in from casing to water level casing, which is 2 feet above ground. Water is 2 ft 5in deep. The well feeds a large 10mx2m tank (250m from well) that overflows to a wetland/stock tank (10m x 20m) that seems to be a perennial open water and wetland system. Water in pond is 2-3 feet deep, and holds potential for CLF habitat.

**Water:** Flow was measured at 0.4 L/s with a volumetric method. Water quality was taken in a well at 29 inches deep.

**Table 3.1 Apache Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.9
Specific Conductance uS/cm	442
Water Temperature °C	19.1
Dissolved Solids	

**Flora:** Surveyors identified 8 plant species at the site. These included all native species except for one. The native status of *Lemna* remains unknown.

**Table 3.2 Apache Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
<i>Rhus microphylla</i>		N	
<i>Lemna</i>	AQ		A
<i>Celtis laevigata</i> var. <i>reticulata</i>	MC	N	R
<i>Juniperus monosperma</i>	SC	N	U
<i>Phoradendron juniperinum</i>	SC	N	U
<i>Rhamnus betulifolia</i>	SC	N	WR
<i>Rhamnus betulifolia</i>	SC	N	WR
<i>Fraxinus velutina</i>	TC	N	R

**Fauna:** Surveyors observed two invertebrate specimens, EPH Baetidae and MOLL Physidae Physa, and 4 vertebrates. These represented aquatic and terrestrial species.

**Table 3.3 Apache Spring Vertebrates.**

Species	Qty	Detection Type
White-nosed coati	1	sign
Mountain lion	1	sign
cedar waxwing	1	obs
American robin	1	obs
Tadpole		obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 12 null risk scores.

Aquifer functionality and water quality are moderate with some restoration potential and there is moderate risk.

Geomorphology condition is very poor with very limited restoration potential and there is moderate risk.

Habitat condition is moderate with some restoration potential and there is moderate risk.

Biotic integrity is moderate with some restoration potential and there is moderate risk.

Human influence of site is poor with limited restoration potential and there is high risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is moderate risk.

**Table 3.4 Apache Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	2.83	3.33
Geomorphology	1.75	3.75
Habitat	2.80	3.75
Biota	3.71	3.29
Human Influence	2.25	4.00
Administrative Context		
Overall Ecological Score	2.77	3.53

**Management Recommendations:** Surveyors did not note any recommendations.

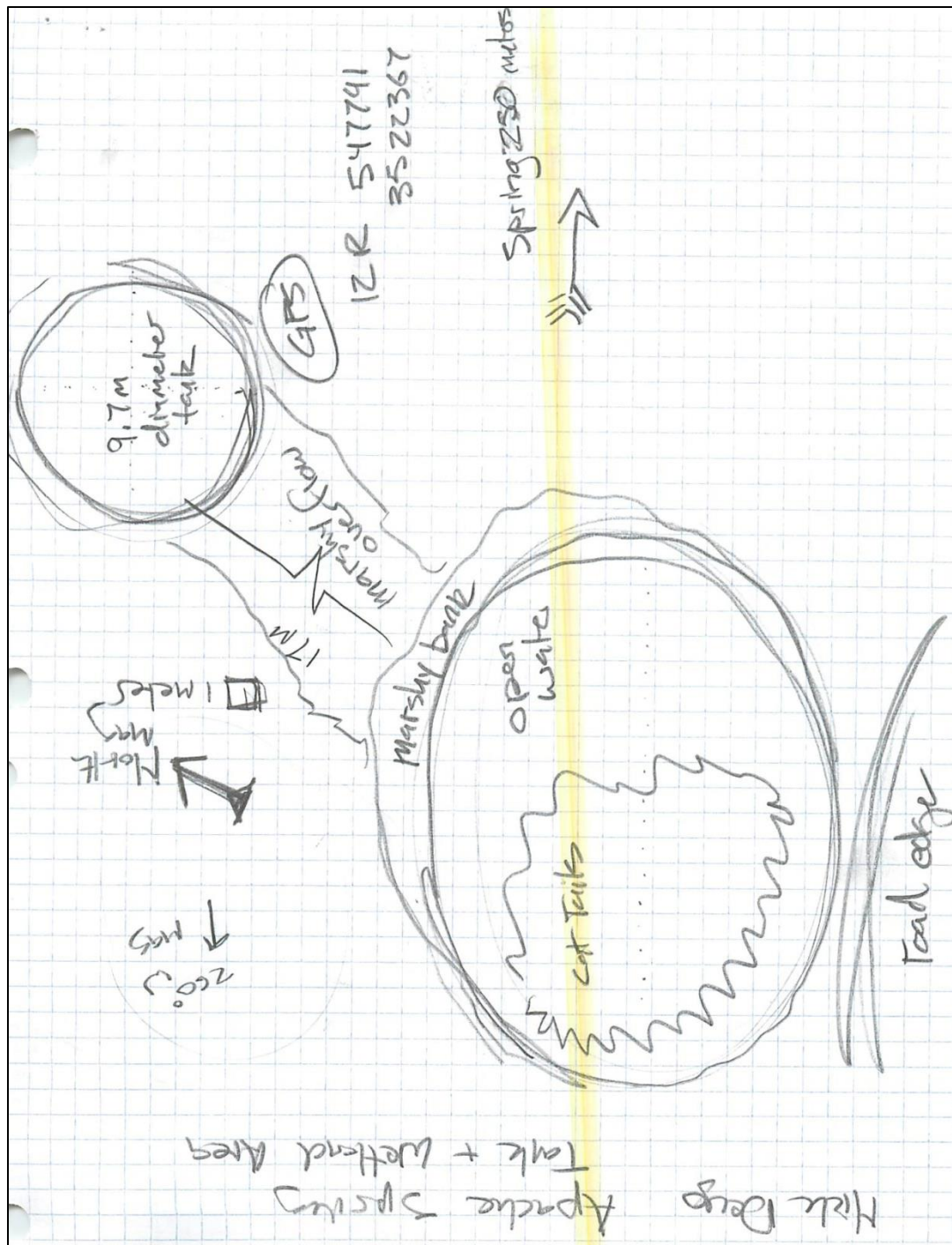


Fig 3.2 Apache Spring Sketchmap.



#### 4. Baldy Spring

##### Survey Summary Report, Site ID 12977

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Baldy Spring ecosystem is located in Santa Cruz County in the Rillito Arizona 8-digit HUC, within Nogales RD in Coronado Ntnl Forest, managed by the US Forest Service. The spring is located at 31 41' 56.717" latitude, -110 50' 44.781" longitude in the Mount Wrightson USGS Quad (NAD 83, 5 meters EPE). The elevation is approximately 2647 meters. Louise Misztal, Randy Serraglio, Aida Catillo-Flores, Gelnn Furnier surveyed the site on 5/19/2012 for 02:00 hours, beginning at 14:30, and collected data in 8 of 12 categories.



**Fig 4.1 Baldy Spring.**

**Physical Description:** Baldy Spring is a helocrene spring on a relatively steep north/northeast facing slope in close proximity to a mountain pass above the origin of Gardner Canyon drainage. The spring emergence is located under within what appears to be a spring box with concrete over it in a Designated Wilderness Area. The microhabitat associated with the spring covers 35 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.



The emergence environment of Baldy Spring is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 570 meters. The site receives approximately 100% of available solar radiation.

**Survey Notes:** This is a helocrene spring located in an area that was severely burned. There is a well used hiking trail within 2 meters of the spring site and the spring emergence is a small pool of water located under a concrete spring box structure. There is old piping infrastructure going from the spring to a rusted out tank just across the hiking trail. The main microhabitat at this site is a small, very shallow pool of water located directly under the concrete.

**Water:** Surveyors did not collect water quality measurements.

**Flora:** Surveyors identified 6 plant species at the site, These included native and nonnative species; the native status of one species remains unknown.

**Table 4.1 Baldy Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Carex sp	GC	N	W
Plantago	GC		WR
Pseudotsuga menziesii	MC	N	U
Pinus ponderosa	SC	N	F
Populus tremuloides	TC	N	U
Quercus gambelii	TC	N	F

**Fauna:** Surveyors observed 1 terrestrial invertebrate species, COL Coccinellidae, and 7 vertebrate species.

**Table 4.2 Baldy Spring Vertebrates.**

Species Common Name	Detection Type
yellow-eyed junco	obs
spotted towhee	obs
Grace's warbler	obs
house wren	obs
hepatic tanager	obs
Steller's jay	obs
Arizona gray squirrel	obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is poor with limited restoration potential and there is moderate risk.

Habitat condition is moderate with some restoration potential and there is low risk.

Biotic integrity is moderate with some restoration potential and there is low risk.

Human influence of site is moderate with some restoration potential and there is low risk.

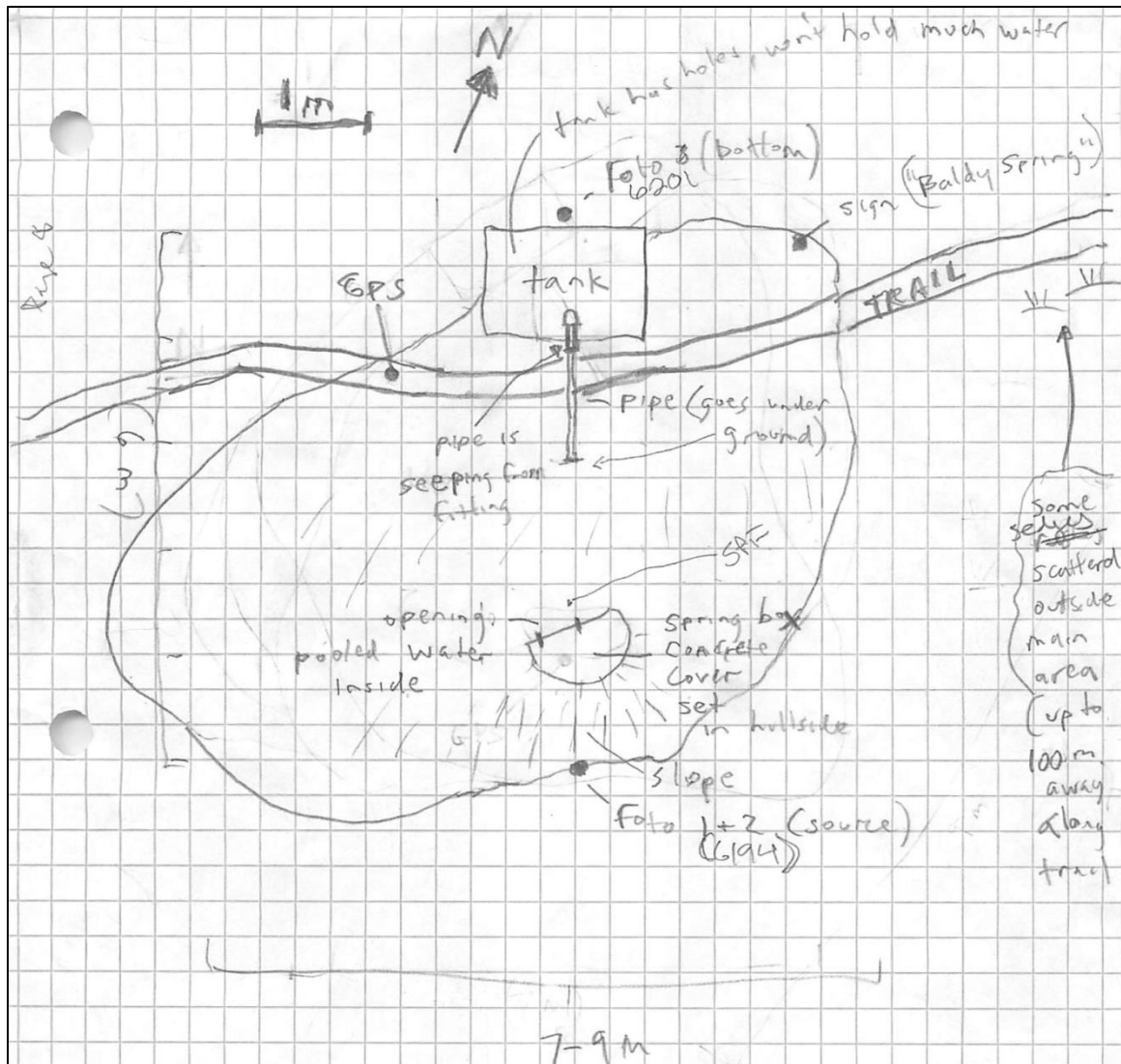
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 4.3 Baldy Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.50	2.50
Geomorphology	2.40	3.20
Habitat	3.40	2.60
Biota	3.25	2.50
Human Influence	3.22	2.00
Administrative Context		
Overall Ecological Score	3.14	2.7

**Management Recommendations:** Check for historic flow data to understand the effect the fire has had on the spring. The spring was verified by the FS so it was probably more productive at one time. This spring is of high value for recreation purposes - hikers in the Wilderness- so it would be beneficial to look at the impact the trail and existing spring box structure is having on spring functionality. It would also be beneficial to clean the spring box. Due to the fire, the spring is very exposed and may benefit from native plant restoration to provide more shade and microhabitat shelter.



**Fig 4.2 Baldy Spring Sketchmap.**

## 5. Barrel Spring Survey Summary Report, Site ID 12931

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Barrel Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, managed by the state. The spring is located at 31 52' 2.079" latitude, -110 40' 54.403" longitude in the Empire Ranch USGS Quad (NAD 83, 5 meters EPE). The elevation is approximately 1303 meters. Matt Pollock, Eric Linzemeyer, Bill Beaver, and Christopher Morris surveyed the site on 5/20/2012 for 03:10 hours, beginning at 10:50, and collected data in 8 of 12 categories.



**Fig 5.1 Barrel Spring.**

**Physical Description:** Barrel Spring is an anthropogenic spring. Spring was a 12' diameter stock tank with no storage capacities due to it being full of sediment. The microhabitat associated with the spring covers 144 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 4231 meters. The site receives approximately 100% of available solar radiation, with 7240 Mj annually.

**Survey Notes:** The spring had no flow due to misuse and neglect. The aquifer has been partially depleted by Wildcat rural housing and industry immediately downstream. The site lies within several miles of the proposed Rosemont mine.

**Water:** There was no measurable flow at the site.

**Flora:** Surveyors identified 6 plant species at the site, these included native species and one species with unknown status.

**Table 5.1 Barrel Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Opuntia			U
Acacia constricta	SC	N	
Acacia greggii	SC	N	F
Condalia warnockii	SC	N	
Proboscidea parviflora	SC	N	
Prosopis pubescens	SC	N	

**Fauna:** Surveyors observed no invertebrate species and one vertebrate species, a Red-tailed Hawk.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 15 null risk scores. Aquifer functionality and water quality are eliminated with no restoration potential and there is undetermined risk due to null scores

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is moderate with some restoration potential and there is low risk.

Biotic integrity is moderate with some restoration potential and there is low risk.

Human influence of site is moderate with some restoration potential and there is moderate risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

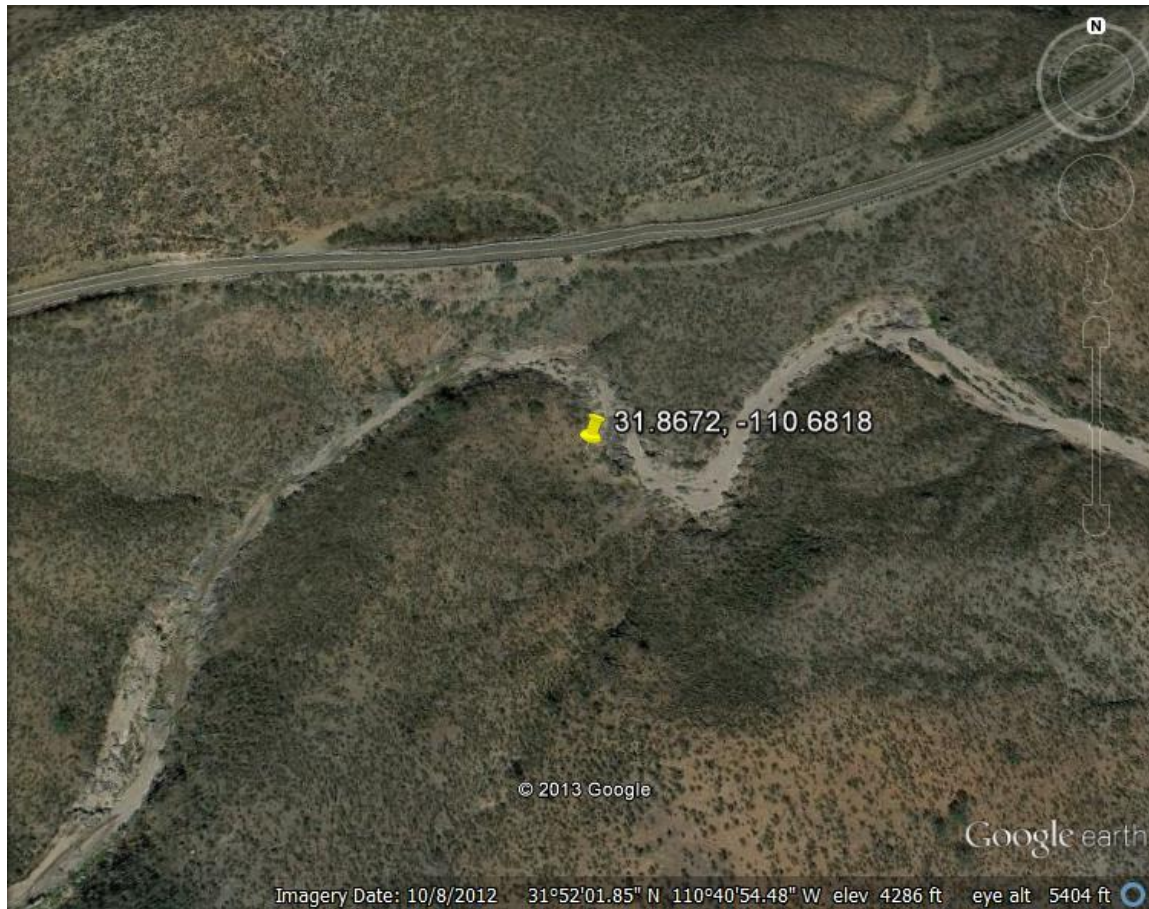
Overall, the site condition is poor with limited restoration potential and there is low risk.

**Table 5.2 Barrel Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	0.00	
Geomorphology	3.80	2.40
Habitat	2.80	2.20
Biota	3.33	2.25
Human Influence	2.88	2.86
Administrative Context		
Overall Ecological Score	2.48	2.28

**Management Recommendations:** No recommendations were made.





**Fig 5.2 Barrel Spring Sketchmap.**

## 7. Bart Spring Survey Summary Report, Site ID 17941

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Bart Spring ecosystem is located in Pima County in the 8-digit HUC. The spring is located at 32.08858 latitude and -110.530959 longitude in the USGS Quad (NAD 83). The elevation is approximately 1895 meters. Nick Deyo, Christopher Morris, Glenn Furnier, and Aida Castillo surveyed the site on 3/29/2013 for 01:00 hours, beginning at 14:00, and collected data in 0 of 12 categories.

**Physical Description:** Surveyors found no evidence of a spring at the given location. The distance to the nearest known spring is 1575 meters.

## 8. Bear Spring

### Survey Summary Report, Site ID 1367

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Bear Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 40' 59.9" latitude, - 110 48' 22.6" longitude in the Mount Wrightson USGS Quad, measured using a GPS (NAD83, 3 meters EPE). The elevation is approximately 1736 meters. Matt Pollock, Eric Linzmeyer, Paul Condon, Bill Beaver, and Christopher Morris surveyed the site on 5/19/2012 beginning at 12:16, and collected data in 10 of 12 categories.



**Fig 8.1 Bear Spring.**

**Physical Description:** Bear Spring is a rheocrene spring in an alluvial cobble channel that trends eastward. Three sources form separate channels that converge about 30 meters downstream. The site generally slopes northward at about 30 degrees. The microhabitat associated with the spring covers 604 m<sup>2</sup>. The site has 1 microhabitat that is 604 meters-squared.



The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 2108 meters. The site receives approximately 95% of available solar radiation, with 6871 Mj annually.

**Survey Notes:** The spring ecosystem appears to be stable and healthy.

**Water:** Flow was measured at 0.14 L/s with a volumetric method. Water quality measurements were collected at a depth of 5 cm.

**Table 8.1 Bear Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.4
Specific Conductance uS/cm	
Water Temperature °C	18.6
Dissolved Solids	

**Flora:** Surveyors identified 17 plant species at the site. These included 13 native and 0 nonnative species; the native status of 4 species remains unknown.

**Table 8.2 Bear Spring Vegetation.**

Species	Cover Code	Native	#	Comments	Wetland
Arctostaphylos		N	15	riparian & floodplain	U
Dasyllirion wheeleri		N	3	young plants	
Juniperus deppeana		N			U
Pinus edulis		N	2		U
Platanus wrightii		N	20	prevalent in riparian	R
Vitis arizonica		N	2		R
Quercus emoryi		N			
algae sp	AQ				A
Aquilegia chrysantha	GC	N	3		W
Carex lenticularis	GC	N	5	riparian zone	W
Cirsium neomexicanum	GC	N	4		F
Glandularia bipinnatifida	GC	N	20		U
Mimulus guttatus	GC	N	100	many	W
Poaceae fam	GC			riparian sp 1	
Poaceae fam	GC			riparian sp 2	
Poaceae fam	GC			riparian sp 3	
Schoenoplectus americanus	GC	N	100	many	A

**Fauna:** Surveyors observed 2 terrestrial invertebrates and 2 aquatic invertebrates, and 1 Canyon Tree Frog.

**Table 8.3 Bear Spring Invertebrates.**

Species	Lifestage	Habitat	Method
COL Gyrinidae	Ad	A	Spot

Species	Lifestage	Habitat	Method
COL Gyrinidae	Ad	T	Spot
HEM Belostomatidae	Ad	A	Spot
LEP Papilionidae	Ad	T	Spot

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 2 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is moderate risk.

Human influence of site is good with significant restoration potential and there is moderate risk.

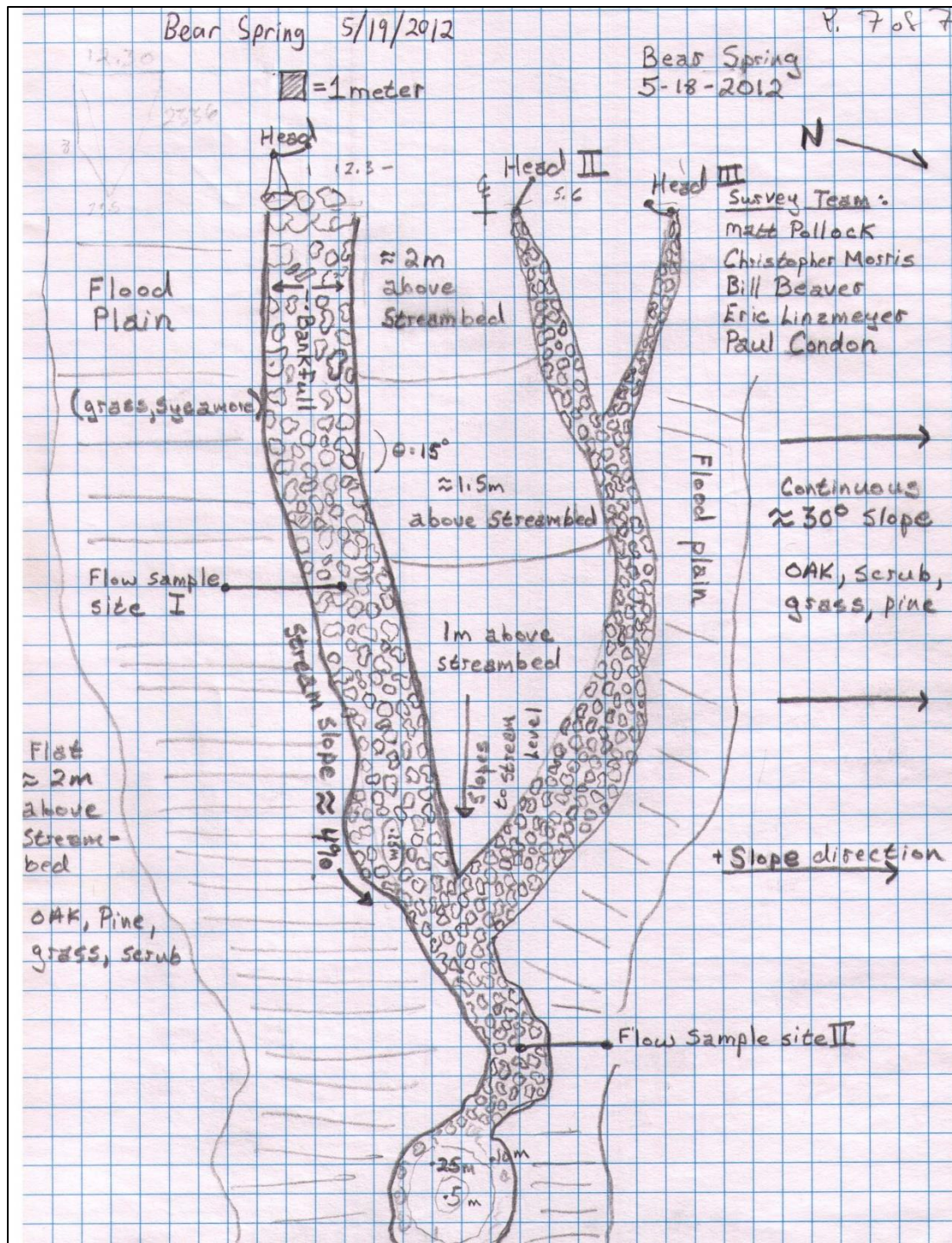
Administrative context status is moderate with some restoration potential and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 8.4 Bear Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.33	2.00
Geomorphology	4.00	2.20
Habitat	4.60	2.40
Biota	4.13	3.50
Human Influence	4.75	3.00
Administrative Context	3.29	
Overall Ecological Score	4.26	2.53

**Management Recommendations:** This has been a release site for Tarahumara frogs (*Lithobates tarahumarae*) but they didn't do well. The only amphibian found was *Hyla aremicolor* during our survey. AZGFD is actively reintroducing Tarahumara frogs into Big Casa Blanca Canyon as of August 2012. This site has some potential as a reference site, and is well known among local biologists as a relatively functioning spring site.





## 9. Bear Spring

### Survey Summary Report, Site ID 12940

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Bear Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31.775 latitude and -110.46 longitude in the Apache Peak USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 4 meters EPE). The elevation is approximately 1746 meters. Louise Misztal, Christopher Morris, Nick Deyo, Amanda Webb, Eric Sophiea, Bill Beaver, Mike Manning, Norma Miller, Glenn Furnier, Aida Furnier, Steve Pavlik, Karen Lowry surveyed the site on 3/15/2013 for 01:27 hours, beginning at 17:03, and collected data in 9 of 12 categories.



**Fig 9.1 Bear Spring.**

**Physical Description:** Bear Spring is a hillslope spring. The spring box is dug into a 314 degree northwest facing hillslope, with 4 by 5 meter cement tanks. It is heavily developed in oak woodland habitat and the microhabitat associated with the spring covers 20 m<sup>2</sup>.

The distance to the nearest spring is 1250 meters. The site receives approximately 100% of available solar radiation.

**Survey Notes:** The spring is completely obliterated and all flow is captured. There is a lot of evidence of cattle grazing and there are two camera traps at the site.

**Water:** Flow was measured at 0.021 L/s with a volumetric method.

**Table 9.1 Bear Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.8
Specific Conductance uS/cm	522
Water Temperature °C	14.4
Dissolved Solids	

**Flora:** Surveyors identified 12 plant species at the site, These included native and nonnative species; the native status of 4 species remains unknown.

**Table 9.2 Bear Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Agave sp.			
Dasyllirion wheeleri		N	
Rhus virens		N	
Yucca sp.			
Bouteloua curtipendula	GC	N	U
Garrya	GC		U
Cercocarpus	MC		U
Quercus arizonica	MC	N	R
Arctostaphylos pungens	SC	N	U
Ceanothus greggii	SC	N	U
Juniperus monosperma	SC	N	U
Nolina microcarpa	SC	N	U

**Fauna:** Surveyors observed one terrestrial invertebrate, ORT Gryllidae Gryllus, and 4 vertebrate species.

**Table 9.3 Bear Spring Vertebrates.**

Species Common Name	Qty	Detection Type
Ruby-crowned Kinglet	1	obs
Bridled Titmouse	3	obs
Bewick's Wren	1	call
Woodpecker sp.	1	obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 10 null risk scores.

Aquifer functionality and water quality are poor with limited restoration potential and there is low risk.

Geomorphology condition is very poor with very limited restoration potential and there is moderate risk.

Habitat condition is poor with limited restoration potential and there is moderate risk.

Biotic integrity is poor with limited restoration potential and there is moderate risk.

Human influence of site is moderate with some restoration potential and there is moderate risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is moderate risk.

**Table 9.4 Bear Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	2.67	2.67
Geomorphology	1.40	3.20
Habitat	2.40	3.00
Biota	2.63	3.38
Human Influence	3.13	3.14
Administrative Context		
Overall Ecological Score	2.27	3.06

**Management Recommendations:** This is a heavily developed site with 100% of water being captured. The area has been degraded by cattle and there is virtually no remaining wetland habitat, aside from tanks and drinkers which are in disrepair. This site was recommended by conservationist Dennis Caldwell as a potential restoration site. It is in a good location to extend Chiricahua Leopard Froge habitat and is historically known to have steady flow. It may be possible to pipe water to a more suitable habitat area down slope.

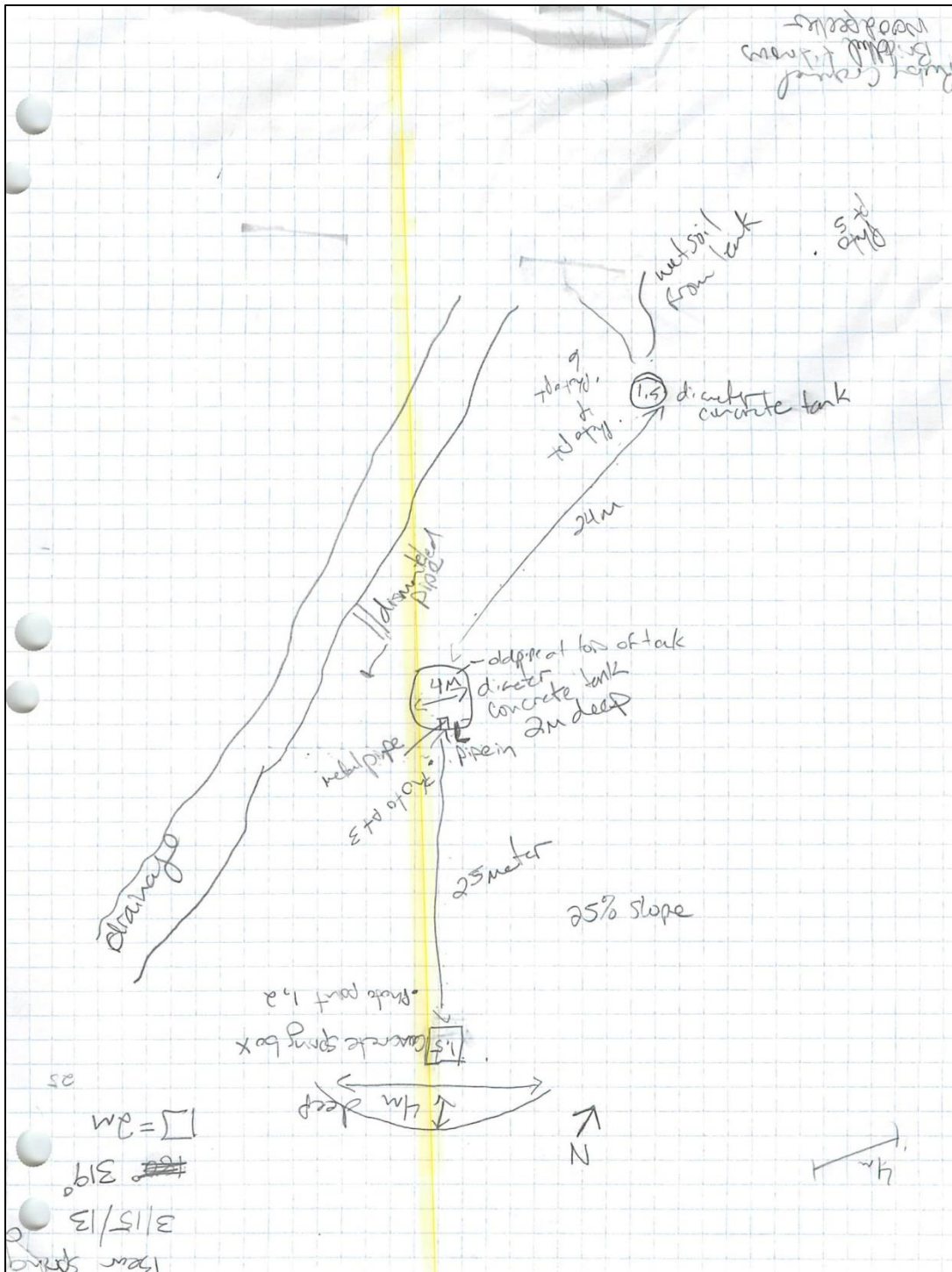


Fig 9.2 Bear Spring Sketchmap.



## 10. Benton Spring

### Survey Summary Report, Site ID 11973

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Benton Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 20' 39.322" latitude, -110 41' 33.072" longitude in the Duquesne USGS Quad, measured using a map(NAD 83, 4 meters EPE). The elevation is approximately 1646 meters. Bill Beaver, Chang You, Mike Manning, Karen Lowery, and Christopher Morris surveyed the site on 1/12/2013 for 00:42 hours, beginning at 15:10, and collected data in 8 of 12 categories.



**Fig 10.1 Benton Spring.**

**Physical Description:** Benton Spring is a rheocrene spring. The microhabitat associated with the spring covers 650 m<sup>2</sup>.

The distance to the nearest spring is 1114 meters. The site receives approximately 88% of available solar radiation, with 6339 Mj annually.

**Survey Notes:** The site consists of a series of pools that emerge with a 150 square-meter wet meadow area around the first two pools. The same pattern alternates upstream at least 1/2 mile and downstream for several hundred yards. This site has seen some degradation by cattle, but not as severe as at Line Boy Spring. The flow in the drainage in other sections seems to be runoff from a recent storm instead of permanent water.



**Water:** Water quality was measured at the pool nearest the UTM coordinates at a depth of 28 cm.

**Table 10.1 Benton Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.7
Specific Conductance uS/cm	449
Water Temperature °C	4.9
Dissolved Solids	

**Flora:** Surveyors identified 11 plant species at the site, these included predominately native species and one nonnative species.

**Table 10.2 Benton Spring Vegetation.**

Species	Cover Code	Native Status	Comments	Wetland Status
Aristida ternipes var. ternipes	GC	N		
Bouteloua gracilis	GC	N		U
Eragrostis	GC	I		WR
Lesquerella	GC	N	photo	
Mammillaria	GC	N	photo	
Muhlenbergia rigens	GC	N		U
Schizachyrium scoparium	GC	N		F
Scirpus	GC	N		W
Sporobolus airoides	GC	N		WR
Juniperus deppeana	MC	N		U
Quercus sp	SC	N		U

**Fauna:** Surveyors did not observe any invertebrate species, and saw the tracks of a White-tailed Deer.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 10.3 Benton Spring Assessment Scores.**

<b>Category</b>	<b>Condition</b>	<b>Risk</b>
Aquifer Functionality & Water Quality	3.83	2.00
Geomorphology	4.00	2.20
Habitat	4.40	2.20
Biota	4.63	2.38
Human Influence	4.13	2.57
Administrative Context		
Overall Ecological Score	4.21	2.19

**Management Recommendations:** This site would benefit from fencing to reduce impacts from herbivory. It would be good to assess the site pre-monsoon to determine flow.

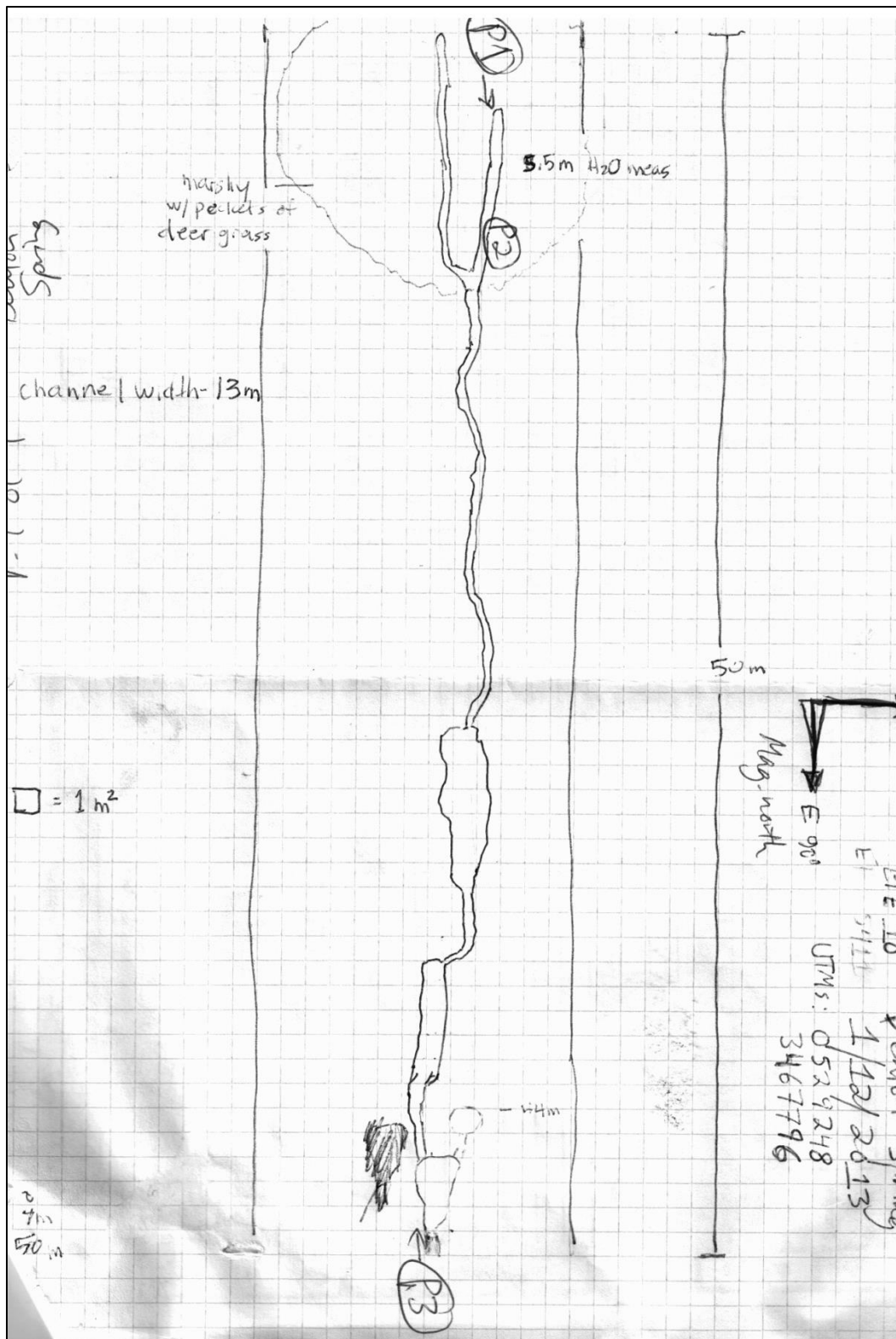


Fig 10.2 Benton Spring Sketchmap.

## 11. Blacktail Spring Survey Summary Report, Site ID 12941

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Blacktail Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, managed by a private US owner. The spring is located at 31.79 latitude, -110.49 longitude in the Apache Peak USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 5 meters EPE). The elevation is approximately 1499 meters. Louise Misztal, Dennis Caldwell, Amanda Webb, and Norma surveyed the site on 3/17/2013 for 01:45 hours, beginning at 09:30 and collected data in 6 of 12 categories.



**Fig 11.1 Blacktail Spring.**

**Physical Description:** Blacktail Spring is a hillslope spring that emerges underneath a large rock outcrop surrounded by sandstone and clay in an Oak Juniper woodland with a small runout channel. The microhabitat associated with the spring covers 60 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 3122 meters.

**Survey Notes:** Pooled water was present under the overhanging rocks and no sun was reaching this pool of water. There was a non-functioning pipe entering the rock face and a secondary pipe emerging out of the ground about 20 meters below the pool that was actively dripping water. There were many wildlife tracks and no sign of cows although the surrounding grass looked browsed.

**Water:** Flow was measured at 0.0049 L/s with a volumetric method. The sample was collected in ponded water at the rock outcrop.

**Table 11.1 Blacktail Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.2
Specific Conductance uS/cm	457
Water Temperature °C	9.1
Dissolved Solids	

**Flora:** Surveyors identified 10 plant species at the site, these included all native species.

**Table 11.2 Blacktail Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Carex sp	GC	N	W
Carex ultra	GC	N	
Muhlenbergia rigens	GC	N	U
Quercus arizonica	MC	N	R
moss	NV	N	F
Ericameria nauseosa	SC	N	F
Fallugia paradoxa	SC	N	F
Mortonia scabrella	SC	N	
Nolina microcarpa	SC	N	U
Rhus aromatica	SC	N	

**Fauna:** Surveyors did not observe any invertebrate or vertebrate species.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 10 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is moderate with some restoration potential and there is high risk.

Habitat condition is moderate with some restoration potential and there is moderate risk.

Biotic integrity is moderate with some restoration potential and there is moderate risk.

Human influence of site is moderate with some restoration potential and there is moderate risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

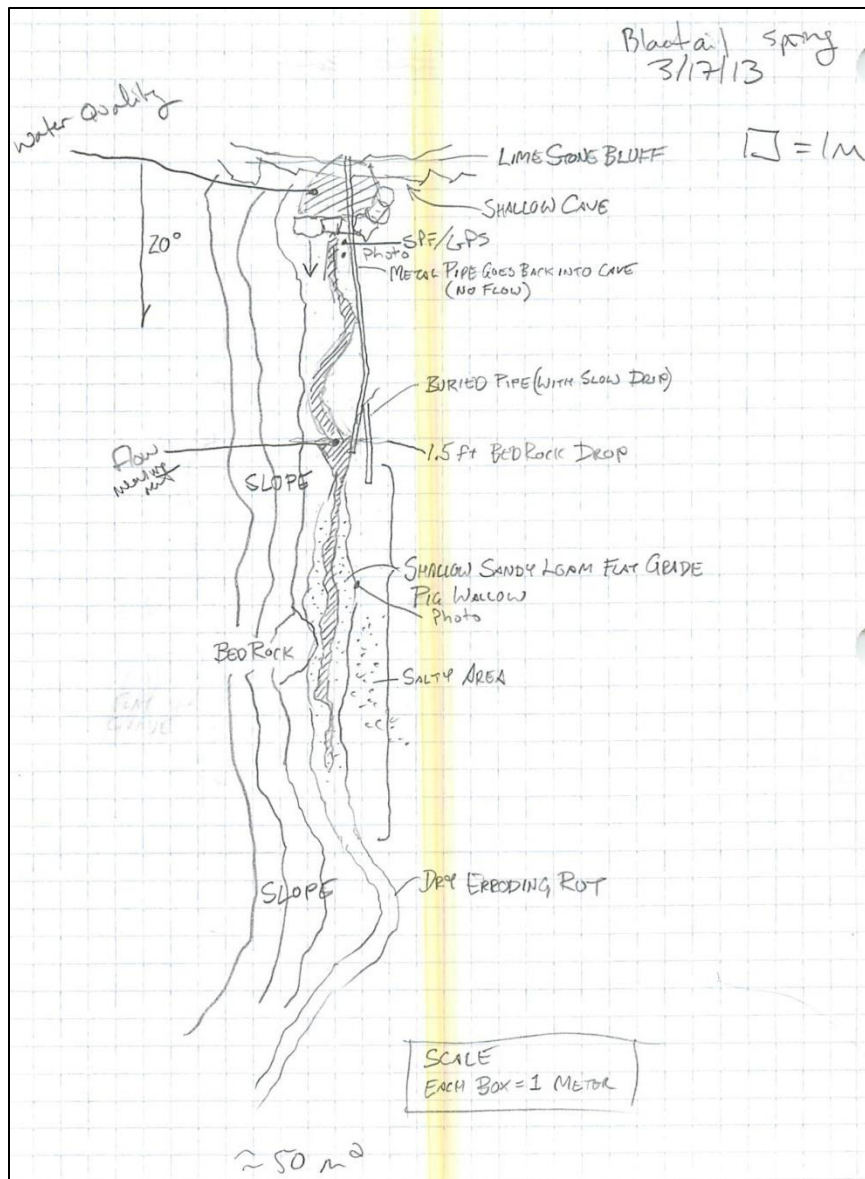
Overall, the site condition is moderate with some restoration potential and there is moderate risk.

**Table 11.3 Blacktail Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.00	2.67
Geomorphology	3.20	3.80
Habitat	3.60	2.80
Biota	3.25	3.00
Human Influence	3.63	3.00
Administrative Context		
Overall Ecological Score	3.51	3.07

**Management Recommendations:** There is significant evidence of erosion at the site below the spring wetted area and along the nearby trail. Giant Sedge was present. The neighboring trail and cattle use may be altering channel dynamics. There is a lot of human influence at the spring- a rock that was dynamited and a wall that has the date 1980 etched in it.





**Fig 11.2 Blacktail Spring Sketchmap.**

## 12. Bootlegger Spring Survey Summary Report, Site ID 12901

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Bootlegger Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, managed by the State. The spring is located at 34.72 latitude,

and -112.702 longitude in The Narrows USGS Quad, measured using a Garmin 12 GPS (NAD 83, 4 meters EPE). The elevation is approximately 1219 meters. Louise Misztal, Carianne Campbell, and Randy Serraglio surveyed the site on 10/4/2013 for 01:00 hours, beginning at 12:00, and collected data in 6 of 12 categories.



**Fig 12.1 Bootlegger Spring.**

**Physical Description:** Bootlegger Spring is a rheocrene spring, located in a small narrow canyon in Oak-juniper woodland above a major tributary drainage to Cienega creek. The total area of the observed microhabitat is 400 meters-squared. The distance to the nearest spring is 422 meters.

**Survey Notes:** There is standing water present and piping infrastructure that appears to be freshly repaired coming from a small dam, but it is unclear where the piping is going. There is a dry holding tank about 200m down channel, and signs of cows in the wetted habitat.

**Water:** Flow was measured at 0.18 L/s with a volumetric method 15 meters below water emersion where rock dam and pipe infrastrucutre is.

**Table 12.1 Bootlegger Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.2

Characteristic Measured	Average Value
Specific Conductance uS/cm	659
Water Temperature °C	21.
Dissolved Solids	

**Flora:** Surveyors identified 22 plant species at the site, these included predominately native species with 2 species having an unknown status.

**Table 12.2 Bootlegger Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Mimosa aculeaticarpa var. biuncifera		N	U
Acacia constricta		N	
Dasylium wheeleri		N	
Rhus microphylla		N	
Ageratina herbacea	GC	N	U
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Eleocharis	GC	N	W
Maurandella antirrhiniflora	GC	N	U
Muhlenbergia rigens	GC	N	U
Populus fremontii	MC	N	R
Aloysia wrightii	SC	N	U
Baccharis sarothroides	SC	N	R
Gutierrezia	SC	N	F
Juniperus	SC	N	U
Lycium	SC		U
Prosopis velutina	SC	N	F
Quercus	SC		U
Vitis arizonica	SC	N	R
Ziziphus obtusifolia	SC	N	
Fraxinus velutina	TC	N	R
Salix gooddingii	TC	N	R

**Fauna:** Surveyors did not observe or collect any invertebrate species. 9 vertebrate species were observed at the site.

**Table 12.3 Bootlegger Spring Vertebrates.**

Species Common Name	Qty	DetectionType
ringtail	1	sign
javelina		sign
deer		sign
yellow-eyed junco		obs
red-naped sapsucker		obs

Species Common Name	Qty	DetectionType
white-crowned sparrow		obs
lazuli bunting		obs
Cassin's Vireo		obs
ash-throated flycatcher		obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 17 null condition scores, and 18 null risk scores.

Aquifer functionality and water quality are poor with limited restoration potential and there is undetermined risk due to null scores

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is negligible risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 12.4 Bootlegger Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	2.00	
Geomorphology	4.60	2.20
Habitat	4.20	2.00
Biota	5.60	1.40
Human Influence	4.67	2.25
Administrative Context		
Overall Ecological Score	4.10	1.87

**Management Recommendations:** Although geomorphology seems to be mostly intact there is extensive modification to the flow with a small constructed rock dam across the channel that has piping infrastructure coming out of it. There is an empty concrete tank downstream with dead/dry standing cattails in it, but piping to it appears to be non-functioning. Looks like there was recent repair on piping nearest the source, but it is unclear where this is going. Notably there are no invasive species and the site is relatively protected from roads/trails. This is a very nice rheocrene site that may benefit from infrastructure removal if it is no longer in use.



### 13. Bug Spring

#### Survey Summary Report, Site ID 12828

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Bug Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within the Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 32 21' 1.648" latitude, -110 42' 26.68" longitude in the Agua Caliente Hill USGS Quad, measured using a Garmin map 60CX GPS (NAD 83). The elevation is approximately 1570 meters. Bill Beaver, Paul Condon, Graciela Robinson, Karen Lowery, and Randy Serraglia surveyed the site on 4/22/2012 for 02:00 hours, beginning at 15:00, and collected data in 5 of 12 categories.



#### **Physical Description:**

Bug Spring is a rheocrene. The distance to the nearest spring is 1949 meters. The site receives approximately 94% of available solar radiation, with 6723 Mj annually.

**Survey Notes:** This survey was part of a training session early on in the process. There is a pool formed from boulders in the channel that is 3m deep. The trees have some damage due to fire. There was algae covering the top pool, but the bottom pool had none. The channel has a sandy bottom. There is some piping down below the source that is not being used.

**Fig 13.1 Bug Spring.**



**Water:** No water quality data was collected.

**Flora:** Surveyors identified 63 plant species at the site, these included native and nonnative species; the native status of several species remains unknown.

**Table 13.1 Bug Spring Vegetation.**

Species	Cover Code	Native Status	Comments	Wetland Status
Echinocereus				U
Verbena				F
Berberis wilcoxii		N		
Dasyllirion wheeleri		N		
Quercus toumeyi		N		
Rhus virens var. choriophylla		N		
algae sp	AQ	N		A
Nasturtium officinale	AQ	I	?? Seedling	W
Agave palmeri	GC	N		
Agrostis	GC	I		W
Astragalus nothoxys	GC	N		
Astrolepis sinuata	GC	N		
Bouteloua hirsuta	GC	N		U
Carex sp	GC	N	species 2	W
Carex sp	GC	N	species 1	W
Castilleja integra	GC	N		
Elymus elymoides	GC	N		F
Erigeron	GC	N		F
Garrya	GC	N	"silver"	U
Glandularia bipinnatifida	GC	N		U
Juncus sp	GC	N	species 1	W
Juncus sp	GC	N	species 2	W
Lactuca	GC	I		WR
Mimosa sp	GC	N		U
Mimulus	GC		brevipes? "yellow"	W
Mimulus guttatus	GC	N		W
Monarda citriodora	GC	N		
Muhlenbergia emersleyi	GC	N		
Packera neomexicana	GC	N		U
Penstemon stenophyllus	GC	N		
Piptochaetium fimbriatum	GC	N		
Pseudognaphalium	GC	N		W
Pseudognaphalium leucocephalum	GC	N		
Taraxacum officinale	GC	I		F

Species	Cover Code	Native Status	Comments	Wetland Status
Thalictrum fendleri	GC	N		F
Toxicodendron radicans	GC	N		WR
Toxicodendron radicans	GC	N		WR
Tragia nepetifolia	GC	N		F
Typha	GC			A
unknown grass	GC		perennial	
unknown grass	GC			
Juniperus deppeana	MC	N		U
Platanus wrightii	MC	N		R
Platanus wrightii	MC	N		R
Populus fremontii	MC	N		R
Populus fremontii	MC	N		R
Quercus arizonica	MC	N		R
moss	NV	N		F
Amorpha fruticosa	SC	N		F
Arctostaphylos pungens	SC	N		U
Cercocarpus montanus	SC	N		U
Dasyllirion wheeleri	SC	N		
Garrya wrightii	SC	N		F
Lonicera albiflora	SC	N		U
Nolina microcarpa	SC	N		U
Prosopis velutina	SC	N		F
Quercus turbinella	SC	N		F
Rhamnus betulifolia	SC	N		WR
Rubus	SC			R
Salix Sp	SC	N		R
Vitis arizonica	SC	N		R
Pinus discolor	TC	N		
Salix bonplandiana	TC	N		

**Fauna:** Surveyors collected or observed terrestrial invertebrate specimens. Vertebrate species observed were one tree lizard and one hummingbird sp.

**Table 13.2 Bug Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method	Species detail
ARAN			T	Spot	more than 1
DIP		Ad	T	Spot	"gnat-like bugs"
DIP		Ad	T	Spot	more than 1
DIP Asilidae Efferia	1	Ad	T	Spot	female

Species	Qty	Lifestage	Habitat	Method	Species detail
DIP Culicidae		Ad	T	Spot	more than 1
HEM Belostomatidae	1	Ad	T	Spot	
HYM	1	Ad	T	Spot	
LEP Lycaenidae		Ad	T	Spot	more than 1
ODO	1	Ad	T	Spot	damselfly

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 15 null condition scores, and 16 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is moderate risk.

Geomorphology condition is moderate with some restoration potential and there is high risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is moderate risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is moderate risk.

**Table 13.3 Bug Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.20	3.40
Geomorphology	3.60	3.80
Habitat	4.00	2.50
Biota	4.20	2.60
Human Influence	4.00	3.33
Administrative Context		
Overall Ecological Score	3.75	3.07

**Management Recommendations:** No recommendations were made.

## 14. Burro Spring

### Survey Summary Report, Site ID 12942

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Burro Spring ecosystem is located in Cochise County in the Rillito Arizona 8-digit HUC, within the Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 51' 26.657" latitude, -110 26'

8.667" longitude in the Apache Peak USGS Quad, measured using an etrex 20 GPS (NAD 83, 3 meters EPE). The elevation is approximately 1736 meters. Keeley Lyons-Letts, Jim Chumbley, Dale Turner, and Nick Deyo surveyed the site on 12/8/2012 for 00:49 hours, beginning at 02:11, and collected data in 7 of 12 categories.



**Fig 14.1 Burro Spring.**

**Physical Description:** Burro Spring is a rheocrene/hypocrene spring located in a steep canyon dominated by Pinyon pine and juniper. The spring was dry but had patches of carex surrounding dry pools. There were also travertine deposits surrounding the spring, particularly a little higher in the drainage. The microhabitat associated with the spring covers 306 m<sup>2</sup>.

Burro Spring emerges from a sedimentary rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1202 meters. The site receives 6723 mJ of energy annually and approximately 94.05% of available solar radiation.

**Survey Notes:** This spring was dry at the time of the assessment, however, it likely has some intermittent flow. Travertine deposits near the spring indicate that there has been more flow in the past. The site is very remote and there is no sign of grazing.

**Water:** There was no measurable flow and no pools of water at the site.

**Flora:** Surveyors identified 10 plant species at the site, these include native and nonnative species; the native status of 3 species remains unknown.



**Table 14.1 Burro Spring Vegetation.**

Species	Cover Code	Native Status	Wetland
Yucca sp			
Carex ultra	GC	N	
Cercocarpus	MC		U
Juniperus deppeana	MC	N	U
Pinus discolor	MC	N	
Mortonia scabrella	SC	N	
Nolina microcarpa	SC	N	U
Rhus sp	SC		U
Rhus trilobata	SC	N	F
Quercus gambelii	TC	N	F

**Fauna:** Surveyors collected or observed aquatic and/or terrestrial invertebrate specimens. One scrub jay was observed at the site.

**Table 14.2 Burro Spring Invertebrates.**

Species	Qty	Habitat	Method	Species detail
DIP		T	Spot	
HYM Apidae		T	Spot	
MOLL			Spot	snail shell found
MOLL Helminthoglyptidae Sonorella	1	T	Spot	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 15 null condition scores, and 16 null risk scores. Aquifer functionality and water quality are very poor with very limited restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is negligible risk.

Habitat condition is moderate with some restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is negligible risk.

Human influence of site is very good with excellent restoration potential and there is negligible risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

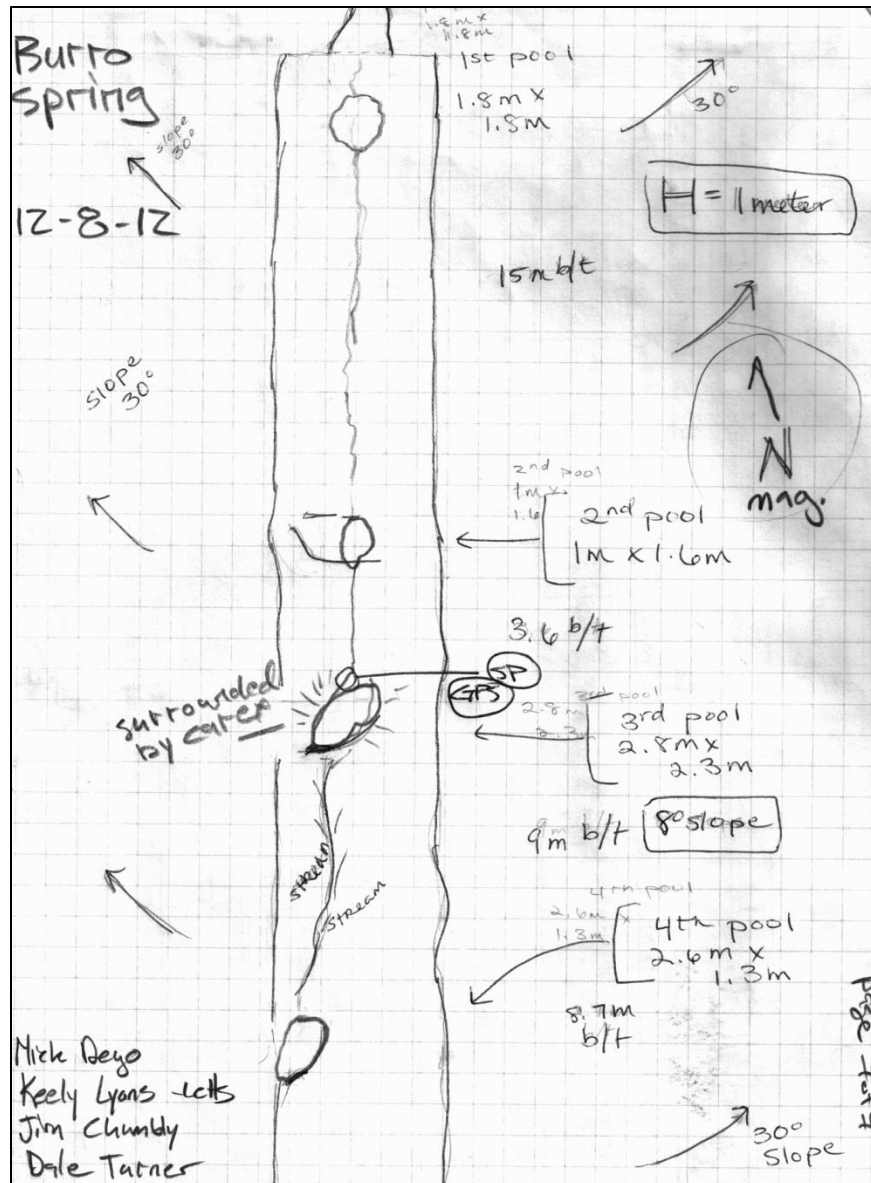
Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 14.3 Burro Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	1.00	2.00
Geomorphology	4.00	1.40

Category	Condition	Risk
Habitat	3.00	2.60
Biota	3.80	1.60
Human Influence	5.25	1.17
Administrative Context		
Overall Ecological Score	2.95	1.9

**Management Recommendations:** No recommendations were made for management.



**Fig 15.1 Burro Spring Sketchmap.**

## 15. Chimney Spring Survey Summary Report, Site ID 12880

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Chimney Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 32.08 latitude, -110.54 longitude in the Rincon Peak USGS Quad, measured using an etrex 20 GPS (NAD 83, 3 meters EPE). The elevation is approximately 1565 meters. Nick Deyo, Glenn Furnier, Aida Catillo, and Christopher Morris surveyed the site on 3/29/2013 for 01:32 hours, beginning at 10:45, and collected data in 8 of 12 categories.



**Fig 15.1 Chimney Spring.**

**Physical Description:** Chimney Spring is a rheocrene regular intermittent spring, located in a steep bedrock canyon with oak woodland habitat and desert grassland. There is a cement dam filled in with a pipe outflow. There are many pools, a large rock face, and an old pipe with a stock tank located 200 m downstream. The microhabitat associated with the spring covers 190 m<sup>2</sup>. The distance to the nearest spring is 1451 meters.

**Survey Notes:** There is a lot of water and good aquatic habitat present. Old pipes are present that are not in use. At the time of visit the area was heavily grazed, particularly below the spring source.

**Water:** Flow was measured at 0.44 L/s with a volumetric method. water collected at the pipe outflow.

**Table 15.1 Chimney Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.7
Specific Conductance uS/cm	168
Water Temperature °C	17.4
Dissolved Solids	

**Flora:** Surveyors identified 28 plant species at the site.

**Table 15.2 Chimney Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Agave parryi	GC	N	
Agave schottii	GC	N	
Astragalus			U
Baccharis salicifolia	SC	N	R
Cheilanthes	GC		U
Chloris virgata	GC	N	WR
Descurainia pinnata	GC	N	F
Elymus elymoides	GC	N	F
Ericameria laricifolia		N	
Ericameria linearifolia	SC	N	U
Fraxinus velutina	TC	N	R
Garrya flavescens	SC	N	F
Glandularia bipinnatifida	GC	N	U
Gossypium thurberi		N	
Juncus sp	GC	N	W
Mammillaria	GC	N	
Mimulus guttatus	GC	N	W
moss	NV	N	F
Muhlenbergia	GC	N	U
Nolina microcarpa	SC	N	U
Opuntia			U
Pellaea truncata	GC	N	
Penstemon pseudospectabilis	GC	N	
Pseudognaphalium	GC		W
Quercus emoryi		N	
Quercus oblongifolia		N	
Simmondsia chinensis		N	



Species	Cover Code	Native Status	Wetland Status
Viguiera dentata	GC	N	

**Fauna:** Surveyors collected or observed aquatic and terrestrial invertebrate specimens.

**Table 15.3 Chimney Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
COL Dytiscidae Thermonectus			A	
LEP Papilionidae Papilio multicaudata			T	
ARAN Lycosidae	1	Ad	T	Spot
DIP Culicidae Culiseta	1	L	A	Spot

**Table 15.4 Chimney Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
ash-throated flycatcher	1	obs	
canyon wren		call	
canyon tree frog	5	obs	
Mountain lion	1	sign	
deer	1	sign	
javelina	1	sign	
hummingbird			

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is moderate risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is very good with excellent restoration potential and there is negligible risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

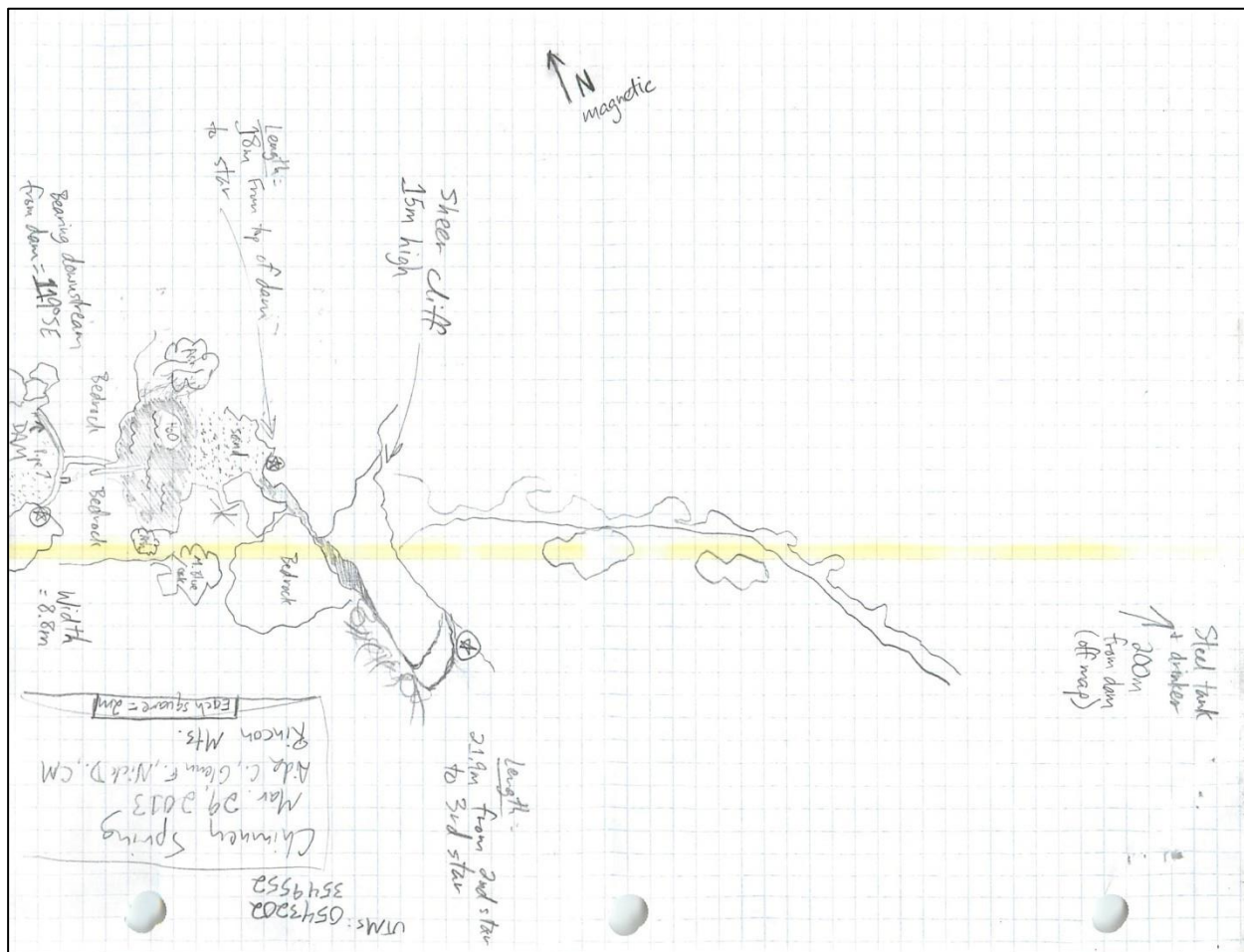
Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 15.6 Chimney Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.83	1.83
Geomorphology	3.80	3.00
Habitat	4.00	2.00

Category	Condition	Risk
Biota	5.33	2.00
Human Influence	5.13	1.57
Administrative Context		
Overall Ecological Score	4.24	2.21

**Management Recommendations:** This spring is highly influenced by an old dam which concentrates the spring's flow. Significant aquatic and wetland habitat exists below the dam. If the dam was removed, it may effect this habitat. There is a lot of piping and other infrastructure associated with the spring that could be removed.



**Fig 15.2 Chimney Spring Sketchmap.**

## 16. Collins Spring

### Survey Summary Report, Site ID 11949

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Collins Spring ecosystem is located in Cochise County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31° 26' 14.286" latitude, -110° 27' 18.433" longitude in the Huachuca Peak USGS Quad, measured using a Garmin GPS (NAD 83, 4 meters EPE). The elevation is approximately 1650 meters. Nick Deyo, Rom Miller, Norma Miller, Bill Beaves, Devin Myers surveyed the site on 6/17/2012, beginning at 10:30, and collected data in 10 of 12 categories.



**Fig 16.1 Collins Spring.**

**Physical Description:** Collins Spring is a limnocrene perennial spring adjacent to Parker Canyon Lake. It is a large, sunken wetland, and has possibly been excavated. There is a well house and maintenance facility adjacent to the spring. The microhabitat associated with the spring covers 1,989 m<sup>2</sup>.

The distance to the nearest spring is 4647 meters. The site receives approximately 100% of available solar radiation, with 7240 Mj annually.

**Survey Notes:** The site is a large wetland with lots of bullfrogs and mesic plants.

**Water:** Flow was measured at 0.31 L/s with a volumetric method. Measurements were taken at our best estimate of where the location of the source was at the site.

The water was covered in duck weed. Measurements were taken at a depth of 6 inches.

**Table 16.1 Collins Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.1
Specific Conductance uS/cm	1
Water Temperature °C	19.7
Dissolved Solids	

**Flora:** Surveyors identified 15 plant species at the site.

**Table 16.2 Collins Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Amorpha fruticosa	SC		F
Juglans major	TC	N	R
Juniperus scopulorum	MC	N	U
Lemna	AQ		A
Melilotus officinalis	GC	I	WR
Mimulus	GC		W
Populus fremontii	MC	N	R
Quercus arizonica	MC	N	R
Quercus emoryi		N	
Salix Sp	SC	N	R
Schoenoplectus	GC		W
Sporobolus	GC		F
Toxicodendron radicans	GC	N	WR
Typha	GC		A
Vitis arizonica	SC	N	R

**Fauna:** Surveyors collected or observed 11 aquatic and terrestrial invertebrate specimens, and observed 9 vertebrate species.

**Table 16.3 Collins Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
ODO Aeshnidae Aeshna interrupta	1	Ad	T	
ODO Libellulidae Erythemis collocata	1	Ad	T	
ARAN		Ad	T	Spot
HYM	1	Ad	T	Spot
LEP Lycaenidae Leptotes marina	1	Ad	T	Spot
LEP Nymphalidae Adelpha bredowii eulalia	1	Ad	T	Spot
LEP Nymphalidae Megisto rubricata		Ad	T	Spot
LEP Papilionidae Battus philenor	1	Ad	T	Spot
ODO Coenagrionidae Argia vivida	1	Ad	T	Spot



Species	Qty	Lifestage	Habitat	Method
ODO Libellulidae Libellula saturata	1	Ad	T	Spot
ORT	1	Ad	T	Spot

**Table 16.4 Collins Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
Western Wood Pewee	1	obs	
ash-throated flycatcher	1	obs	
lesser goldfinch	1	obs	
common raven	1	obs	
pyrrhuloxia	1	obs	
Alligator lizard	1	obs	
hepatic tanager	1	obs	
bullfrog		obs	many
Dusky-capped Flycatcher	1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is poor with limited restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is moderate risk.

Biotic integrity is poor with limited restoration potential and there is moderate risk.

Human influence of site is moderate with some restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is moderate risk.

**Table 16.5 Collins Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	2.83	2.67
Geomorphology	2.20	2.20
Habitat	4.20	3.00
Biota	2.75	3.50
Human Influence	3.00	2.57
Administrative Context		
Overall Ecological Score	3.00	2.84

**Management Recommendations:** Surveyors made no management recommendations for this site.



## 17. Copper Mountain unnamed Survey Summary Report, Site ID 13002

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Copper Mountain unnamed ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31° 33' 14.237" latitude, -110° 38' 33.847" longitude in the Mount Hughes USGS Quad, measured using a map (NAD 83). The elevation is approximately 1440 meters. Nick Deyo, Nick Pacini, Alleson Brennan, Keeley Lyons-Letts, Matt M. surveyed the site on 1/12/2013 and collected data in 3 of 12 categories.



**Fig 17.1 Copper Mountain unnamed.**

**Physical Description:** Copper Mountain unnamed is a rheocrene spring with a large pool (approx 50'x8' by 10' deep). The distance to the nearest spring is 1421 meters.

**Survey Notes:** There was evidence of moderate grazing, as there is a cattle use site for water. The source is likely perennial because of the presence of *Abedus herberti*.

**Water:** Surveyors recorded no water quality measurements.

**Flora:** Surveyors did not report vegetation at the site.

**Fauna:** Surveyors collected or observed two aquatic invertebrate specimens, but did not report any vertebrates.

**Table 17.1 Copper Mountain unnamed Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
HEM Belostomatidae Abedus herberti			A	
HEM Belostomatidae Lethocerus			A	

**Assessment:** Surveyors did not do an assessment.

**Management Recommendations:** Surveyors did not include any management recommendations.

## 18. Cott Tank

### Survey Summary Report, Site ID 13013

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Cott Tank ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 30' 35.889" latitude, -110 37' 2.398" longitude in the O'Donnel Canyon USGS Quad, measured using a GPS (NAD 83, 5 meters EPE). The elevation is approximately 1543 meters. Larry Stevens, Louise Misztal, Sue Carnahan, Cliff Hirshaw, and Chip Harnbaugh surveyed the site on 10/28/2012 for 02:00 hours, beginning at 10:30, and collected data in 9 of 12 categories.





**Fig 18.1 Cott Tank.**

**Physical Description:** Cott Tank is a rheocrene spring that discharges from beneath a mossy rock and flows into a channel. The entire site has an exclosure to keep cattle out and to protect native plants. The exclosure was constructed in 1996. There is a dam upstream of the spring that has been silted in. The microhabitat associated with the spring covers 450 m<sup>2</sup>.

The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1732 meters. The site receives approximately 89% of available solar radiation, with 6478 MJ annually.

**Survey Notes:** Cott Tank Spring has been exclosed from grazing since 1992. The site was in good condition with no evidence of recent human activity. Something has been browsing the *Juncus* heavily.

**Water:** Flow was measured at 0.0013 L/s with a volumetric method. The water quality measurements were strongly influenced by surface dynamics.

**Table 18.1 Cott Tank Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.4
Specific Conductance uS/cm	1633
Water Temperature °C	19.5

Characteristic Measured	Average Value
Dissolved Solids	

**Flora:** Riparian experts conducted this plant survey. Surveyors identified 45 plant species at the site.

**Table 18.2 Cott Tank Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Agave palmeri	GC		
algae sp	AQ	N	A
Aster sp	GC	N?	
Avena	GC	I	
Bidens	GC		F
Bothriochloa barbinodis	GC	N	F
Bouteloua	GC	N	U
Bouteloua curtipendula	GC	N	U
Bouteloua hirsuta	GC	N	U
Brickellia			F
Conyza	GC		F
Echinocereus rigidissimus	GC		
Epilobium	GC		WR
Equisetum	GC	N	WR
Eryngium	GC	I?	
Fraxinus	SC	N	R
Fraxinus velutina	MC		R
Gamochaeta purpurea	GC		
Gnaphalium	GC	I?	W
Juncus ensifolius	GC	N	W
Juncus sp	GC	N	W
Juniperus deppeana	MC	N	U
Leptochloa dubia	GC	N?	
Melilotus	GC	I	WR
Muhlenbergia	GC	N	U
Muhlenbergia emersleyi	GC	N	
Muhlenbergia rigens	GC	N	U
Nasturtium officinale	AQ	I	W
Penstemon	GC		U
Polypogon monspeliensis	GC	I	WR
Populus fremontii	MC	N	R
Prosopis velutina	SC	N	F
Quercus emoryi	MC	N	
Rhus trilobata	SC	N	F
Salix gooddingii	TC	N	R

Species	Cover Code	Native Status	Wetland Status
Salvia subincisa	GC	N?	
Schizachyrium	GC	N	
Schizachyrium scoparium	GC	N	F
Setaria			
Sonchus	GC		F
Sorghum halepense	GC	I	F
Sporobolus airoides	GC	N	WR
Tragia nepetifolia	GC	N	F
Verbena			F
Xanthium strumarium	GC	I	W

**Fauna:** Surveyors collected or observed 12 aquatic and terrestrial invertebrate specimens, and observed 6 vertebrate species.

**Table 18.3 Cott Tank Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
Adelpha radiatta	1	Ad	T	Spot
Athalis iole	1	Ad	T	Spot
Corixidae	1	Ad	A	Spot
Dytiscidae	1	Ad	A	Spot
Echinargus isola	1	Ad	T	Spot
Eurema nicippe	1	Ad	T	Spot
Lycaenidae	1	Ad	T	Spot
Nephila	1	Ad	T	Spot
Pieridae	1	Ad	T	Spot
Pyrgus communis	1	Ad	T	Spot
Thermonectus marmoratus	1	Ad	A	Spot
Vanessa annabella	1	Ad	T	Spot

**Table 18.4 Cott Tank Vertebrates.**

Species	Common Name	Qty	Detection Type	Comments
	northern flicker	1	obs	
	black phoebe	1	obs	
	ruby-crowned kinglet	1	obs	
	dark-eyed junco	1	obs	
	common raven	1	obs	
	red-naped sapsucker	1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 12 null condition scores, and 10 null risk scores.

Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is very good with excellent restoration potential and there is negligible risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 18.5 Cott Tank Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.50	1.83
Geomorphology	4.75	1.80
Habitat	4.75	2.40
Biota	5.00	2.00
Human Influence	5.00	1.71
Administrative Context		
Overall Ecological Score	4.50	2.01

**Management Recommendations:** Surveyors did not note any management recommendations.





## 19. Cottonwood Spring Survey Summary Report, Site ID 15390

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Cottonwood Spring ecosystem is located in Pima County in the Upper San Pedro Arizona 8-digit HUC, managed by a private US owner. The spring is located in the Mustang Mountains USGS Quad. The elevation is approximately 1573 meters. Christopher Morris, Aida Castillo, Glenn Furnier, Eric Sophiea, Karen Lowry, Mike Manning surveyed the site on 3/16/2013 for 00:25 hours, beginning at 14:05, and collected data in 7 of 12 categories.



**Fig 19.1 Cottonwood Spring.**

**Physical Description:** Cottonwood Spring is a rheocene spring. The site now contains an 8.5 meter diameter developed cattle tank with solar panels. The microhabitat associated with the spring covers 63 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 2056 meters.

**Survey Notes:** The spring has been developed into a cattle pond with a guzzler 20 meters to the east.

**Water:** Surveyors measured water quality at the tank with the windmill.

**Table 19.1 Cottonwood Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.9
Specific Conductance uS/cm	431
Water Temperature °C	16.7
Dissolved Solids	

**Flora:** Surveyors identified two plant species at the site, *Acacia constricta* and *Prosopis velutina*.

**Fauna:** Surveyors observed Gerridae at the site and 3 vertebrate species.

**Table 19.2 Cottonwood Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
rufous-crowned sparrow		obs	
black-chinned sparrow		obs	
Vermillion Flycatcher		obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 12 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is moderate risk.

Geomorphology condition is poor with limited restoration potential and there is high risk.

Habitat condition is poor with limited restoration potential and there is high risk.

Biotic integrity is poor with limited restoration potential and there is moderate risk.

Human influence of site is moderate with some restoration potential and there is high risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is moderate risk.

**Table 19.3 Cottonwood Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.33	3.00
Geomorphology	1.80	3.80
Habitat	1.80	4.60
Biota	2.00	3.75
Human Influence	3.13	3.86
Administrative Context		
Overall Ecological Score	2.23	3.79



**Management Recommendations:** The site consists of a windmill with solar panels. Water is pumping into a large tank with an adjacent cattle guzzler. The adjacent drainage has suffered noticeably. The water has also been pumped through unsightly plastic tubing all the way to and from Goat Well 2/3 mile away. Historically the spring was likely in the adjacent riparian area. The site may benefit from putting water back into the ground in the adjacent riparian area to restore some wetted/riparian habitat, but restoration of the spring source to a more natural state does not seem likely.

## 20. Cottonwood Spring Survey Summary Report, Site ID 12999

Submitted December 23, 2013 by Sky Island Alliance





**Fig 20.1 Cottonwood Spring.**

**Location:** The Cottonwood Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 32' 54.743" latitude, -110 38' 8.661" longitude in the Mount Hughes USGS Quad, measured using an etrex 20 GPS (NAD 83, 3 meters EPE). The elevation is approximately 1461 meters. Nick Deyo, Nick Pacini, Allison Brennan, Keeley Lyons-Letts, Matt M. surveyed the site on 1/12/2013 for 01:15 hours, beginning at 13:00, and collected data in 6 of 12 categories.

**Physical Description:** Cottonwood Spring is a rheocrene spring that emerges from numerous places along a desert grassland canyon. There is an old spring box and check dam at spring site.

The distance to the nearest spring is 95 meters. The site receives approximately 95% of available solar radiation, with 6912 Mj annually.

**Survey Notes:** None of the dam or spring box infrastructure is diverting or retaining water. There was evidence of cattle and the area is not heavily grazed.

**Water:** Flow was measured at 0.31 L/s with a volumetric method at the pool near the spring source.

**Table 20.1 Cottonwood Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	8.0
Specific Conductance uS/cm	533
Water Temperature °C	2.7
Dissolved Solids	

**Flora:** Surveyors identified 17 plant species at the site.

**Table 20.2 Cottonwood Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Baccharis	GC	N	R
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Cercocarpus	MC		U
Chloris virgata	GC	N	WR
Cupressus arizonica	MC	N	F
Eragrostis	GC	I	WR
Holodiscus dumosus	SC	N	F
Juniperus deppeana	MC	N	U
Muhlenbergia rigens	GC	N	U

Species	Cover Code	Native Status	Wetland Status
Opuntia			U
Pinus monophylla	GC	N	U
Populus fremontii	MC	N	R
Prosopis velutina	SC	N	F
Sambucus	GC		F
Yucca			

**Fauna:** Surveyors reported no faunal species at the site, other than domestic cattle.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 14 null condition scores, and 14 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is moderate with some restoration potential and there is negligible risk.

Biotic integrity is very good with excellent restoration potential and there is negligible risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is negligible risk.

**Table 20.3 Cottonwood Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.00	1.50
Geomorphology	4.00	1.80
Habitat	3.40	1.60
Biota	5.00	1.67
Human Influence	4.88	1.86
Administrative Context		
Overall Ecological Score	4.10	1.64

**Management Recommendations:** The spring is in a mostly natural state. There are non-functional pipes, drinkers and a concrete dam on site. There is moderate herbivory by cattle. Spring is in a steep bedrock channel with little wetland or soil formation likely too much erosion from natural flooding. Several pools and sources of flow are present.

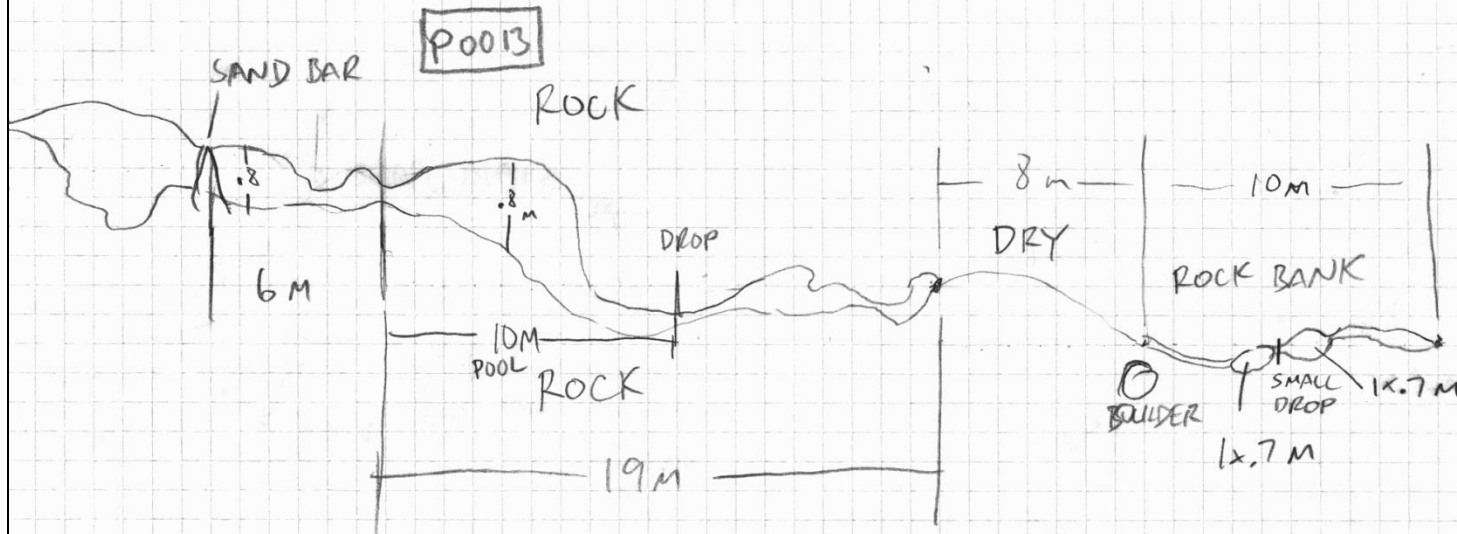
Cottonwood Spring

1-12-2013

Matt M., Keely Lyons-Letts

729 NSD

1 SQ = 1 MEER



PAGE 1 of 3

**Fig 20.2 Cottonwood Spring Sketchmap.**

## 21. Coyote Spring Survey Summary Report, Site ID 12949

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Coyote Spring ecosystem is located in Cochise County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 51' 0.552" latitude, -110 26' 32.493" longitude in the Apache Peak USGS Quad, measured using an etrex 20 GPS (NAD 83, 3 meters EPE). The elevation is approximately 1620 meters. Nick Deyo, Jim Chumbly, Dale Turner, Keely surveyed the site on 12/8/2012 for 00:15 hours, beginning at 12:15, and collected data in 5 of 12 categories.





**Fig 21.1 Coyote Spring.**

**Physical Description:** Coyote Spring is an exposure spring piped directly from the steep rock face. The distance to the nearest spring is 1202 meters.

**Survey Notes:** At the time of visit the flow at the site was completely regulated. There was low flow coming from a pipe and leaking onto the ground and a former cattle drinker that was not currently in use. The wetted soil area was about 1 m squared.

**Water:** Flow was measured at 0.0044 L/s with a volumetric method. Surveyors did not record water quality measurements.

**Flora:** Surveyors identified 11 plant species at the site.

**Table 21.1 Coyote Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Agave			
Bouteloua curtipendula	GC	N	U
Celtis laevigata var. reticulata	MC	N	R
Cercocarpus	MC		U
Choisya	SC	N	

Species	Cover Code	Native Status	Wetland Status
Gutierrezia	SC	N	F
Mortonia scabrella	SC	N	
Muhlenbergia	GC	N	U
Nolina microcarpa	SC	N	U
Rhus trilobata	SC	N	F

**Fauna:** Surveyors did not report any invertebrate species, and only observed one vertebrate, a hermit thrush.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 16 null condition scores, and 16 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is very poor with very limited restoration potential and there is negligible risk.

Habitat condition is poor with limited restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is negligible risk.

Human influence of site is very good with excellent restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is negligible risk.

**Table 21.2 Coyote Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.50	2.00
Geomorphology	1.40	1.00
Habitat	1.80	2.40
Biota	4.17	1.67
Human Influence	5.14	1.83
Administrative Context		
Overall Ecological Score	2.72	1.77

**Management Recommendations:** This spring had a low but detectable flow. 100% of the spring water was piped from a rock wall. The pipe outflows to the canyon bottom forming a small pool (less than 1 meter-squared). There is an old cattle drinker on site that is no longer filled by the spring.

## 22. Death Trap Spring

### Survey Summary Report, Site ID 12943

Submitted December 23, 2013 by Sky Island Alliance



**Location:** The Death Trap Spring ecosystem is located in Cochise County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31.794785 latitude, -110.451735 longitude in the Apache Peak USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 8 meters EPE). The elevation is approximately 1678 meters. Louise Misztal, Steve Pavlak, Norma Miller, Amanda Webb surveyed the site on 3/16/2013 for 01:23 hours, beginning at 11:17, and collected data in 7 of 12 categories.



**Fig 22.1 Death Trap Spring.**

**Physical Description:** Death Trap Spring is located in a narrow mountainous canyon in an oak woodland with pronounced bedrock exposure creating tinaja structures. The microhabitat associated with the spring covers 105 m<sup>2</sup>. The distance to the nearest spring is 874 meters.

**Survey Notes:** The site has signs of domestic cattle and the areas below the spring source have significantly more. There may have been more water present due to snow melt. The grasses were browsed significantly. Neighboring springs - bear and simpson- are hammered by cows, but this spring presents a natural pinch point to deter cows.

**Water:** Flow was measured at 0.0081 L/s with a volumetric method, and collected 26 m downstream.

**Table 22.1 Death Trap Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	8.3
Specific Conductance uS/cm	356
Water Temperature °C	12.1
Dissolved Solids	

**Flora:** Surveyors identified 10 plant species at the site.

**Table 22.2 Death Trap Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Adiantum capillus-veneris	GC	N	W
Carex sp	GC	N	W
Cercocarpus	MC		U
Fraxinus velutina	TC	N	R
Graptopetalum bartramii	GC	N	
Juniperus	SC	N	U
moss	NV	N	F
Muhlenbergia rigens	GC	N	U
Nolina microcarpa	SC	N	U
Salix Sp	SC	N	R

**Fauna:** Surveyors collected or observed two aquatic invertebrate specimens and 12 vertebrate species.

**Table 22.3 Death Trap Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
DIP Chironomidae Chironomus	2	L	A	Spot
MOLL Physidae Physa	1	Ad	A	Spot

**Table 22.4 Death Trap Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
Bewick's wren		obs	
Mexican Jay		obs	
yellow-eyed junco			
swallow			
cactus wren			
spotted towhee			
chipping sparrow			
canyon tree frog			
tree lizard			
Yarrow's Spiny Lizard			



Species Common Name	Qty	DetectionType	Comments
Clark's spiny lizard			
domestic cow			

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 10 null condition scores, and 10 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is very good with excellent restoration potential and there is negligible risk.

Habitat condition is good with significant restoration potential and there is negligible risk.

Biotic integrity is good with significant restoration potential and there is low risk.

Human influence of site is very good with excellent restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is negligible risk.

**Table 22.5 Death Trap Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.60	1.83
Geomorphology	5.60	1.00
Habitat	4.20	1.40
Biota	3.88	2.43
Human Influence	5.00	2.14
Administrative Context		
Overall Ecological Score	4.57	1.67

**Management Recommendations:** According to Dennis Caldwell, this area should support mud turtles. Cows could obliterate what is left of sensitive plants, and old fencing is not working, so new fencing should be installed to protect neighboring springs.

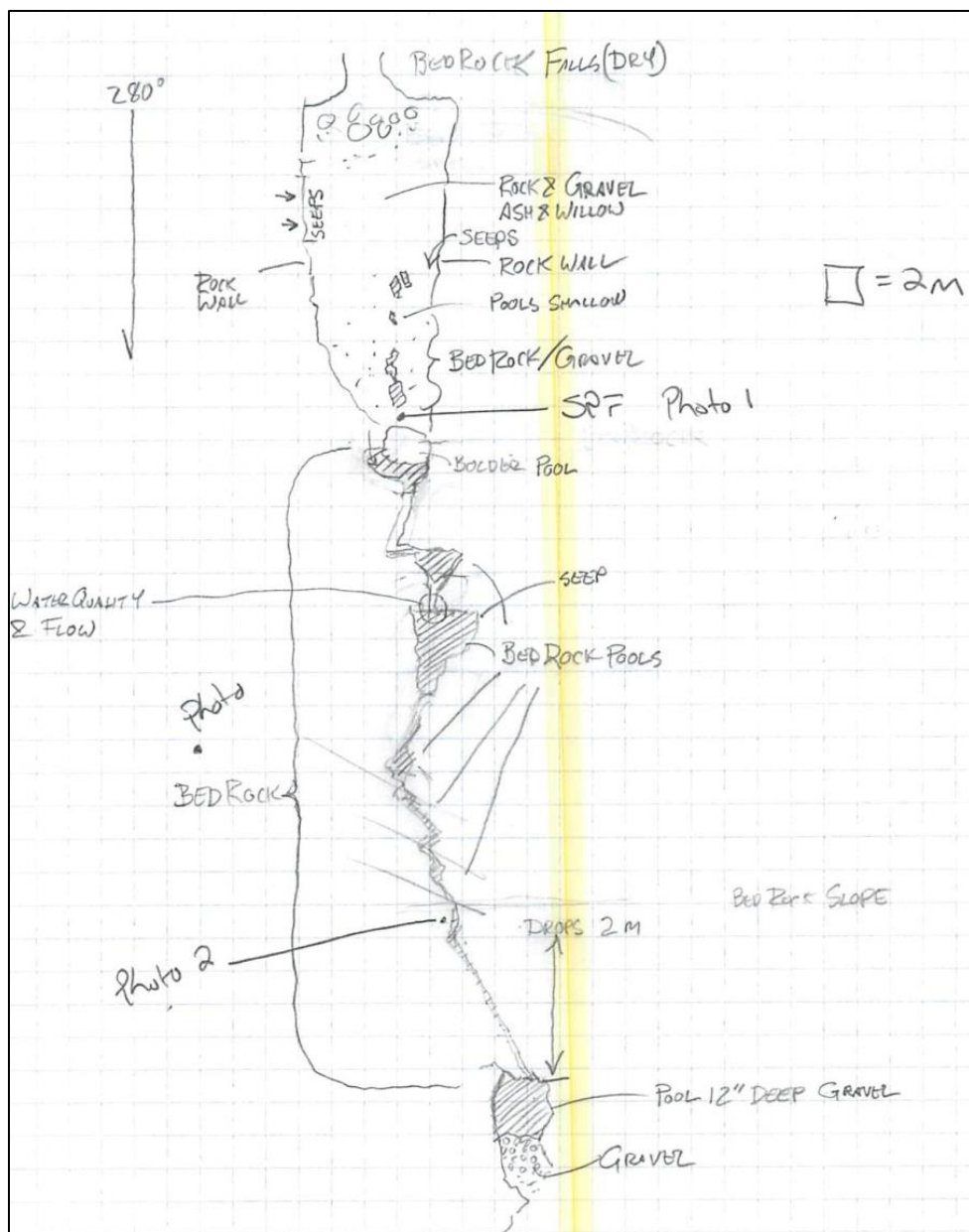


Fig 22.1 Death Trap Spring Sketchmap.

## 23. Dripping Spring Survey Summary Report, Site ID 17086

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Dripping Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31.602289 latitude, -110.800066 longitude in the Patagonia USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 6 meters EPE). The elevation is approximately 1402 meters. Nick Deyo, Sarah Williams, University of Virginia alt spring break class surveyed the site on 3/14/2013 for 01:46 hours, beginning at 12:29, and collected data in 6 of 12 categories.



**Fig 23.1 Dripping Spring.**

**Physical Description:** Dripping Spring is a rheocrene intermittent spring. It is located in a bedrock channel with multiple pools, some moss and quatic plants, and is probably ephemeral. The microhabitat associated with the spring covers 383 m<sup>2</sup>. Geomorphic diversity is 0.19, based on the Shannon-Weiner diversity index. The distance to the nearest spring is 1325 meters.

**Survey Notes:** There was some evidence of grazing and some garbage from migrants. Overall the site was in good condition.

**Water:** Recent rains would indicate that water quality measurements were a mix of spring and surface water. Measurements were taken in the upper most pool.

**Table 23.1 Dripping Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.9
Specific Conductance uS/cm	815
Water Temperature °C	21.2
Dissolved Solids	

**Flora:** Surveyors reported the presence of an unknown fern and bryophyte. Surveyors identified 24 plant species at the site.

**Table 23.2 Dripping Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Agave			
Artemisia ludoviciana	GC	N	F
Baccharis salicifolia	SC	N	R
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Cheilanthes lindheimeri	GC		
Cylindropuntia	SC	N	
Elytraria imbricata	GC	N	
Garrya wrightii	SC	N	F
Juniperus coahuilensis	TC	N	
Juniperus deppeana	MC	N	U
Juniperus monosperma	SC	N	U
Laennecia eriophylla	GC	N	
Mammillaria	GC	N	
moss	NV	N	F
Muhlenbergia rigens	GC	N	U
Nolina			F



Species	Cover Code	Native Status	Wetland Status
Opuntia			U
Pellaea ternifolia	GC	N	
Quercus	SC		U
Quercus oblongifolia		N	
Schizachyrium scoparium	GC	N	F
Yucca			

**Fauna:** Surveyors collected or observed six aquatic and one terrestrial invertebrate specimen, and 3 vertebrate species.

**Table 23.3 Dripping Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
ARAN Lycosidae	1	Ad	T	Spot
DIP Chironomidae	1	L	A	Spot
DIP Culicidae Culiseta	1	P	A	Spot
DIP Culicidae Culiseta	1	P	A	Spot
DIP Culicidae Culiseta	2	L	A	Spot
MOLL Physidae Physa	4	Ad	A	Spot
PLE Chloroperlidae	1	L	A	Spot

**Table 23.4 Dripping Spring Vertebrates.**

Species	Common Name	Qty	DetectionType	Comments
Anna's hummingbird		1	obs	
canyon tree frog		1	obs	
Alligator lizard		1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 14 null condition scores, and 15 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is negligible risk.

Biotic integrity is very good with excellent restoration potential and there is negligible risk.

Human influence of site is very good with excellent restoration potential and there is low risk.

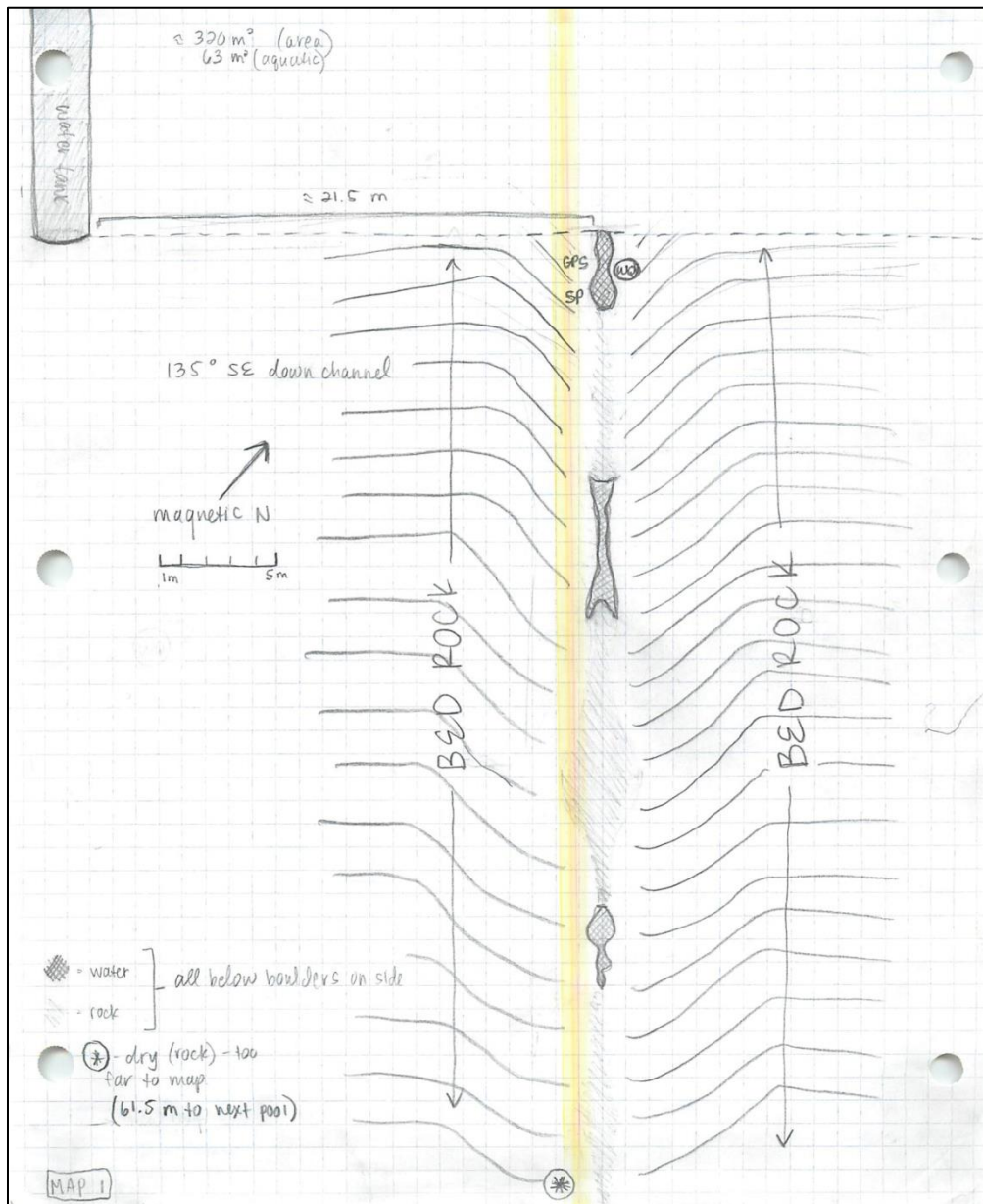
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is negligible risk.

**Table 23.5 Dripping Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.17	1.67
Geomorphology	4.20	2.00
Habitat	4.00	1.67
Biota	5.00	1.50
Human Influence	4.88	2.29
Administrative Context		
Overall Ecological Score	4.34	1.71

**Management Recommendations:** There was a small amount of migrant trash. There was a very large tank that would be extremely hard to remove. Presence of moss and aquatic insects indicate the spring is consistently wet.





**Fig 23.1 Dripping Spring Sketchmap.**

## 24. Farrell Spring Survey Summary Report, Site ID 11961

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Farrell Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 26' 16.44" latitude, - 110 41' 56.22" longitude in the Harshaw USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 5 meters EPE). The elevation is approximately 1583 meters. Nick Deyon, Jim Chumbley, Kim Franklin, Dale Turner, Micheal Bogen surveyed the site on 4/26/2013 for 01:42 hours, beginning at 13:45, and collected data in 6 of 12 categories.



**Fig 24.1 Farrell Spring.**

**Physical Description:** Farrell Spring is a mound-form/anthropogenic spring with a windmill and drinker that mark the location. The spring emerges from a channel northeast of the infrastructure. This site was a large mound-forming spring historically with huge amounts of travertine. The microhabitat associated with the spring covers 271 m<sup>2</sup>. Geomorphic diversity is 0.19, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 3565 meters. The site receives approximately 55% of available solar radiation, with 3991 Mj annually.

**Survey Notes:** Windmill and infrastructure are still working. The site is not heavily grazed, and small pools northesast of windmill appears in natural condition. The road is wetted by groundwater.

**Water:** Surveyors measured water quality at a small natural pool associeated with the windmill about 100 m NE with very low flow.

**Table 24.1 Farrell Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.1
Specific Conductance uS/cm	610
Water Temperature °C	19.4
Dissolved Solids	

**Flora:** Surveyors did not report vegetation at the site.

**Fauna:** Surveyors collected or observed 23 aquatic and terrestrial invertebrate specimens, but no vertebrates.

**Table 24.2 Farrell Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
COL Dytiscidae Agabus			A	
COL Dytiscidae copelatus distinctus			A	
COL Dytiscidae Desmopachria mexicana			A	
COL Dytiscidae Desmopachria portmanni			A	
COL Dytiscidae Laccophilus oscillator			A	
COL Dytiscidae Laccophilus pictus			A	
COL Dytiscidae Liodessus obscurellus			A	
COL Dytiscidae Rhantus atricolor			A	
COL Dytiscidae Rhantus gutticollis			A	
COL Dytiscidae Sanfilippodytes			A	
COL Dytiscidae Stictotarsus aequinoctialis			A	
COL Dytiscidae Stictotarsus striatellus			A	
COL Hydraenidae Hydraena			A	
COL Hydrophilidae Berosus			A	



Species	Qty	Lifestage	Habitat	Method
COL Hydrophilidae Cymbiodyta			A	
DIP Chironomidae Chironomus			A	
DIP Culicidae Culiseta				
EPH Baetidae Callibaetis				
HEM Corixidae Graptocorixa serrulata			T	
HEM Gerridae Aquarius remigis			T	
HEM Notonectidae Notonecta lobata			A	
HEM Veliidae Microvelia			A	
TRI Limnephilidae Limnephilus				

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 13 null condition scores, and 14 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is moderate risk.

Geomorphology condition is moderate with some restoration potential and there is moderate risk.

Habitat condition is moderate with some restoration potential and there is moderate risk.

Biotic integrity is good with significant restoration potential and there is moderate risk.

Human influence of site is moderate with some restoration potential and there is moderate risk.

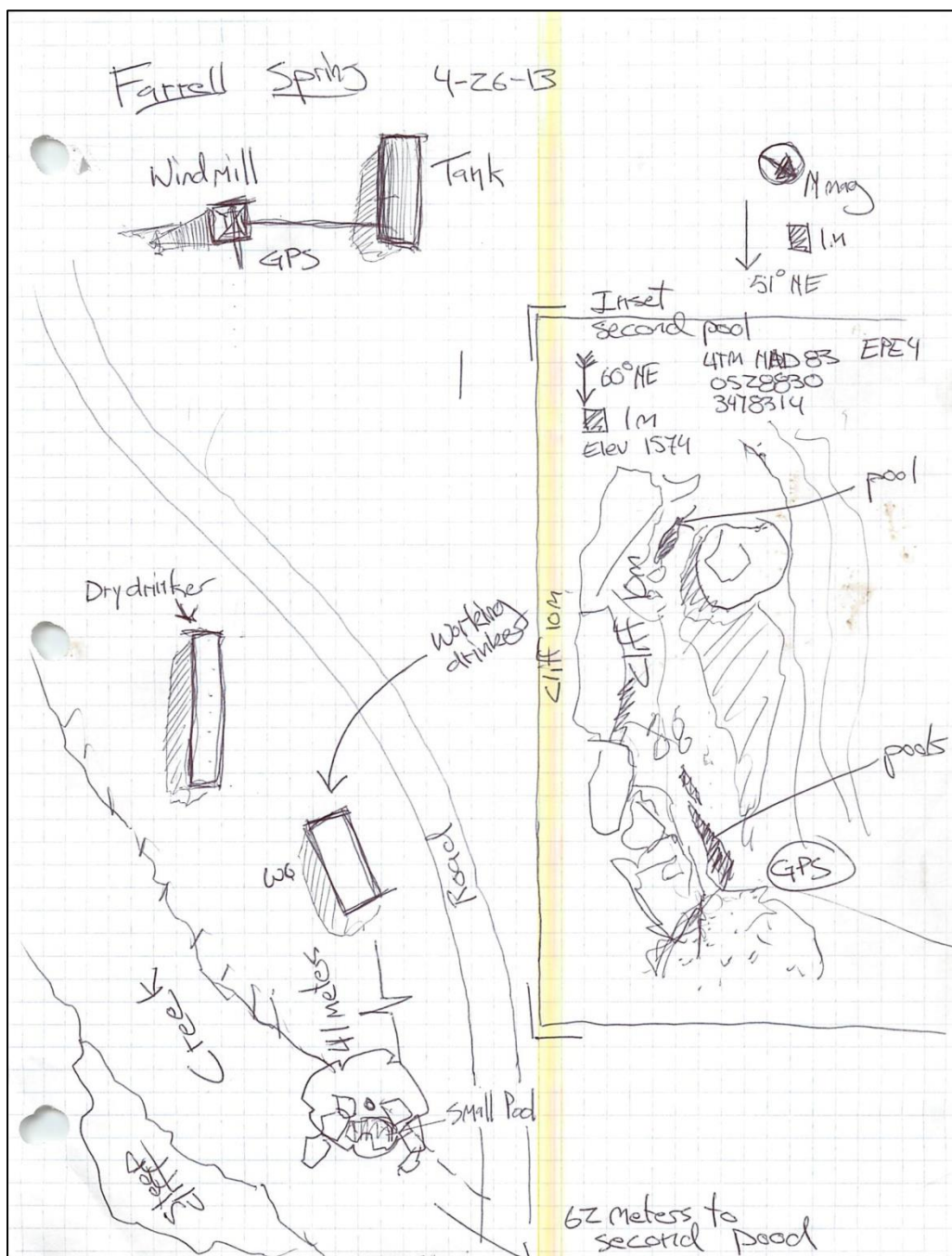
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is moderate risk.

**Table 24.3 Farrell Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.33	3.17
Geomorphology	2.80	3.60
Habitat	3.40	3.50
Biota	4.50	3.50
Human Influence	3.63	3.14
Administrative Context		
Overall Ecological Score	3.51	3.44

**Management Recommendations:** The site has an active windmill on it which is depleting the spring's aquifer. This water could be diverted to the channel or a flow splitter could be used. Scarily the water overflows onto the road and does not benefit wildlife. Spring is near a proposed mine site. Historically this was a very large spring site. There is a great deal of travertine deposit at the site.



## 25. Flux Canyon

### Survey Summary Report, Site ID 17084

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Flux Canyon ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, managed by the State. The spring is located at 31.50051 latitude, -110.775424 longitude in the Patagonia USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 4 meters EPE). The elevation is approximately 1242 meters. Nick Deyo, Jim Chumbley, Michael Bogan, Jim Rorabaugh, Doug Danforth, Rich Bailowitz, Kim Franklin surveyed the site on 4/26/2013 for 01:00 hours, beginning at 10:25, and collected data in 6 of 12 categories.



Fig 25.1 Flux Canyon.



**Physical Description:** Flux Canyon is an anthropogenic spring with a dry cattle tank next to a well boring 10 cm pipe 10 m to water. The microhabitat associated with the spring covers 102 m<sup>2</sup>.

The distance to the nearest spring is 3026 meters. The site receives approximately 100% of available solar radiation, approximately 7,240 mj annually.

**Survey Notes:** The site is heavily grazed pasture land. Water in the well was 10 meters down.

**Water:** There was no measurable flow, and surveyors did not measure water quality

**Flora:** Surveyors identified 33 plant species at the site.

**Table 25.2 Flux Canyon Vegetation.**

Species	Cover Code	Native Status	Wetland Status
<i>Alternanthera caracasana</i>	GC	I	
<i>Anisacanthus thurberi</i>	SC	N	
<i>Argemone pleiacantha</i>	GC	N	
<i>Aristida ternipes</i> var. <i>ternipes</i>	GC	N	
<i>Artemisia ludoviciana</i>	GC	N	F
<i>Asclepias asperula</i> ssp. <i>asperula</i>	GC	N	
<i>Bouteloua hirsuta</i>	GC	N	U
<i>Calliandra humilis</i>	GC	N	
<i>Cirsium neomexicanum</i>	GC	N	F
<i>Cylindropuntia spinosior</i>	SC	N	U
<i>Dasyllirion wheeleri</i>		N	
<i>Descurainia pinnata</i>	GC	N	F
<i>Elytraria imbricata</i>	GC	N	
<i>Eriogonum abertianum</i>	GC	N	
<i>Evolvulus alsinoides</i> var. <i>angustifolius</i>	GC	N	
<i>Glandularia bipinnatifida</i>	GC	N	U
<i>Gomphrena caespitosa</i>	GC	N	
<i>Hybanthus attenuatus</i>	GC	N	
<i>Juniperus deppeana</i>	MC	N	U
<i>Mentzelia albicaulis</i>	GC		R
<i>Nolina microcarpa</i>	SC	N	U
<i>Opuntia phaeacantha</i>	SC	N	U
<i>Pectis longipes</i>	GC	N	
<i>Penstemon parryi</i>	GC	N	
<i>Phaseolus</i>			F
<i>Prosopis velutina</i>	SC	N	F
<i>Pseudognaphalium leucocephalum</i>	GC	N	
<i>Quercus arizonica</i>	MC	N	R



Species	Cover Code	Native Status	Wetland Status
Quercus emoryi		N	
Sida neomexicana	GC	N	
Tetramerium nervosum	GC	N	
Yucca baccata	SC	N	U
Ziziphus obtusifolia	SC	N	

**Fauna:** Surveyors did not report any invertebrate species, and only domestic cow.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 12 null condition scores, and 13 null risk scores. Aquifer functionality and water quality are eliminated with no restoration potential and there is very high risk.

Geomorphology condition is very poor with very limited restoration potential and there is high risk.

Habitat condition is poor with limited restoration potential and there is high risk.

Biotic integrity is poor with limited restoration potential and there is high risk.

Human influence of site is poor with limited restoration potential and there is high risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is very poor with very limited restoration potential and there is high risk.

**Table 25.3 Flux Canyon Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	0.00	5.00
Geomorphology	0.80	4.60
Habitat	1.80	4.50
Biota	2.17	4.33
Human Influence	2.00	4.14
Administrative Context		
Overall Ecological Score	1.19	4.61

**Management Recommendations:** A smaller solar setup would be able to supply water to the site. The site has been obliterated and consists of a dry stock pond and a well.

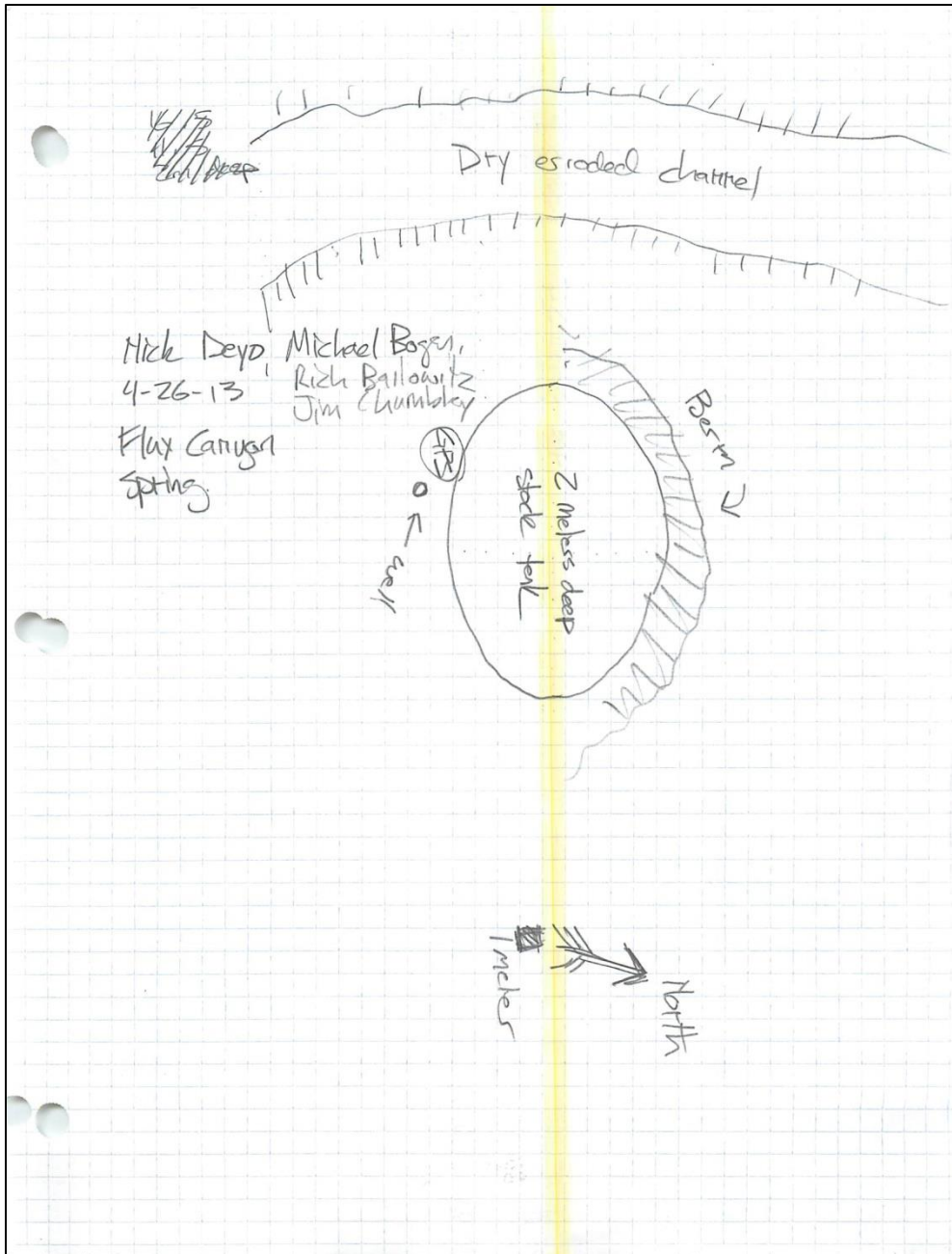


Fig 25.2 Flux Canyon Sketchmap.

## 26. Gate Spring

### Survey Summary Report, Site ID 12998

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Gate Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31° 31' 52.42" latitude, -110° 38' 58.73" longitude in the Mount Hughes USGS Quad, measured using a Garmin GPS (NAD 83, 5 meters EPE). The elevation is approximately 1411 meters. Louise Misztal, Julia Fonseca, Chris Cokinos, Rick Mick, and Cliff Hirsch surveyed the site on 1/12/2013 for 02:30 hours, beginning at 12:00, and collected data in 10 of 12 categories.



**Fig 26.1 Gate Spring.**

**Physical Description:** Gate Spring is a rheocrene spring, located in an open stream channel, upstream from a petroglyph site in a mixed oak woodland. The spring is within a cattle enclosure that was established in 1994. The microhabitat associated with the spring covers 280 m<sup>2</sup>.

The emergence environment is subaerial, with a gravity flow force mechanism. It is mixed dominated. The distance to the nearest spring is 1557 meters. The site receives approximately 97% of available solar radiation, with 7001 Mj annually.

**Survey Notes:** The site is in very good condition with the spring emergence point at the time of this survey located upstream of where it was previously mapped. At time of survey the emergence point was a ponded area with free flowing water below.

**Water:** Flow was measured at 0.225 L/s with a volumetric method. The sample was collected 22 meters downstream of the spring emergence, and measured at a depth of 1 cm.

**Table 26.1 Gate Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.2
Specific Conductance uS/cm	880
Water Temperature °C	8.5
Dissolved Solids	

**Flora:** Surveyors identified five plant species at the site.

**Table 26.2 Gate Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Fraxinus	MC	N	R
Juglans major	TC	N	R
Muhlenbergia rigens	GC	N	U
Populus fremontii	MC	N	R
Sorghum halepense	GC	I	F

**Fauna:** Surveyors visited the site on a very cold day when the water was partially frozen, so there was very little animal activity. Surveyors collected or observed two aquatic invertebrate specimens.

**Table 26.3 Gate Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
HEM Belostomatidae			A	
HEM Corixidae			A	

**Table 26.4 Gate Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
goldfinch		call	
skunk	1	sign	fur and remnants from a kill
red-tailed hawk		obs	
rufous-crowned sparrow		obs	
woodpecker			



**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is moderate with some restoration potential and there is low risk.

Habitat condition is very good with excellent restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is very good with excellent restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 26.5 Gate Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.67	2.00
Geomorphology	3.20	2.00
Habitat	5.20	2.00
Biota	5.00	2.00
Human Influence	5.11	2.50
Administrative Context		
Overall Ecological Score	4.52	2.

**Management Recommendations:** This site is well protected and likely a good reference site for Rheocrene spring. There is a possibility of the water table rising since the spring was originally mapped because we located the origin further upstream. Maintain enclosure as spring site appears very healthy and is showing signs of recovery. There is a lot of mining pressures in this area that may negatively affect spring health.

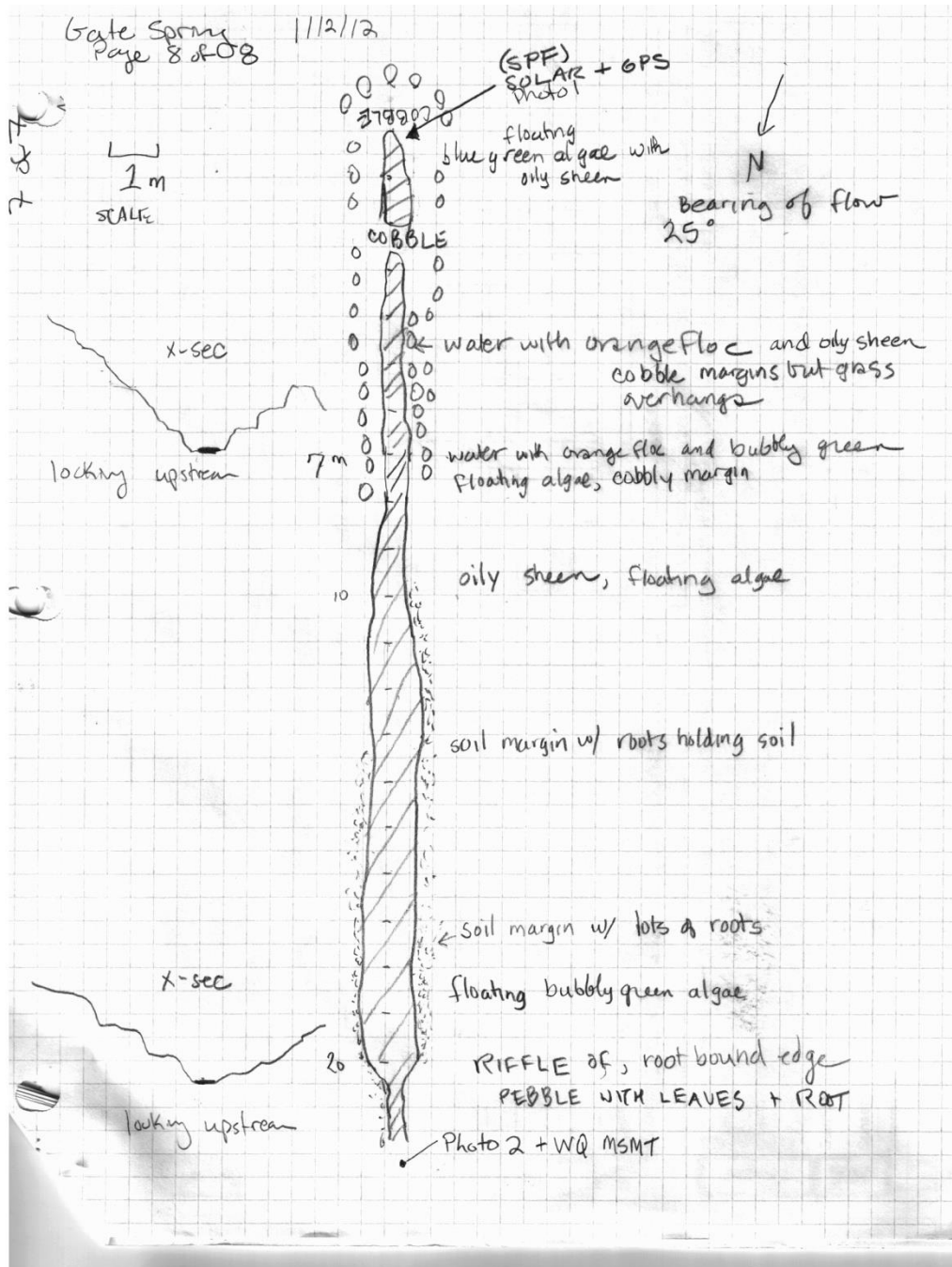


Fig 26.2 Gate Spring Sketchmap.

## 27. Goat Well Spring

### Survey Summary Report, Site ID 12953

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Goat Well Spring ecosystem is located in Pima County in the Upper San Pedro Arizona 8-digit HUC, managed by the County. The spring is located at 31.751988 latitude, -110.467339 longitude in the Apache Peak USGS Quad, measured using a Garmin GPS (NAD 83). The elevation is approximately 1586 meters. Christopher MorrisMike Manning, Karen Lowry, Aida, Glenn Frederick, Eric Sophea, surveyed the site on 3/16/2013 for 00:36 hours, beginning at 14:47, and collected data in 7 of 12 categories.



**Fig 27.1 Goat Well Spring.**

**Physical Description:** Goat Well Spring is a rheocrene, a stock pond where an earthen berm has captured all of the water. The microhabitat associated with the spring covers 760 m<sup>2</sup>.

The distance to the nearest spring is 2056 meters. The site receives approximately 100% of available solar radiation,

**Survey Notes:** Heavily used by cattle at the time of visit. Appears to be surface water catchment. An old trough and windmill are present.

**Water:** There was no measurable flow, and surveyors did not measure water quality.

**Flora:** Surveyors did not report vegetation at the site.

**Fauna:** Surveyors did not report presence of invertebrates.

**Table 27.1 Goat Well Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
black-chinned sparrow			
black phoebe			
blue-gray gnatcatcher			
quail	8		
lesser goldfinch			
bobcat	1	sign	
coyote	1	sign	
mule deer	1	sign	
javelina	1	sign	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are poor with limited restoration potential and there is moderate risk.

Geomorphology condition is very poor with very limited restoration potential and there is moderate risk.

Habitat condition is poor with limited restoration potential and there is moderate risk.

Biotic integrity is moderate with some restoration potential and there is moderate risk.

Human influence of site is poor with limited restoration potential and there is high risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is moderate risk.

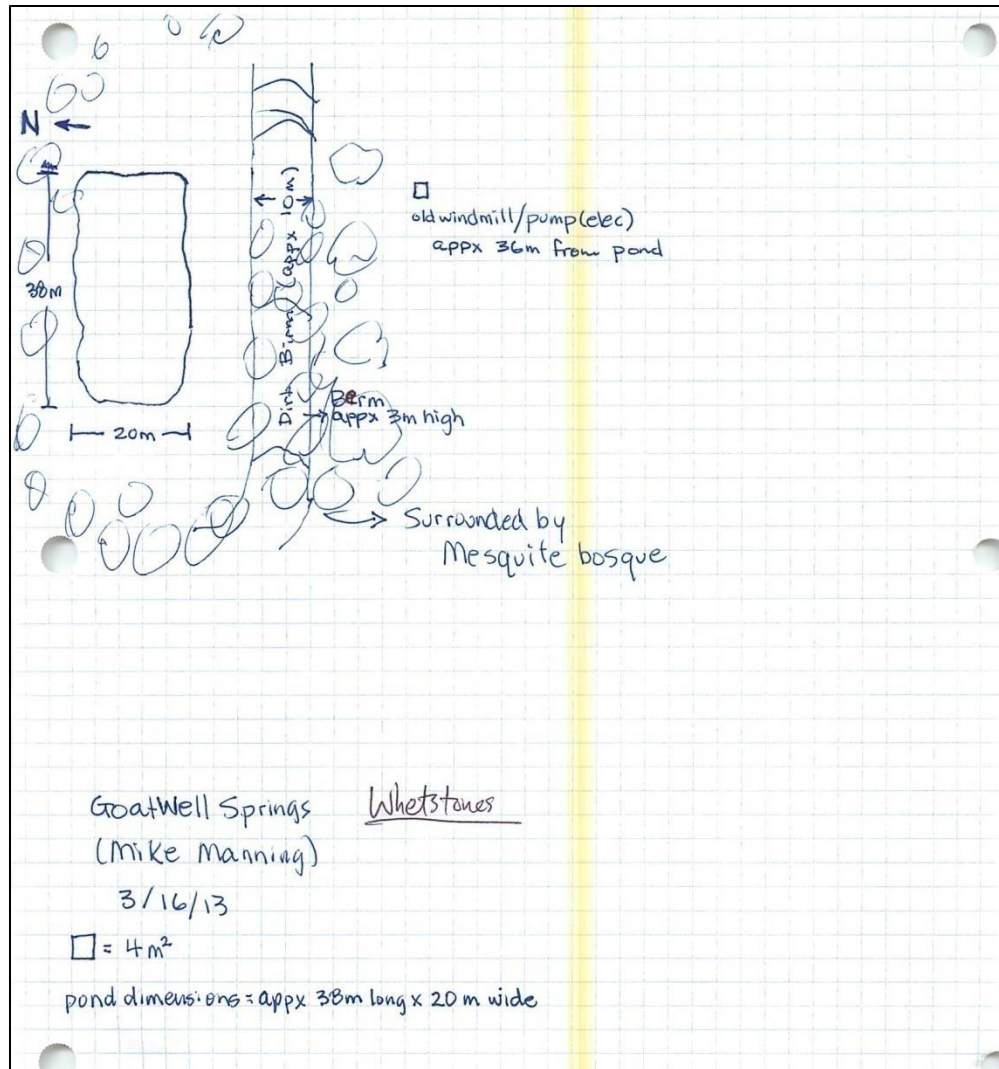
**Table 27.2 Goat Well Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	2.50	3.50
Geomorphology	1.40	3.40
Habitat	2.60	3.25
Biota	3.50	2.88
Human Influence	2.13	3.86



Category	Condition	Risk
Administrative Context		
Overall Ecological Score	2.50	3.26

**Management Recommendations:** The stock tank is very open and impacted by cattle. It could be fenced off and naturalized a bit but don't know what habitat would be left if the berm was breached. There was water present but it was not clear what the discharge sphere of the spring may be or if there is still a flowing source



**Fig 27.1 Goat Well Spring Sketchmap.**

## 28. Happy Jack Unnamed Survey Summary Report, Site ID 17085

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Happy Jack Unnamed ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Nogales RD Coronado Ntnl Forest, managed by the US Forest Service. The spring is located at 31 35' 48.58" latitude, - 110 49' 48.12" longitude in the Patagonia USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 5 meters EPE). The elevation is approximately 1604 meters. Aida Castillo, Chang You, John Stansberry, Sue Carnahan, Michael Bogan, Bill Beaver, Curtis Smith, George Ferguson, and Nick Deyo surveyed the site on 2/2/2013 for 02:06 hours, beginning at 10:24, and collected data in 10 of 12 categories.



**Fig 28.1 Happy Jack Unnamed.**

**Physical Description:** Happy Jack Unnamed is a rheocrene intermittent spring. This spring emerges as two main seeps from a bedrock channel forming two large pools (2m in diameter), a spring channel, and stands of *juncus* spp. There are historic mine sites located above the spring in the drainage. The habitat surrounding the spring is oak woodland and desert grassland. There is an old roadbed that is adjacent to the spring channel. The aquatic fauna consists mostly of stopover

species, not indicating a perennial water. The microhabitat associated with the spring covers 1,800 m<sup>2</sup>.

Happy Jack Unnamed emerges from a metamorphic rock layer. The emergence environment is subaerial, with a gravity flow force mechanism. It is mixed dominated. The distance to the nearest spring is 1769 meters. The site receives approximately 95% of available solar radiation, with 6862 Mj annually.

**Survey Notes:** There is an old mining road adjacent to the spring, which retains one side of the spring channel. There has been cattle grazing at the site, but the impacts were minimal. The spring pools have a curious white deposit in them and the pH was low (below 5). Abandoned mines higher up in the drainage may be contributing to poor water quality. According to the ranger district biologist the spring lies within a Superfund site.

**Water:** Flow was measured at 0.047 L/s with a volumetric method. Water quality measurements were taken in a large pool just downstream of the spring source. There was a noticeable white precipitate in the water. The pH was also tested using a pH strip and measured near 5.

**Table 28.1 Happy Jack Unnamed Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	4.3
Specific Conductance uS/cm	620
Water Temperature °C	8.2
Dissolved Solids	

**Flora:** This plant list was made by Sue Carnahan and George Furgeson, both excellent botanists. Surveyors identified 38 plant species at the site.

**Table 28.2 Happy Jack Unnamed Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Agave palmeri	GC	N	
Arctostaphylos pungens	SC	N	U
Artemisia ludoviciana	GC	N	F
Bommeria hispida	GC	N	
Brickellia californica	GC	N	F
Brickellia venosa	GC	N	
Castilleja	GC	N	U
Cheilanthes	GC		U
Conyza canadensis	GC	N	R
Dasyllirion wheeleri		N	
Echinocereus rigidissimus		N	
Echinocereus triglochidiatus	GC	N	
Eragrostis intermedia	GC	N	
Erigeron	GC	N	F
Galium aparine	GC	N	WR

Species	Cover Code	Native Status	Wetland Status
Garrya wrightii	SC	N	F
Hedeoma			U
Ipomopsis	GC		U
Juncus sp	GC	N	W
Juniperus deppeana	MC	N	U
Mammillaria macdougalii	GC		
Muhlenbergia rigens	GC	N	U
Nolina microcarpa	SC	N	U
Opuntia engelmannii	SC	N	U
Pellaea			U
Pinus chihuahuana	MC	N	
Pinus discolor	TC	N	
Piptochaetium fimbriatum	GC	N	
Pseudognaphalium	GC		W
Quercus arizonica	MC	N	R
Quercus emoryi		N	
Quercus toumeyii	MC	N	
Rhus aromatica	SC	N	
Rhus virens	SC	N	
Salix Sp	SC	N	R
Schizachyrium			
Senecio	GC		F
Yucca madrensis	GC	N	

**Fauna:** Surveyors collected or observed 19 aquatic and 10 terrestrial invertebrate specimens. These represented 18 aquatic and 8 terrestrial species.

**Table 28.3 Happy Jack Unnamed Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
ANNE Oligochaetae	1	Ad	A	Spot
ARAN Tetragnathidae	1	Ad	T	Spot
COL Dytiscidae Desmopachria portmanni	1	Ad	A	Spot
COL dytiscidae laccobius	1	Ad	A	Spot
COL Dytiscidae Laccophilus pictus	1	Ad	A	Spot
COL Dytiscidae Liodessus obscurellus	1	Ad	A	Spot
COL Dytiscidae Rhantus gutticollis	1	Ad	A	Spot
COL Dytiscidae Rhantus gutticollis	1	Ad	A	Spot
COL Dytiscidae Thermonectus marmoratus	1	Ad	A	Spot
COL Dytiscidae Thermonectus nigrofasciatus	1	Ad	A	Spot
COL Gyrinidae Dineutus sublineatus	1	Ad	A	Spot
COL Hydrophilidae Berosus salvini	1	Ad	A	Spot



Species	Qty	Lifestage	Habitat	Method
COL Hydrophilidae Helochaes normatus	1	Ad	A	Spot
DIP	1	Ad	T	Spot
DIP	1	Ad	T	Spot
DIP	1	Ad	T	Spot
DIP Chironomidae Chironomidae	1	L	A	Spot
DIP Chironomidae Orthoclaadiinae	1	L	A	Spot
HEM Belostomatidae Lethocerus medius	1	Ad	A	Spot
HEM Notonectidae Notonecta lobata	1	Ad	A	Spot
HEM Veliidae Microvelia	1	Ad	A	Spot
HYM	1	Ad	T	Spot
HYM Apidae Apis mellifera	1	Ad	T	Spot
HYM Megachilidae osmia	1	Ad	T	Spot
LEP Lycaenidae Celastrina ladon	1	Ad	T	Spot
LEP Nymphalidae Libytheana carinenta	1	Ad	T	Spot
ODO Coenagrionidae Argia	1	L	A	Spot
ODO Lestidae Archilestes grandis	1	L	A	Spot
ORT	1	Ad	T	Spot

**Table 28.4 Happy Jack Unnamed Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
Bewick's wren	1	obs	
Mexican Jay	1	obs	
ruby-crowned kinglet	1	obs	
Bridled Titmouse	1	obs	
spotted towhee	1	obs	
Hutton's Vireo	1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 10 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is negligible risk.

Geomorphology condition is moderate with some restoration potential and there is negligible risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is negligible risk.

Human influence of site is moderate with some restoration potential and there is low risk.

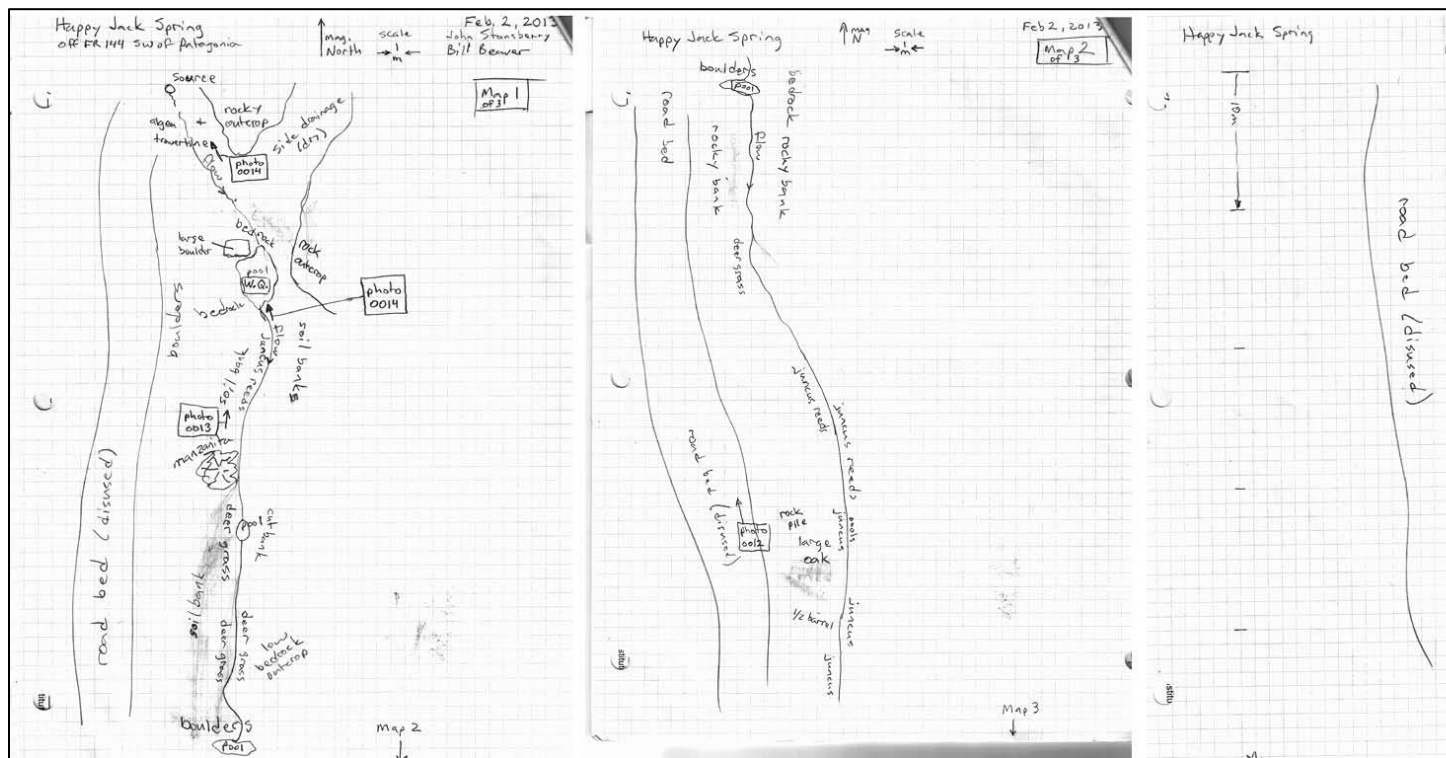
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is negligible risk.

**Table 28.5 Happy Jack Unnamed Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.17	1.60
Geomorphology	3.40	1.40
Habitat	4.20	2.00
Biota	4.88	1.75
Human Influence	3.50	2.71
Administrative Context		
Overall Ecological Score	3.91	1.69

**Management Recommendations:** The spring is located in a superfund site and may have water quality issues. It remains an important resource for wildlife, however, it should be addressed in any clean-up efforts. Although site has very poor water quality, mining contamination is visually pervasive and this would be a very difficult site to remediate.



**Fig 28.2 Happy Jack Unnamed Sketchmap.**

## 29. Harshaw Creek unnamed Survey Summary Report, Site ID 13005

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Harshaw Creek unnamed ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 30' 33.44" latitude, -110 40' 54.85" longitude in the Mount Hughes USGS Quad, measured using a Garmin GPS (NAD 83, 5 meters EPE). The elevation is approximately 1341 meters. Louise Misztal, Larry Stevens, Julia Fonseca and multiple volunteers with the Arizona Riparian Council surveyed the site on 10/27/2012 for 02:00 hours, beginning at 17:00, and collected data in 10 of 12 categories.



**Fig 29.1 Harshaw Creek unnamed.**

**Physical Description:** Harshaw Creek unnamed is a rheocrene that emerges in the Harshaw Creek channel along Harshaw Creek Road, within a somewhat narrow and steep canyon. There are scattered residential properties all along this road next to the creek channel. The microhabitat associated with the spring covers 275 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The emergence environment is subaerial, with a gravity flow force mechanism. It is runoff dominated. The distance to the nearest spring is 2889 meters. The site receives approximately 97% of available solar radiation, with 7012 Mj annually.

**Survey Notes:** There are multiple historic and proposed new mines in the Harshaw Creek watershed. The spring emergence is very close to a small eroding utility road that ends at a maintenance site.

**Water:** Flow was measured at 0.2575 L/s with a volumetric method. Water quality measurements were taken as close to the emergence point as possible (at approx 2 m on map). We dug a hole near the emergence of flow to get a reading in fresh water without leaf litter. We believe the Hanna Combo instrument was giving a more accurate reading.

**Table 29.1 Harshaw Creek unnamed Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.1
Specific Conductance uS/cm	556
Water Temperature °C	15.7
Dissolved Solids	

**Flora:** Surveyors identified 16 plant species at the site.

**Table 29.2 Harshaw Creek unnamed Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Anisacanthus thurberi	SC	N	
Baccharis salicifolia	SC	N	R
Bouteloua curtipendula	GC	N	U
Convolvulus	GC		F
Conyza	GC		F
Cynodon dactylon	GC	I	WR
Juniperus deppeana	MC	N	U
moss	NV	N	F
Muhlenbergia rigens	GC	N	U
Platanus wrightii	MC	N	R
Populus fremontii	MC	N	R
Prosopis velutina	SC	N	F
Salix gooddingii	TC	N	R
Salix Sp	SC	N	R
Sorghum halepense	GC	I	F
Xanthium strumarium	GC	I	W

**Fauna:** Surveyors collected or observed 11 invertebrate specimens. These represented 5 aquatic and 4 terrestrial species. They also observed 3 vertebrate species.

**Table 29.3 Harshaw Creek unnamed Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
HEM Belostomatidae Abedus herberti		I	A	



Species	Qty	Lifestage	Habitat	Method
horsehair worm				
slug		Ad		
ARAN Lycosidae		Ad	T	Spot
COL Dytiscidae Thermonectus		Ad	A	Spot
COL Dytiscidae Thermonectus marmoratus		Ad	A	Spot
COL Dytiscidae Thermonectus nigrofasciatus		Ad	A	Spot
HEM Belostomatidae Abedus		Ad	T	Spot
HEM Cicadidae		Ad	T	Spot
HEM Nepidae Ranatra		Ad	A	Spot
ORT Acrididae		Ad	T	Spot

**Table 29.4 Harshaw Creek unnamed Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
black phoebe	1	obs	
longfin dace	1	obs	
red-naped sapsucker		obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 10 null risk scores.

**Table 29.5 Harshaw Creek unnamed Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.60	2.40
Geomorphology	4.60	2.00
Habitat	4.50	3.00
Biota	4.00	3.00
Human Influence	4.33	2.25
Administrative Context		
Overall Ecological Score	4.43	2.6

**Management Recommendations:** Surveyors did not report any management recommendations.

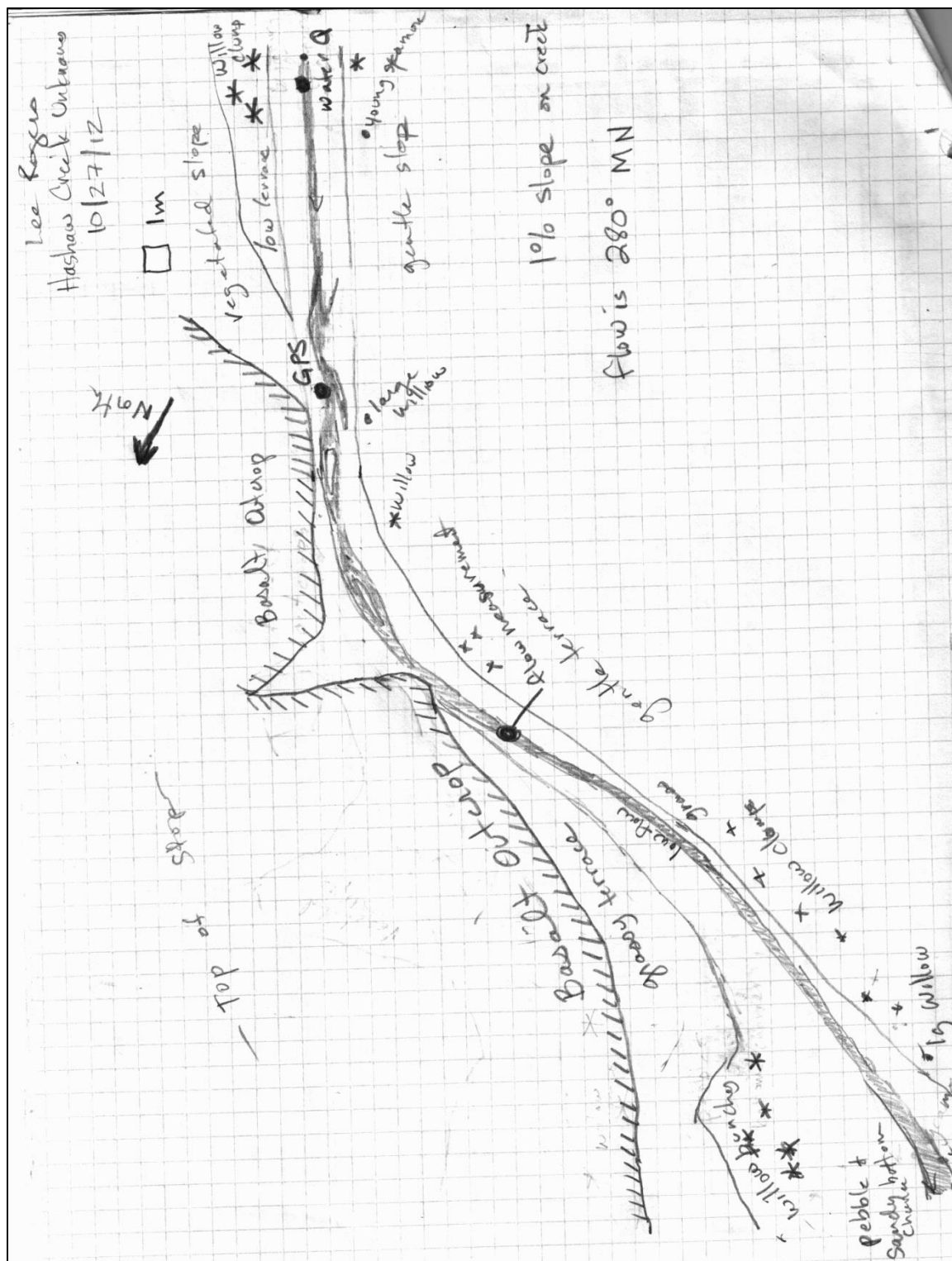


Fig 29.2 Harshaw Creek Unnamed Sketchmap.

### 30. Hidden Spring Survey Summary Report, Site ID 12885

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Hidden Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 32° 3' 58.085" latitude, -110° 33' 16.765" longitude in the Rincon Peak USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83). The elevation is approximately 1210 meters. Susan Qashu, Karen Lowery, Glenn Furnier, and Nick Deyo surveyed the site on 11/21/2012 for 00:37 hours, beginning at 04:03, and collected data in 8 of 12 categories.



**Fig 30.1 Hidden Spring.**

**Physical Description:** Hidden Spring is a rheocrene/anthropogenic spring. This site is in a canyon surrounded by foothills thornscrub. The spring is on an allotment and has been completely developed. There is a well with an electric pump at what was probably once the spring source. The water is piped to storage tanks which feed several cattle drinkers. There is a small shack next to the spring/well. The microhabitat associated with the spring covers 375 m<sup>2</sup>.

It is runoff dominated. The distance to the nearest spring is 1180 meters.

**Survey Notes:** This spring has been completely developed and water no longer naturally flows from the spring. Water has to be pumped from several feet below the surface of the channel and is piped to storage tanks and cattle drinkers. The surrounding area is heavily grazed and invaded with bermuda grass. There is also a small building and other infrastructure built next to the spring.

**Water:** No water quality measurements were taken.

**Flora:** Surveyors identified 13 plant species at the site.

**Table 30.1 Hidden Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Acacia greggii	SC	N	F
Agave			
Baccharis sarothroides	SC	N	R
Celtis laevigata var. reticulata	MC	N	R
Cynodon dactylon	GC	I	WR
Erythrina			
Fraxinus velutina	TC	N	R
Gutierrezia microcephala	SC	N	F
Morus microphylla		N	F
Muhlenbergia rigens	GC	N	U
Opuntia			U
Prosopis velutina	SC	N	F
Quercus arizonica	MC	N	R

**Fauna:** Surveyors collected or observed 2 aquatic and terrestrial invertebrate specimens. Two vertebrate species were observed.

**Table 30.2 Hidden Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
LEP Nymphalidae Asterocampa leilia	1	Ad	T	Spot
LEP Pieridae Colias eurytheme	1	Ad	T	Spot

**Table 30.3 Hidden Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
Oriole	1	other	nest
ruby-crowned kinglet	1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 10 null condition scores, and 15 null risk scores. Aquifer functionality and water quality are very poor with very limited restoration potential and there is moderate risk.

Geomorphology condition is poor with limited restoration potential and there is moderate risk.



Habitat condition is moderate with some restoration potential and there is moderate risk.

Biotic integrity is poor with limited restoration potential and there is moderate risk.

Human influence of site is poor with limited restoration potential and there is moderate risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is moderate risk.

**Table 30.4 Hidden Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	0.80	3.00
Geomorphology	2.00	3.60
Habitat	2.80	3.00
Biota	2.63	2.83
Human Influence	2.38	2.86
Administrative Context		
Overall Ecological Score	2.06	3.11

**Management Recommendations:** Surveyors made no management recommendations.

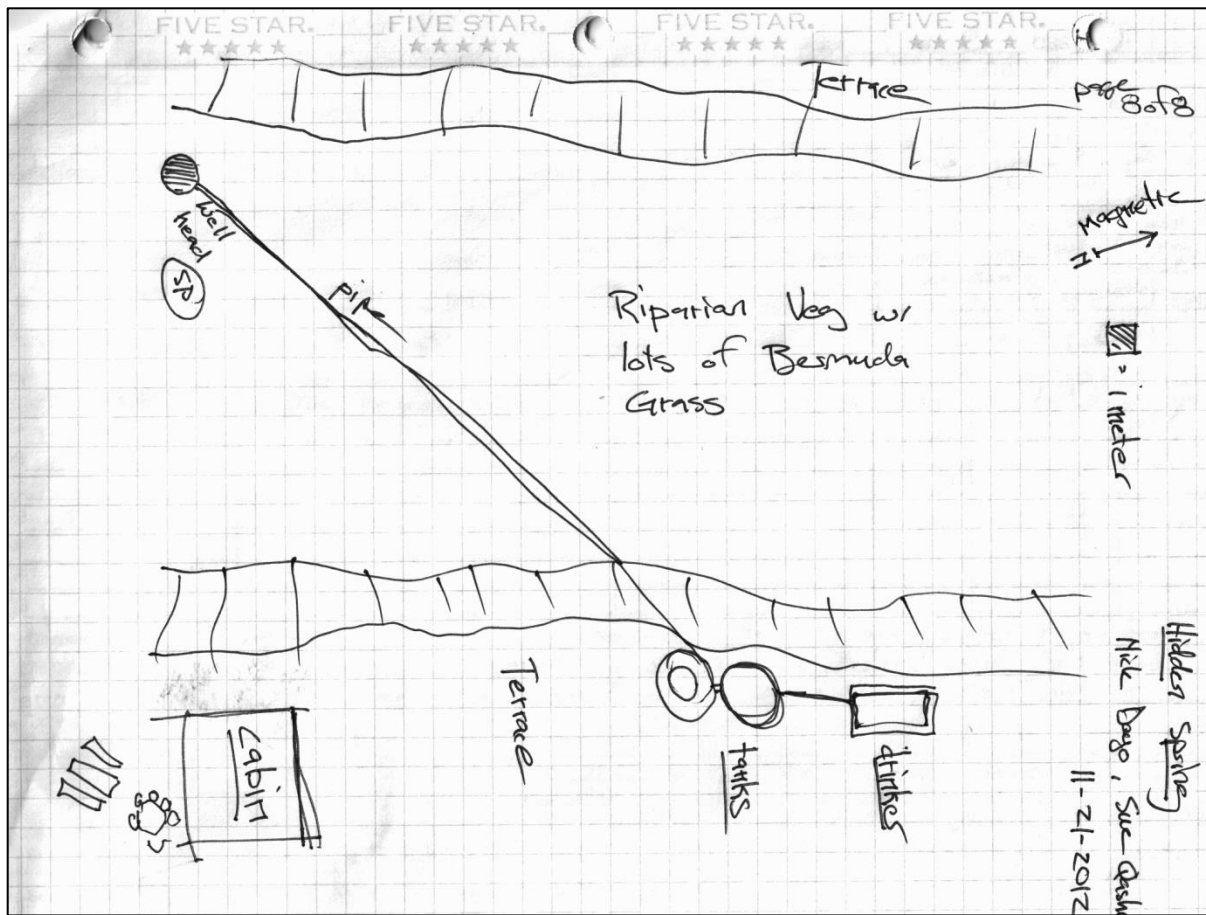


Fig 30.2 Hidden Spring Sketchmap.

### 31. Johnson Spring Survey Summary Report, Site ID 13026

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Johnson Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, managed by a private US owner. The spring is located at 31° 34' 19.738" latitude, -110° 48' 13.251" longitude in the Patagonia USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 12 meters EPE). The elevation is approximately 1371 meters. Nick Deyo, Bill beaver, John Standsberry, Aida Castillo, George George Fesgegori, Michael Bogar, and Chang You surveyed the site on 2/2/2013 for 00:50 hours, beginning at 03:20, and collected data in 9 of 12 categories.



Fig 31.1 Johnson Spring.

**Physical Description:** Johnson Spring is an anthropogenic/hanging garden spring. Spring is an artificial hanging garden with a seeping 15 ft. wall with two large pools and marshy seeps in between. The microhabitat associated with the spring covers 300 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

Johnson Spring has a gravity flow force mechanism. The distance to the nearest spring is 1439 meters. The site receives approximately 78% of available solar radiation, with 5638 MJ annually.

**Survey Notes:** Spring has been dammed and the area behind the dam has silted over. The spring is seeping through the wall of the dam forming a hanging garden. There is no sign of grazing. Downstream at the road is an old ranch that looks abandoned. Aquatic fauna probably die once every ten years or so, contains amphipods that don't get around well. Site is severely altered by the old dam but still provides diverse and important spring habitat.

**Water:** Water quality was measured in the first pool below the dam wall.

**Table 31.1 Johnson Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.9
Specific Conductance uS/cm	205
Water Temperature °C	12.6
Dissolved Solids	

**Flora:** Surveyors identified 23 plant species at the site.

**Table 31.2 Johnson Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Agave palmeri	GC	N	
Arctostaphylos pungens	SC	N	U
Baccharis salicifolia	SC	I?	R
Baccharis sarothroides	SC	I	R
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Conyza	GC		F
Cylindropuntia spinosior	SC	N	U
Dasyllirion wheeleri	GC	N	
Eragrostis lehmanniana	GC	I	U
Ipomoea barbatissepala	GC	N	
Juncus sp	GC	N	W
Juniperus	SC		U
Leptochloa dubia	GC	N	
Mentha	GC		WR



Species	Cover Code	Native Status	Wetland Status
Mimulus	GC	N	W
Muhlenbergia rigens	GC	N	U
Nolina microcarpa	SC	N	U
Pseudognaphalium	GC		W
Quercus	SC	N	U
Quercus oblongifolia	SC	N	
Salix gooddingii	TC	N	R
Toxicodendron radicans	GC	N	WR

**Fauna:** Surveyors collected or observed 19 aquatic and 0 terrestrial invertebrate specimens. These represented 19 aquatic and 0 terrestrial species. 2 vertebrate species were observed.

**Table 31.3 Johnson Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
AMPH Hyalellidae Hyalella	1	Ad	A	Spot
COL Dytiscidae Hydroporinae	1	L	A	Spot
COL Dytiscidae Liodessus obscurellus	1	Ad	A	Spot
COL Dytiscidae Thermonectus marmoratus	1	Ad	A	Spot
COL Dytiscidae Thermonectus nigrofasciatus	1	Ad	A	Spot
COL Gyrinidae Dineutus sublineatus	1	Ad	A	Spot
COL Hydrophilidae Berosus salvini	1	Ad	A	Spot
DIP Chironomidae chironominae	1	L	A	Spot
DIP Chironomidae Orthocladiinae	1	L	A	Spot
DIP Chironomidae Tanypodinae Paramerina	1	L	A	Spot
DIP Culicidae Culiseta	1	L	A	Spot
EPH Baetidae Callibaetis	1	Ad	A	Spot
HEM Belostomatidae Lethocerus medius	1	Ad	A	Spot
HEM Gerridae Aquarius remigis	1	Ad	A	Spot
HEM Notonectidae Notonecta lobata	1	Ad	A	Spot
HEM Veliidae Microvelia	1	Ad	A	Spot
ODO Coenagrionidae Argia	1	L	A	Spot
ODO Libellulidae Libellula saturata	1	L	A	Spot
TRI Odontoceridae Marilia	1	L	A	Spot

**Table 31.4 Johnson Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
ruby-crowned kinglet	1	obs	
black phoebe	1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores.

Aquifer functionality and water quality are moderate with some restoration potential and there is negligible risk.

Geomorphology condition is poor with limited restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is negligible risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 31.5 Johnson Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.50	1.67
Geomorphology	2.40	2.20
Habitat	4.20	2.20
Biota	5.00	1.63
Human Influence	4.13	2.14
Administrative Context		
Overall Ecological Score	3.78	1.92

**Management Recommendations:** This spring is highly developed with an old dam dominating the morphology of the spring. Removal of the dam would be very difficult due to the extensive amount of sediment upstream. However, the spring has large pools that support wetland species, making it an important management concern.

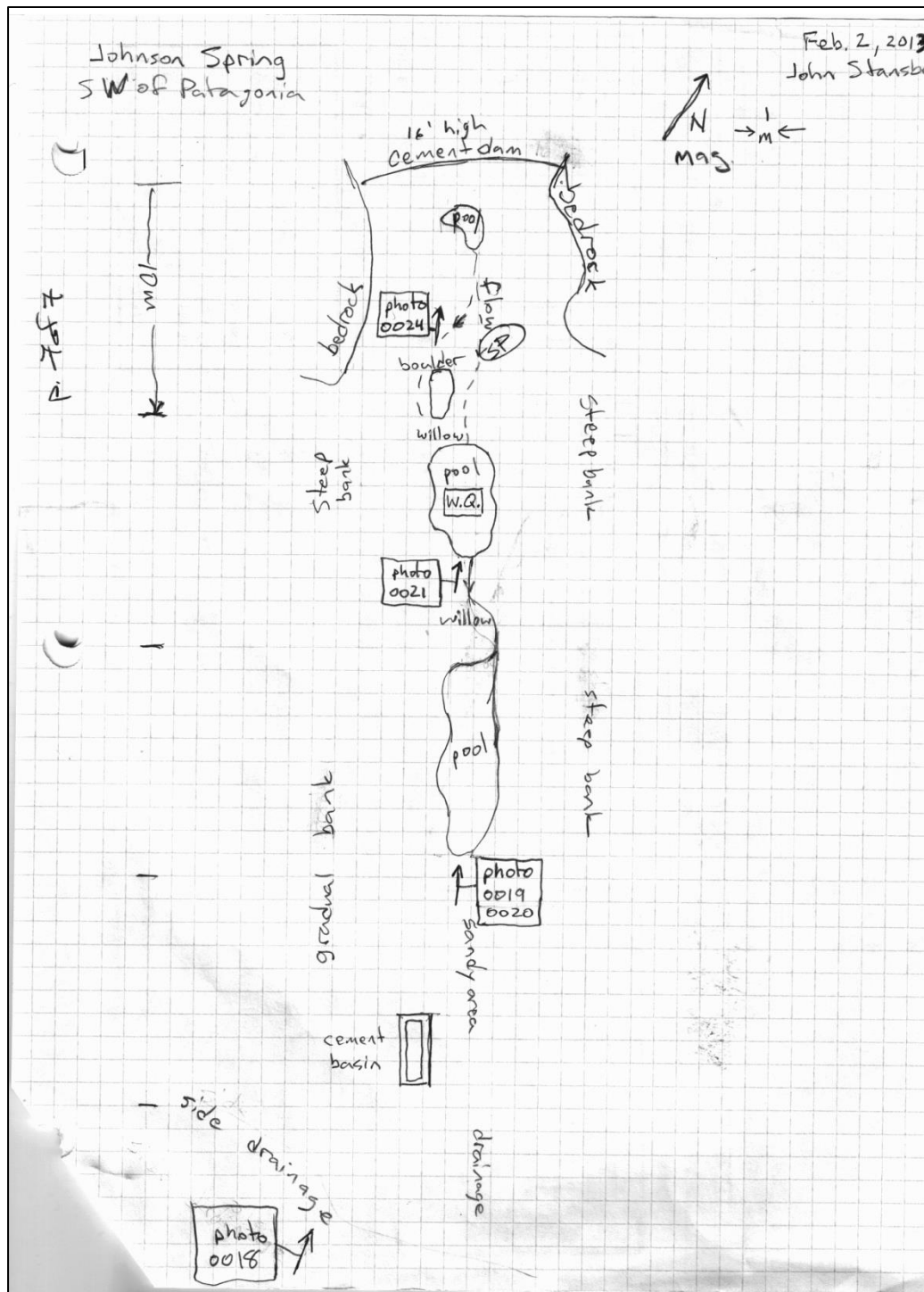


Fig 31.2 Johnson Spring Sketchmap.

## 32. Juniper Spring Survey Summary Report, Site ID 15386

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Juniper Spring ecosystem is located in Cochise County in the Upper San Pedro Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31.75259 latitude, -110.419243 longitude in the Apache Peak USGS Quad, measured using a Garmin map 60CX GPS (NAD 83, 4 meters EPE). The elevation is approximately 1561 meters. Nick Deyo, Christopher Morris, Aida Castillo, Glenn Furnier, Bill Beaver, and Keith Sharcross surveyed the site on 3/18/2013 for 01:10 hours, beginning at 10:50, and collected data in 8 of 12 categories.



**Fig 32.1 Juniper Spring.**

**Physical Description:** Juniper Spring is a rheocrene site that has a cement spring box, and is located in a steep bedrock and cobble channel. There are old pipes and a cement drinker associated with the spring. The microhabitat associated with the



spring covers 414 m<sup>2</sup>. The site has 3 microhabitats, including A -- a 4 sqm, B -- a 178 sqm channel, and C -- a 232 sqm adjacent uplands. Geomorphic diversity is 0.32, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 1462 meters. The site receives approximately 100% of available solar radiation.

**Survey Notes:** Spring is drained and heavily grazed. There are old pipes and a drinker in disrepair.

**Water:** There was no measurable flow, and surveyors did not measure water quality.

**Flora:** Surveyors identified 9 plant species at the site.

**Table 32.1 Juniper Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Agave schottii	GC	N	
Baccharis sarothroides	SC	N	R
Cylindropuntia spinosior	SC	N	U
Echinocereus			U
Eragrostis lehmanniana	GC	I	U
Erythrina flabelliformis	SC	N	
Juniperus deppeana	MC	N	U
Opuntia			U
Salvia	SC		U

**Fauna:** Surveyors did not collect or observe invertebrate species. 5 vertebrate species were observed.

**Table 32.2 Juniper Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
Montezuma Quail	1	obs	
pyrrhuloxia	1	obs	
verdin	1	obs	
blue-gray gnatcatcher	1	obs	
deer	1	sign	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 15 null risk scores. Aquifer functionality and water quality are eliminated with no restoration potential and there is moderate risk.

Geomorphology condition is poor with limited restoration potential and there is low risk.

Habitat condition is poor with limited restoration potential and there is moderate risk.

Biotic integrity is poor with limited restoration potential and there is low risk.

Human influence of site is moderate with some restoration potential and there is moderate risk.

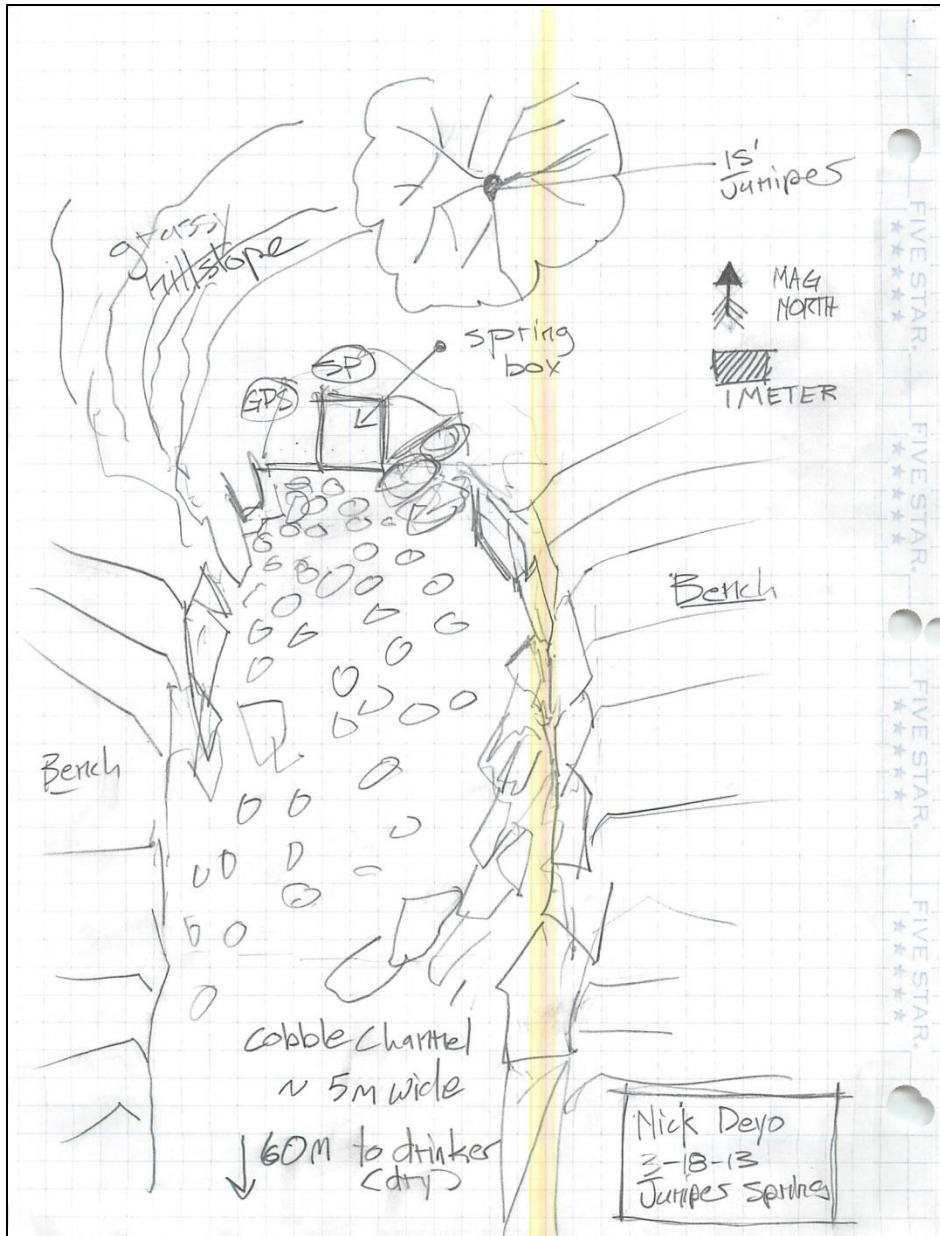
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is low risk.

**Table 32.3 Juniper Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	0.00	3.00
Geomorphology	2.40	2.00
Habitat	2.60	2.80
Biota	2.50	2.63
Human Influence	3.63	3.00
Administrative Context		
Overall Ecological Score	1.88	2.61

**Management Recommendations:** There was no water at this spring and it has been highly altered by a spring box. It is a low restoration priority.



**Fig 32.2 Juniper Spring Sketchmap.**

### 33. Kennedy Spring Survey Summary Report, Site ID 12996

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Kennedy Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 30' 5.873"

latitude, -110 38' 19.173" longitude in the Mount Hughes USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 5 meters EPE). The elevation is approximately 1510 meters. Julia Fonseca, Linda Brewer, Susan Carnahan, Curtis Smith, and Nick Deyo surveyed the site on 10/28/2012 for 02:15 hours, beginning at 11:45, and collected data in 10 of 12 categories.



**Fig 33.1 Kennedy Spring.**

**Physical Description:** Kennedy Spring is a rheocrene that emerges from numerous locations in a primarily bedrock channel. The canyon is very steep and supports desert grassland and oak woodland habitat. Water seeps from fractures in the bedrock and becomes exposed in the alluvium as well. Small pools and patches of deer grass provide some riparian and wetland habitat. The microhabitat associated with the spring covers 70 m<sup>2</sup>.

Kennedy Spring emerges from an igneous rock layer. The emergence environment is subaerial, with a flow force mechanism. It is mixed dominated. The distance to the



nearest spring is 1191 meters. The site receives approximately 76% of available solar radiation, with 5470 Mj annually.

**Survey Notes:** The site had noticeable seeps and small pools, however, very little flow was detected--the spring is likely ephemeral. There was evidence of regular scouring at the site from flood events. Due to flooding and the steep narrow configuration of the channel, little wetland habitat can establish at this spring. It appears to be functioning at its natural potential.

**Water:** Water quality was measured in the first emergence pool at this spring (5cm deep). There was no measurable flow at this pool, no odor, no algae, and the water was clear.

**Table 33.1 Kennedy Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	8.5
Specific Conductance uS/cm	910
Water Temperature °C	15.5
Dissolved Solids	

**Flora:** Surveyors identified 37 plant species at the site.

**Table 33.2 Kennedy Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Agave palmeri	GC	N	
Amaranthus palmeri	GC	N	
Anoda cristata	GC	N	F
Argyrochosma incana	NV	N	
Aristida	GC	N?	U
Avena	GC	I?	
Bidens	GC	N?	F
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Bouteloua radicata	GC	N	
Brickellia		N?	F
Chamaecrista nictitans	GC	N	
Commelina	GC	N	U
Conyza	GC	N?	F
Dalea		N?I	U
Dasyllirion wheeleri	SC	N	
Desmodium	GC	N?	
Digitaria sanguinalis	GC	I	
Eragrostis	GC	I	WR
Erigeron	GC	N	F
Eriochloa acuminata	GC	N	

Species	Cover Code	Native Status	Wetland Status
Galium	GC	I	F
Gamochaeta purpurea	GC	N	
Ipomoea		N?	
Ipomoea	GC	N?	
Leptochloa dubia	GC	N	
Mentzelia	GC	N?	
moss	NV	N	F
Muhlenbergia	GC	N	U
Muhlenbergia rigens	GC	N	U
Nolina microcarpa	SC	N	U
Opuntia		N?	U
Polypogon	GC	N?	
Rhus trilobata	SC	N	F
Toxicodendron radicans	GC	N	WR
Tragia nepetifolia	GC	N	F
Yucca madrensis	GC	N	

**Fauna:** Surveyors collected or observed 7 aquatic and terrestrial invertebrate specimens.

**Table 33.3 Kennedy Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
DIP Tipulidae				
COL Coccinellidae	1	Ad	T	Spot
HYM Apidae	1	Ad	T	Spot
HYM Vespidae	1	Ad	T	Spot
LEP Nymphalidae Adelpha Eulalia	1	Ad	T	Spot
LEP Pieridae	1	Ad	T	Spot
ORT Melanoplinae Dactylotum bicolor	1	Ad	A	Spot

**Table 33.4 Kennedy Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
Bridled Titmouse	1	obs	
common raven	1	obs	
chipping sparrow	1	obs	
rufous-crowned sparrow	1	obs	
Canyon Towhee	1	obs	
tree lizard	1	obs	
red-naped sapsucker	1	obs	
house wren	1	obs	
dark-eyed junco	1	obs	

Species Common Name	Qty	DetectionType	Comments
pine siskin	1	obs	
Merlin	1	obs	
Northern Harrier	1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is negligible risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is negligible risk.

Human influence of site is very good with excellent restoration potential and there is negligible risk.

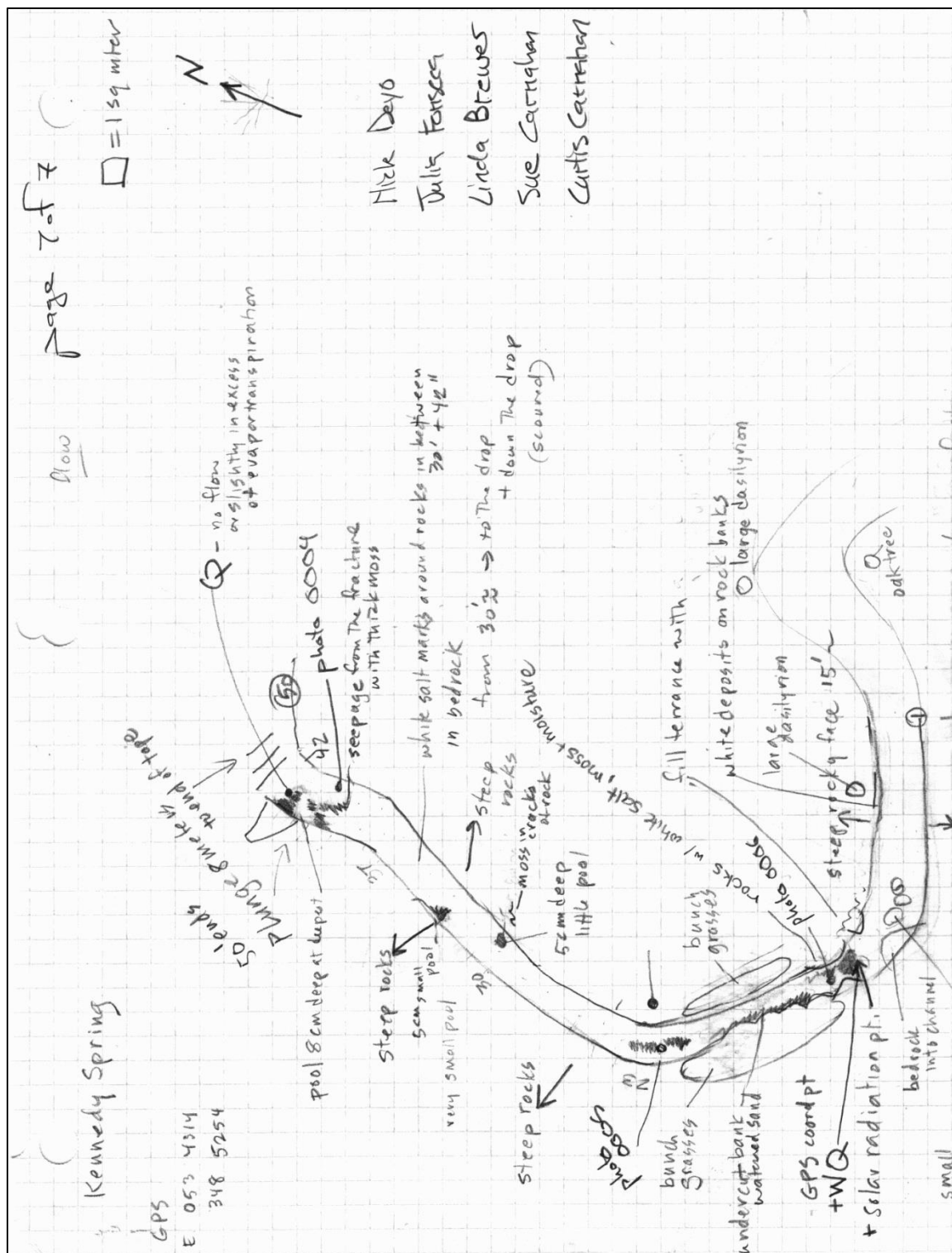
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is negligible risk.

**Table 33.5 Kennedy Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.83	2.00
Geomorphology	4.40	1.00
Habitat	3.80	1.80
Biota	5.25	1.13
Human Influence	5.38	1.43
Administrative Context		
Overall Ecological Score	4.32	1.48

**Management Recommendations:** This spring is very remote and has little impact from people or cattle. It is also not a very diverse wetland ecosystem, so it is probably not a priority area for management.



**Fig 33.2 Kennedy Spring Sketchmap.**



### 34. La Cebadilla Cienega Survey Summary Report, Site ID 19158

Submitted December 23, 2013 by Sky Island Alliance

The Survey Report for this spring is not included here due to its location on private land and the privacy wishes of the owners.

### 35. Line Boy Spring Survey Summary Report, Site ID 11974

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Line Boy Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 20' 10.674" latitude, -110 41' 19.958" longitude in the Duquesne USGS Quad, measured using a GPS (NAD 83, 5 meters EPE). The elevation is approximately 1582 meters. Chang You, Karen Lowery, Bill Beaver, Mike Manning, and Christopher Morris surveyed the site on 1/12/2013 for 00:48 hours, beginning at 12:30, and collected data in 8 of 12 categories.



Fig 35.1 Line Boy Spring.

**Physical Description:** Line Boy Spring is a rheocrene spring. The likely origin of the spring is near a young cottonwood that has been undercut. The spring discharges from a narrow drainage surrounded by Oak woodland habitat. It was within the vicinity of Line Boy Mine and consisted of a channel, very little flow, and two pools less than 1 m. in diameter. The microhabitat associated with the spring covers 936 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 1114 meters.

**Survey Notes:** A seep comes out of the toe of a slope in the channel 20 m. downstream from the source and has been severely trampled and grazed by cattle. The spring had been developed historically and piping was still visible 200' below the spring, leading around the bend to a cement trough (now empty). The Border Patrol has constructed patrol roads within 1/4 mi. from the spring on the Mexican border.

**Water:** The water quality was collected from the top pool. Water quality measurements are likely influenced by surface water conditions.

**Table 35.1 Line Boy Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.4
Specific Conductance uS/cm	583
Water Temperature °C	5.6
Dissolved Solids	

**Flora:** Surveyors identified 10 plant species at the site.

**Table 35.2 Line Boy Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
<i>Aristida ternipes</i> var. <i>ternipes</i>	GC	N	
<i>Baccharis salicifolia</i>	SC	N	R
<i>Bothriochloa barbinodis</i>	GC	N	F
<i>Bouteloua curtipendula</i>	GC	N	U
<i>Bouteloua gracilis</i>	GC	N	U
<i>Digitaria californica</i>	GC	N	
<i>Juniperus deppeana</i>	MC	N	U
<i>Muhlenbergia rigens</i>	GC	N	U
<i>Quercus arizonica</i>	MC	N	R
<i>Scirpus</i>	GC	N?	W

**Fauna:** Surveyors did not collect or report invertebrate specimens. Surveyors reported signs or observations of 5 vertebrate species.

**Table 35.3 Line Boy Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
White-tailed Deer	1	sign	Tracks found in mud and snow.
American black bear	1	sign	Tracks found in mud and snow.
Mountain lion	1	sign	Tracks found in mud and snow
Northern Harrier	1	obs	Male found 1/2 mi. NW.
Greater earless lizard	1	obs	(dead) found 1/4 mi. W.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is moderate with some restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is low risk.

Human influence of site is moderate with some restoration potential and there is moderate risk.

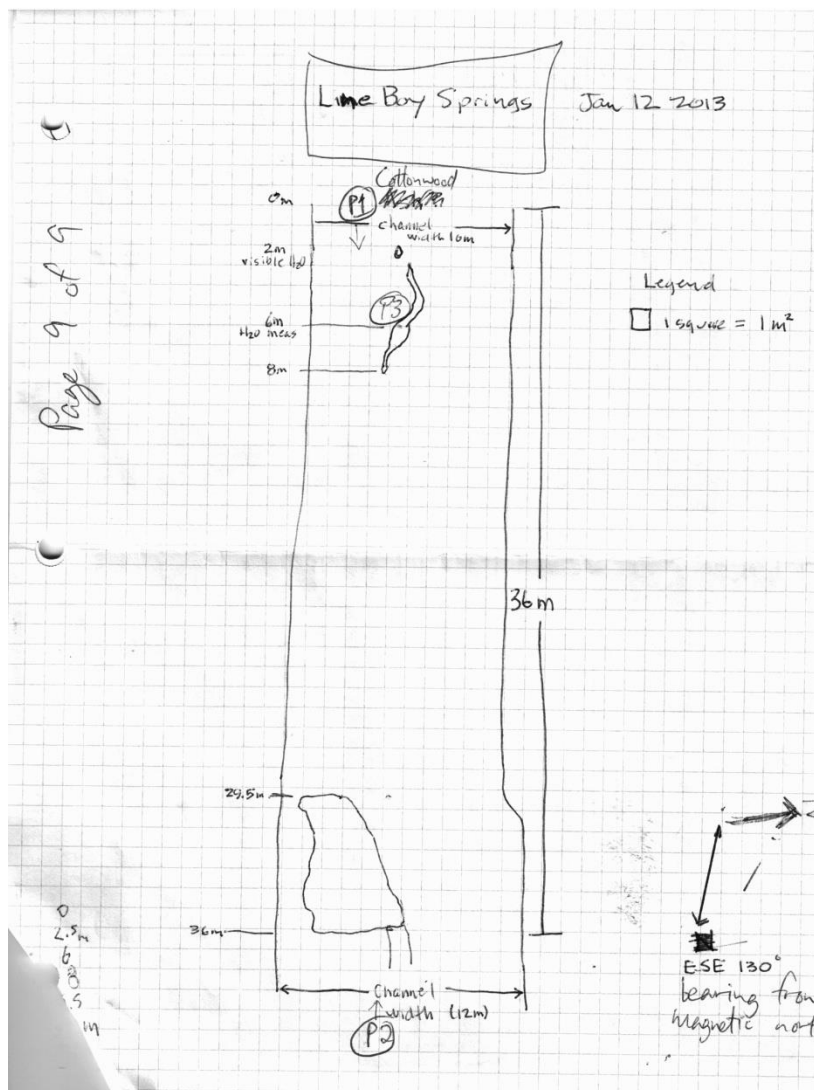
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 35.4 Line Boy Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.50	2.17
Geomorphology	3.40	2.40
Habitat	3.80	2.20
Biota	4.50	2.25
Human Influence	3.75	3.00
Administrative Context		
Overall Ecological Score	3.80	2.25

**Management Recommendations:** This site would benefit greatly from fencing, and fortunately access for restoration work is good. The actual spring source may be upstream of surveyed site. There is evidence of historic mining near this spot.



**Fig 35.2 Line Boy Spring Sketchmap.**

### 36. Little Nogales Spring Survey Summary Report, Site ID 12905

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Little Nogales Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, managed by the US Bureau of Land Management. The spring is located at 31 52' 56.121" latitude, -110 28' 37.256" longitude in the Mescal USGS Quad, measured using a GPS (NAD 83, 1 meters EPE). The elevation is approximately 1421 meters. Joe Cisero, Chris S., Karen Lowery, Julia Fonseca, Chang You, Mike Manning, Dennis Caldwell, Sammy Hammer and Christopher Morris



surveyed the site on 10/8/2012 for 01:40 hours, beginning at 10:50, and collected data in 10 of 12 categories.



**Fig 36.1 Little Nogales Spring.**

**Physical Description:** Little Nogales Spring is a rheocrene spring that emerges from a channel in a conglomerate rock formation in an otherwise limestone area. It is surrounded by thick riparian shrubs and trees and has a lot of leaf litter in the spring pools and spring channel. It had water at the time of the survey and consists of both pool and channel habitats. The end of the spring flow was recorded further down the channel at 12N 0549573 3528045. The microhabitat associated with the spring covers 100 m<sup>2</sup>.

Little Nogales Spring emerges from a sedimentary rock layer. The distance to the nearest spring is 391 meters. The site receives approximately 82% of available solar radiation, with 5969 Mj annually.

**Survey Notes:** The site was not heavily impacted by humans or cattle, however, there was a recent flood event that left debris 8-10 feet up on some of the adjacent trees-this was a major disturbance event.

**Water:** Flow was measured at 0.19 L/s with a volumetric method. pH and temperature were measured at the source but the DO and conductivity were measured in a pool further down where the flow was measured.

**Table 36.1 Little Nogales Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.4
Specific Conductance uS/cm	498
Water Temperature °C	12.
Dissolved Solids	

**Flora:** Surveyors identified 17 plant species at the site.

**Table 36.2 Little Nogales Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Adiantum capillus-veneris	GC	N	W
Carex ultra	GC	N	
Dasyllirion wheeleri		N	
Frangula californica	SC	N	U
Fraxinus velutina	MC	N	R
Juniperus deppeana	MC	N	U
Mimosa aculeaticarpa var. biuncifera	GC	N	U
Mortonia scabrella	SC	N	
Muhlenbergia	GC	N	U
Nolina microcarpa	SC	N	U
Pinus edulis	SC	N	U
Rhus microphylla		N	
Rhus trilobata	SC	N	F
Rhus virens		N	
Toxicodendron radicans	GC	N	WR
Vitis arizonica	SC	N	R
Zizyphus obtusifolia	SC	N	

**Fauna:** A flatworm or possibly a leech was found at the site. Surveyors collected or observed 10 aquatic and 3 terrestrial invertebrate species. 5 vertebrate species were observed.

**Table 36.3 Little Nogales Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
ACAR Hydrachnella	1	Ad	A	Spot
COL Carabidae Brachinus elongatulus	1	Ad	T	Spot

Species	Qty	Lifestage	Habitat	Method
COL Carabidae Platynus	1	Ad	T	Spot
COL Hydrophilidae Anacaena	2	Ad	A	Spot
DIP Culicidae	100	L	A	Spot
HEM Belostomatidae Abedus	1	Ad	A	Spot
HEM Gerridae Gerrinae	1	Ad	A	Spot
HEM Notonectidae Notonecta	1	Ad	A	Spot
ODO	10	L	A	Spot
PHA Phasmatidae	1	Ad	T	Spot

**Table 36.4 Little Nogales Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
hermit thrush	1	obs	
Green-tailed Towhee	1	obs	
white-crowned sparrow	1	obs	
wren	1	obs	
common raven	1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores.

Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is moderate with some restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is moderate risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 36.5 Little Nogales Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.83	2.67
Geomorphology	3.40	2.20
Habitat	4.00	2.60
Biota	5.00	2.25
Human Influence	4.38	3.00
Administrative Context		
Overall Ecological Score	4.06	2.43

Artist: Mike M. & Chang Y.,  
12/8/2012, 1050-1130 hrs,  
Little Neagles Spring

P. 9 of 9

1st pool

7m flood plain

high terrace

rocks same level 1. tier

sand gravel

5m channels, bedrock

2m flow measurement

26.9m bedrock

28.2 end of clearly visible H<sub>2</sub>O

29.1 H<sub>2</sub>O end

photo (P2) (30m)

P1 + P1a

small radiation, phi temperature, photo

water at surface 2.1m start of 2nd pool (3m)

6.8m

7.8m start of 3rd pool

11.2m debris across stream (diag)

13m end of diag debris

14m gravel debris across stream bed

Spring

rt, Site ID 15391

128



measured using a Garmin GPS (NAD 83). The elevation is approximately 1536 meters. Mike Manning, Aida and Glenn, Karen Lowry, Eric Sophiea, Christopher Morris surveyed the site on 3/16/2013 for 01:22 hours, beginning at 11:29, and collected data in 7 of 12 categories.



**Fig 37.1 Mescal Spring.**

**Physical Description:** Mescal Spring is a hillslope spring that has been dug out and reinforced with a stone wall. There are pockets of water. The microhabitat associated with the spring covers 178 m<sup>2</sup>.

The distance to the nearest spring is 1462 meters.

**Survey Notes:** The spring has been developed and piped out for cattle but piping and bottom tanks are empty and in disrepair.

**Water:** There was no measurable flow at spring origin.

**Table 37.1 Mescal Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.0
Specific Conductance uS/cm	
Water Temperature °C	16.
Dissolved Solids	

**Flora:** Surveyors identified 8 plant species at the site.

**Table 37.2 Mescal Spring Vegetation.**

Species	Cover Code	A	B	C	D	E	F	G	H	Native Status	Wetland Status
Celtis laevigata	SC	0	0	0	0	0	0	0	0	N	R
Frangula californica	SC	0	0	0	0	0	0	0	0	N	U
Muhlenbergia rigens	GC	0	0	0	0	0	0	0	0	N	U
Opuntia		0	0	0	0	0	0	0	0		U
Prosopis velutina	SC	0	0	0	0	0	0	0	0	N	F
Salix Sp	SC	0	0	0	0	0	0	0	0	N	R
Vitis arizonica	SC	0	0	0	0	0	0	0	0	N	R
Ziziphus obtusifolia	SC	0	0	0	0	0	0	0	0	N	

**Fauna:** Surveyors observed or collected 7 aquatic and 3 terrestrial specimens. Surveyors observed or saw signs of 7 vertebrate species.

**Table 37.3 Mescal Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
ACAR Hydrachnella	1	Ad	A	Spot
COL Carabidae Brachinus elongatulus	1	Ad	T	Spot
COL Carabidae Platynus	1	Ad	T	Spot
COL Hydrophilidae Anacaena	2	Ad	A	Spot
DIP Culicidae	100	L	A	Spot
HEM Belostomatidae Abedus	1	Ad	A	Spot
HEM Gerridae Gerrinae	1	Ad	A	Spot
HEM Notonectidae Notonecta	1	Ad	A	Spot
ODO	10	L	A	Spot
PHA Phasmatidae	1	Ad	T	Spot

**Table 37.4 Mescal Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
javelina	7	obs	
tree lizard	2		
Northern Cardinal	1	obs	male
chipping sparrow	1	obs	
Bewick's wren			
mourning dove			
Canyon Towhee			

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores.

Aquifer functionality and water quality are very poor with very limited restoration potential and there is low risk.

Geomorphology condition is poor with limited restoration potential and there is low risk.

Habitat condition is moderate with some restoration potential and there is low risk.

Biotic integrity is poor with limited restoration potential and there is negligible risk.

Human influence of site is moderate with some restoration potential and there is low risk.

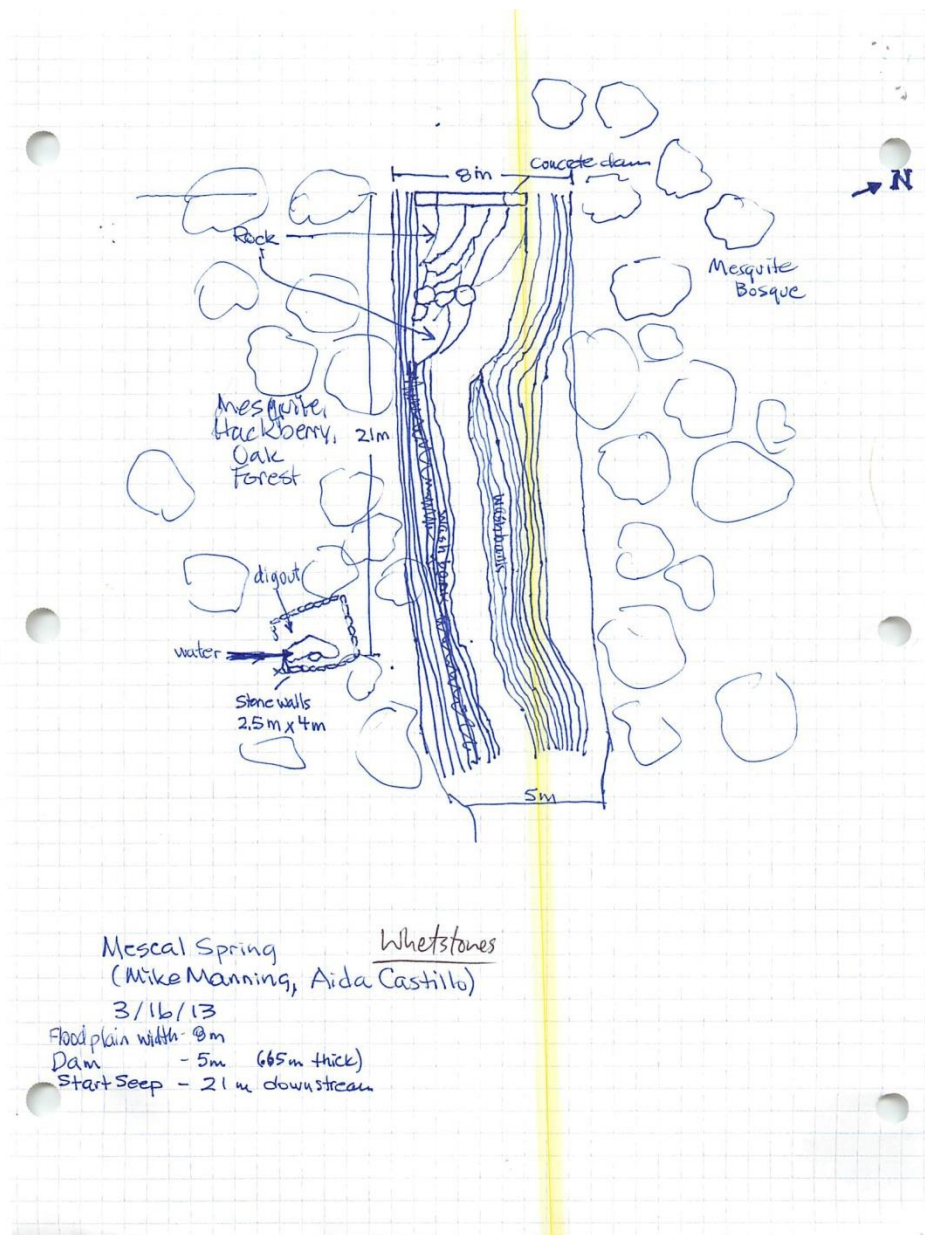
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is low risk.

**Table 37.5 Mescal Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	1.50	2.67
Geomorphology	2.20	2.40
Habitat	3.60	2.00
Biota	2.63	1.38
Human Influence	3.25	2.71
Administrative Context		
Overall Ecological Score	2.48	2.11

**Management Recommendations:** Cattle exclusion fencing could potentially recreate wetland vegetation. Road access is pretty good for bringing in materials, but I don't know if that road access would need to be requested by us via the Sands Ranch or other parties.



**Fig 37.2 Mescal Spring Sketchmap.**

### 38. Mud Spring Survey Summary Report, Site ID 11951

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Mud Spring ecosystem is located in Cochise County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 26' 31.457" latitude, -



110 23' 32.123" longitude in the Huachuca Peak USGS Quad, measured using a GPS (NAD 83, 7 meters EPE). The elevation is approximately 1836 meters. Louise Misztal, Christopher Morris, Bill Beaver, Paul Condon, Devin Meyer surveyed the site on 6/17/2012 for 02:00 hours, beginning at 10:00, and collected data in 10 of 12 categories.



**Fig 38.1 Mud Spring.**

**Physical Description:** Mud Spring is a rheocrene spring located in a mountain canyon in Oak woodland habitat within the Miller Peak Wilderness. It is in close proximity to a FS trail. The microhabitat associated with the spring covers 146 m<sup>2</sup>.

The emergence environment is subaerial, with a flow force mechanism. The distance to the nearest spring is 2088 meters. The site receives approximately 91% of available solar radiation, with 6563 Mj annually.

**Survey Notes:** At the time of survey there was no water at the spring but there was fair sized patch of moist soil and the area looked recently wet. There was some cow signs around the spring and a small campsite that appears to get regular human use about 75 meters upstream.

**Water:** No water present at time of survey.

**Flora:** Surveyors identified 7 plant species at the site.

**Table 38.1 Mud Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Arctostaphylos	SC		U
Carex sp	GC	N	W
Juniperus deppeana	MC	N	U
moss	NV	N	F
Pinus chihuahuana			
Platanus wrightii	MC	N	R
Vitis arizonica	SC	N	R

**Fauna:** Surveyors collected or observed 5 terrestrial invertebrate species, and observed or saw signs of 7 vertebrate species.

**Table 38.2 Mud Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
COL Lycidae Lycus arizonensis			T	Spot
LEP Lycaenidae Euphilotes spaldingi			T	Spot
LEP Nymphalidae Adelpha bredowii			T	Spot
LEP Nymphalidae Megisto rubricata			T	Spot
LEP Papilionidae Papilio multicaudata			T	Spot

**Table 38.3 Mud Spring Vertebrates.**

Species	Common Name	Qty	DetectionType	Comments
Western Wood Pewee			obs	
American black bear			obs	
elegant trogon	1		obs	
plumbeous vireo			obs	
mountain spiny lizard			obs	
warbler			call	
rabbit			sign	scat

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 10 null condition scores, and 10 null risk scores.

Aquifer functionality and water quality are very poor with very limited restoration potential and there is negligible risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

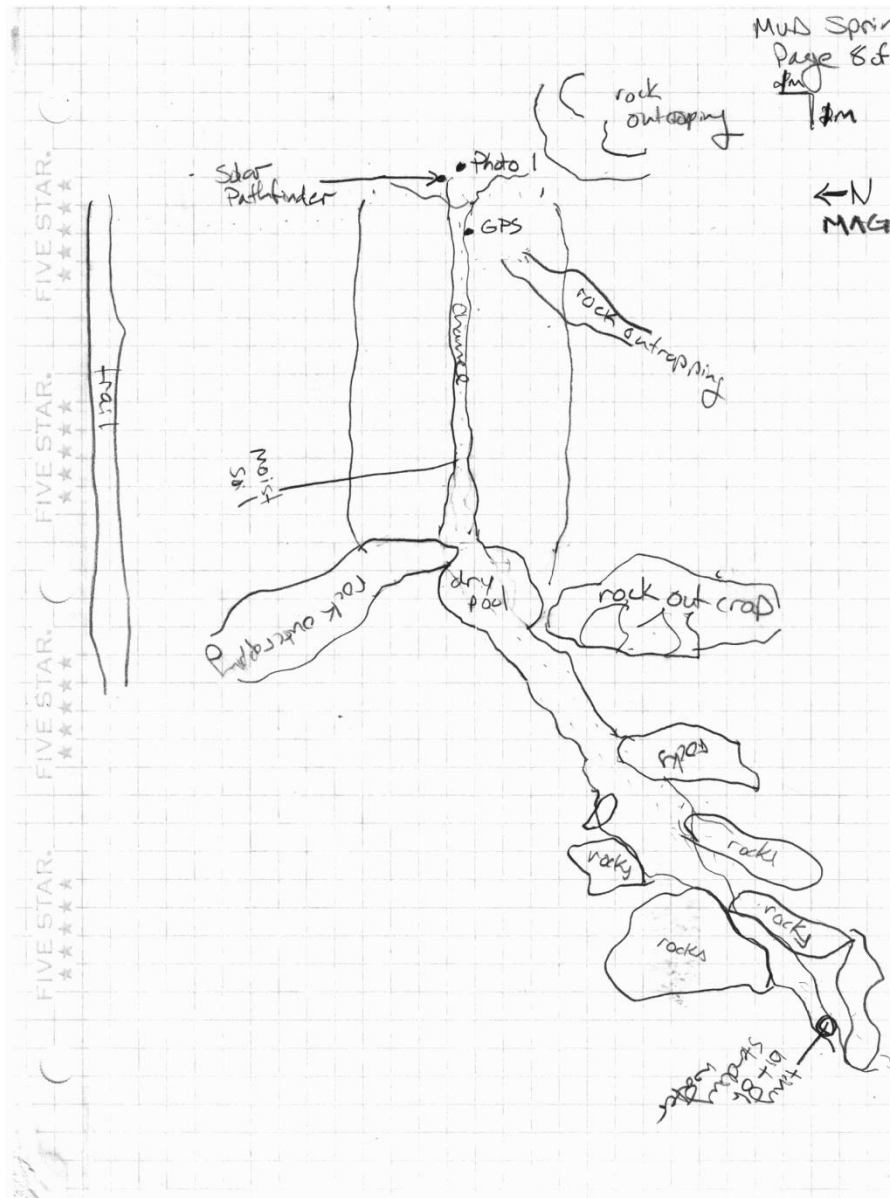
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 38.4 Mud Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	1.33	1.67
Geomorphology	4.00	2.00
Habitat	4.40	2.00
Biota	5.29	2.00
Human Influence	3.89	2.13
Administrative Context		
Overall Ecological Score	3.75	1.92

**Management Recommendations:** Site was heavily impacted by grazing and could benefit from fencing. It would be good to assess flows at other times of the year and to survey the plants. There is a trail in close proximity to the spring, but the spring appears to be ephemeral and there are little signs of human use of the spring, although there is a campsite nearby. There should be monitoring for any changes in human use. There are fresh signs of cow, there should be monitoring for overuse by cow.



**Fig 38.2 Mud Spring Sketchmap.**

### 39. Nogales Spring Survey Summary Report, Site ID 12904

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Nogales Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, managed by the US Bureau of Land Management. The spring is located at 31 52' 57.172" latitude, -110 28' 8.854" longitude in the Mescal USGS Quad, measured using a Garmin GPS (NAD 83, 5 meters EPE). The elevation is approximately 1402 meters. Dale Turner, Julia Fonseca, Dennis Carter, Chris



Cokinos, Karen Lowery, Sammy Hammer, Joe Cisero, Christopher Morris, Jim Chumbley, Nick Deyo, and Keely Lyons-Letts surveyed the site on 12/9/2012 for 01:18 hours, beginning at 12:25, and collected data in 10 of 12 categories.



**Fig 39.1** Nogales Spring.

**Physical Description:** Nogales Spring is a mound-form/rheocrene perennial spring. The discharge is from a travertine mound which flows into a channel. The microhabitat associated with the spring covers 5,000 m<sup>2</sup>.

The emergence environment is subaerial, with a flow force mechanism. The distance to the nearest spring is 180 meters. The site receives approximately 90% of available solar radiation, with 6507 Mj annually.

**Survey Notes:** This spring has seen very little external impacts and is quite pristine. The total length of spring flow is 0.2 miles.

**Water:** Flow was measured at 35 L/s with a volumetric method. Water quality was measured at the source at a depth of 45 cm.

**Table 39.1** Nogales Spring Water Quality with multiple readings averaged.

Characteristic Measured	Average Value
pH	7.1
Specific Conductance uS/cm	565
Water Temperature °C	21.1

Characteristic Measured	Average Value
Dissolved Solids	

**Flora:** Julia Fonseca was the botanist. Surveyors identified 22 plant species at the site.

**Table 39.2 Nogales Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Adiantum capillus-veneris	GC	N	W
Aquilegia	GC	N	W
Carex ultra	GC	N	
Celtis laevigata var. reticulata	MC	N	R
Chara sp	AQ	N	A
Choisya	SC	N	
Clematis drummondii	SC	N	
Frangula californica	SC	N	U
Juglans major	TC	N	R
Juniperus deppeana	MC	N	U
Lonicera	SC	N	U
Maurandella antirrhiniflora	GC	N	U
Mimosa aculeaticarpa var. biuncifera	GC	N	U
Nolina microcarpa	SC	N	U
Populus fremontii	MC	N	R
Prosopis velutina	SC	N	F
Quercus emoryi	SC	N	
Rhus virens	MC	N	
Sporobolus	GC	N	F
Toxicodendron radicans	GC	N	WR
Vitis arizonica	SC	N	R
Zizyphus obtusifolia	SC	N	

**Fauna:** Surveyors collected or observed 3 aquatic and 1 terrestrial invertebrate specimens. Surveyors observed or reported signs of 3 vertebrate species.

**Table 39.3 Nogales Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
HEM Gerridae			A	Spot
HEM Notonectidae			A	Spot
PHA	1		T	Spot

**Table 39.4 Nogales Spring Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
American black bear	1	sign	scat

Species Common Name	Qty	DetectionType	Comments
deer	1	sign	tracks
Sonoran mud turtle	1	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores.

Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is very good with excellent restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is very good with excellent restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 39.5 Nogales Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.17	2.50
Geomorphology	4.40	1.80
Habitat	4.80	2.40
Biota	5.13	2.25
Human Influence	4.88	2.71
Administrative Context		
Overall Ecological Score	4.62	2.24

**Management Recommendations:** This is a very high quality site with unique travertine deposits. Higher elevation travertine deposits indicate the aquifer has lowered. The presence of ATVs and adjacent roads indicates that the site would benefit from travel management. A social trail could be removed to reduce foot impact.

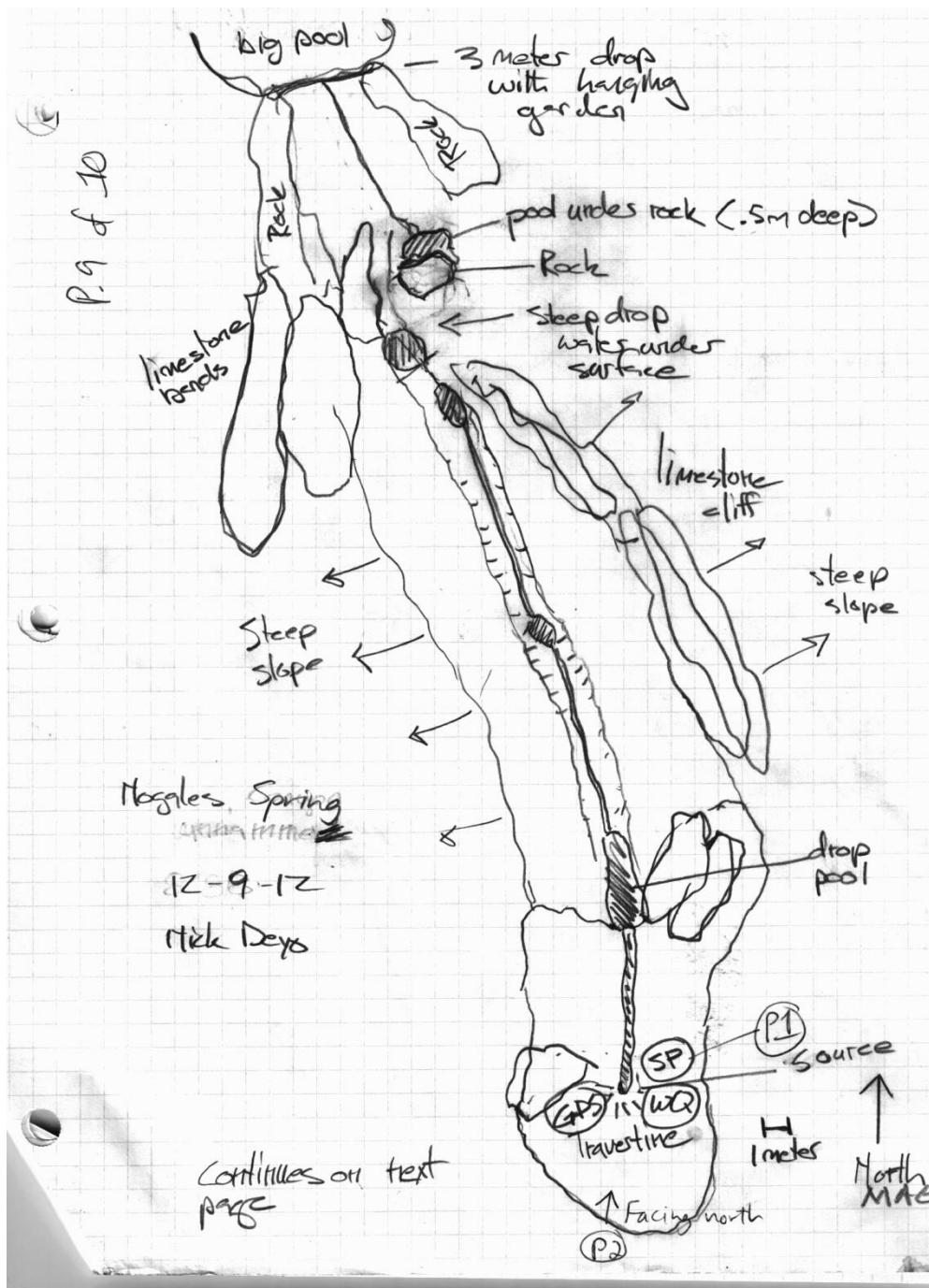


Fig 39.2 Nogales Spring Sketchmap.

#### 40. Oak Grove unnamed south Survey Summary Report, Site ID 13001

Submitted December 23, 2013 by Sky Island Alliance



**Location:** The Oak Grove unnamed south ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 33' 57.028" latitude, -110 39' 38.591" longitude in the Mount Hughes USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 5 meters EPE). The elevation is approximately 1502 meters. Tim Cook, Britt Oleson, Bill Beaver, Ambre Chaudoin, Paul Condon, and Christopher Morris surveyed the site on 10/28/2012 for 02:51 hours, beginning at 11:53, and collected data in 9 of 12 categories.



**Fig 40.1 Oak Grove unnamed south.**

**Physical Description:** Oak Grove unnamed south is a rheocrene perennial spring. The spring is located in a west-trending flow in a steeply-sided grassy drainage. Two springs were close within the same drainage but in different drainage branches. The microhabitat associated with the spring covers 288 m<sup>2</sup>.

Oak Grove unnamed south has a gravity flow force mechanism. The distance to the nearest spring is 257 meters.

**Survey Notes:** There was some cattle disturbance at the site.

**Water:** Flow was measured at 0.072 L/s with a volumetric method. Water quality was measured in the source pool below the spring origin.

**Table 40.1 Oak Grove unnamed south Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.4
Specific Conductance uS/cm	430
Water Temperature °C	17.7
Dissolved Solids	

**Flora:** Surveyors identified 7 plant species at the site.

**Table 40.2 Oak Grove unnamed south Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Juniperus	SC	N	U
Juniperus deppeana	MC	N	U
Nolina microcarpa	SC	N	U
Quercus arizonica	SC	N	R
Quercus emoryi	TC	N	
Solidago velutina	GC	N	U
Thymophylla acerosa	GC	N	

**Fauna:** Surveyors collected or observed 7 aquatic and terrestrial invertebrate species. Surveyors observed or reported signs of 6 vertebrates.

**Table 40.3 Oak Grove unnamed south Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
COL Dytiscidae Thermonectus marmoratus	5	Ad	A	
LEP Nymphalidae Libytheana carinenta	1	Ad	T	
LEP Nymphalidae Vanessa cardui	2	Ad	T	
LEP Pieridae Phoebis sennae	2	Ad	T	
LEP Pieridae Pieris rapae	1	Ad	T	
MOLL Physidae	10	Ad	A	

**Table 40.4 Oak Grove unnamed south Vertebrates.**

Species Common Name	Qty	DetectionType	Comments
tree lizard	1	obs	
red-naped sapsucker	1	obs	
common raven	1	obs	
White-tailed Deer	1	sign	tracks downstream
Mountain lion	1	sign	tracks downstream
White-nosed coati	1	sign	tracks downstream

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is moderate risk.

Geomorphology condition is good with significant restoration potential and there is moderate risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is very good with excellent restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 40.5 Oak Grove unnamed south Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.67	3.00
Geomorphology	3.80	3.00
Habitat	4.20	2.40
Biota	5.00	2.63
Human Influence	5.25	1.86
Administrative Context		
Overall Ecological Score	4.17	2.76

**Management Recommendations:** This is a potential rheocrene spring reference site. There is some impact from grazing.

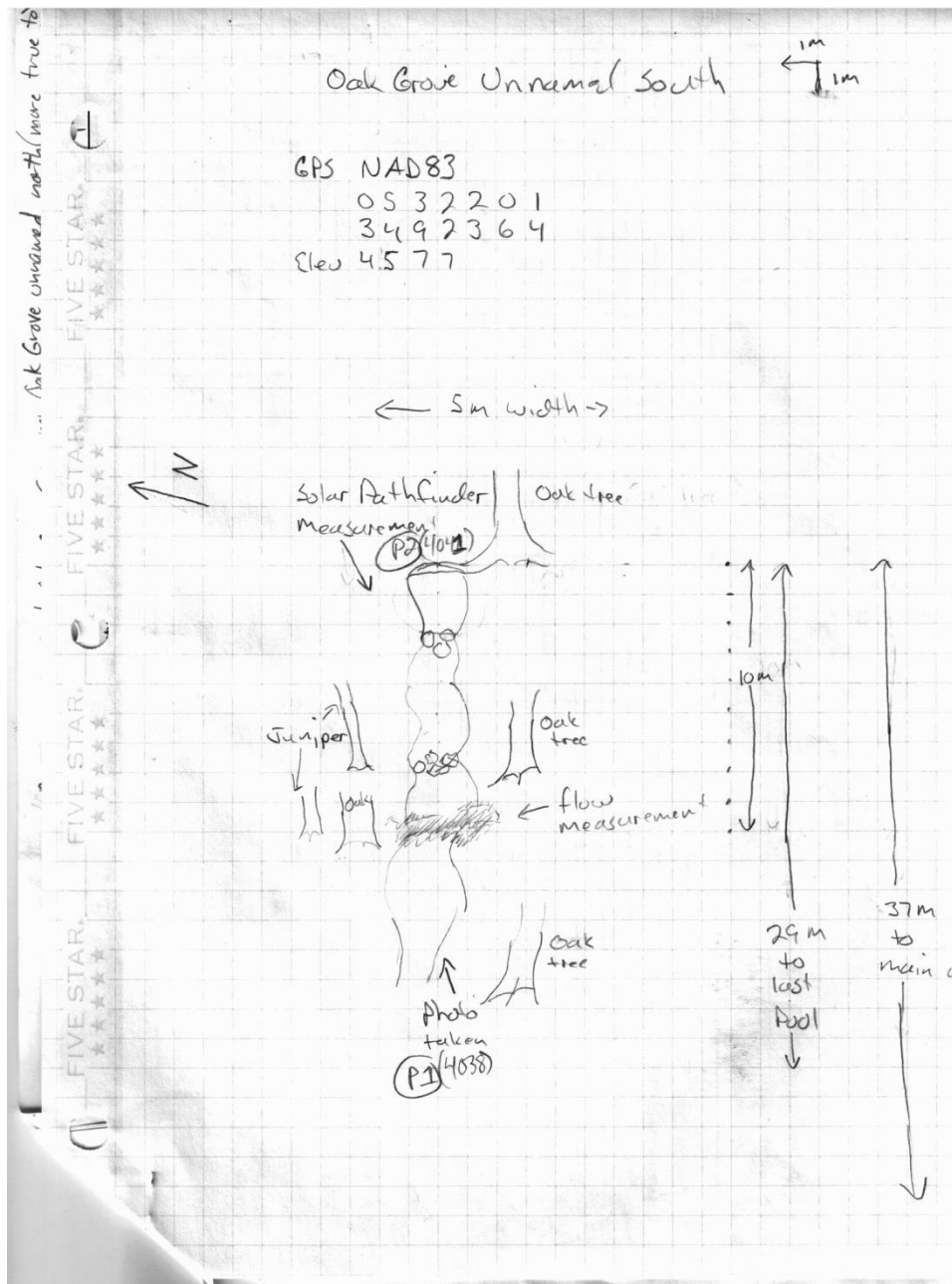


Fig 40.2 Oak Grove unnamed south Sketchmap.

#### 41. Oak Spring Survey Summary Report, Site ID 15343

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Oak Spring ecosystem is located in Cochise County in the Upper San Pedro Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed



by the US Forest Service. The spring is located at 31 21' 55.351" latitude, -110 17' 51.212" longitude in the Montezuma Pass USGS Quad, measured using a Garmin GPS (NAD 83). The elevation is approximately 2001 meters. Nick Deyo, Ron Miller, Norma Miller, Tim Allen, Caroline Butashon, and Lauri Fleming surveyed the site on 6/16/2012 for 01:30 hours, beginning at 11:00, and collected data in 9 of 12 categories.



**Fig 41.1 Oak Spring.**

**Physical Description:** Oak Spring is a rheocrene perennial spring. This site is in a steep, rocky canyon. The microhabitat associated with the spring covers 312 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

Oak Spring emerges from a sedimentary, limestone rock layer. The distance to the nearest spring is 415 meters. The site receives approximately 76% of available solar radiation, with 5519 Mj annually.

**Water:** To measure water quality, we set a pipe in the stream below where the flow converged, this was 30 meters below pipe outflow.

**Table 41.1 Oak Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	8.1
Specific Conductance uS/cm	663
Water Temperature °C	22.6
Dissolved Solids	

**Flora:** Surveyors identified 9 plant species at the site.

**Table 41.2 Oak Spring Vegetation.**

Poly	Species	CoverCode	Native	Wetland
X	Yucca xschottii	GC	N	
X	Juniperus scopulorum	MC	N	U
X	Platanus wrightii	MC	N	R
X	Quercus arizonica	MC	N	R
X	Quercus hypoleucoides	SC	N	
X	Rhus trilobata	SC	N	F
X	Arbutus arizonica	TC	N	
X	Hesperocyparis arizonica	TC	N	
X	Juglans major	TC	N	R

**Fauna:** Surveyors collected or observed 14 terrestrial invertebrate specimens, and observed 4 vertebrate species.

**Table 41.3 Oak Spring Invertebrates.**

Species	Qty	Lifestage	Habitat	Method	Species detail
DIP Bombyliidae	1	Ad	T	Spot	Xenox tigrinus
DIP Calliphoridae	1	Ad	T	Spot	"Calliphora vicina"
HOM Cicadidae	1	Ad	T	Spot	
HYM	1	Ad	T	Spot	
HYM Pompilidae Pepsis	1	Ad	T	Spot	
LEP Lycaenidae Leptotes marina	1	Ad	T	Spot	
LEP Nymphalidae Adelpha bredowii eulalia		Ad	T	Spot	many
LEP Nymphalidae Danaus gilippus	1	Ad	T	Spot	
LEP Papilionidae Papilio	1	Ad	T	Spot	cresphontes
LEP Papilionidae Papilio multicaudata	1	Ad	T	Spot	
LEP Pieridae	1	Ad	T	Spot	"Euchloe hyantis lotta"
LEP Pieridae Colias philodice	1	Ad	T	Spot	
ODO Coenagrionidae Argia vivida	1	Ad	T	Spot	
OPIL	1	Ad	T	Spot	

**Table 41.4 Oak Spring Vertebrates.**

Species Common Name	Qty	DetectionType
Mexican Jay	1	obs
hepatic tanager	1	obs
Arizona woodpecker	1	obs
Dusky-capped Flycatcher	1	obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 14 null condition scores, and 16 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk.

Geomorphology condition is moderate with some restoration potential and there is negligible risk.

Habitat condition is moderate with some restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is moderate risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 41.6 Oak Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.25	1.75
Geomorphology	3.40	1.50
Habitat	3.00	2.25
Biota	4.00	3.00
Human Influence	4.38	2.29
Administrative Context		
Overall Ecological Score	3.66	2.13

**Management Recommendations:** The site has very little wetland vegetation and is heavily impacted by grazing and flooding. It may benefit from fencing but it looks like it has been heavily disturbed by frequent flooding. Fencing may be destroyed by flooding.

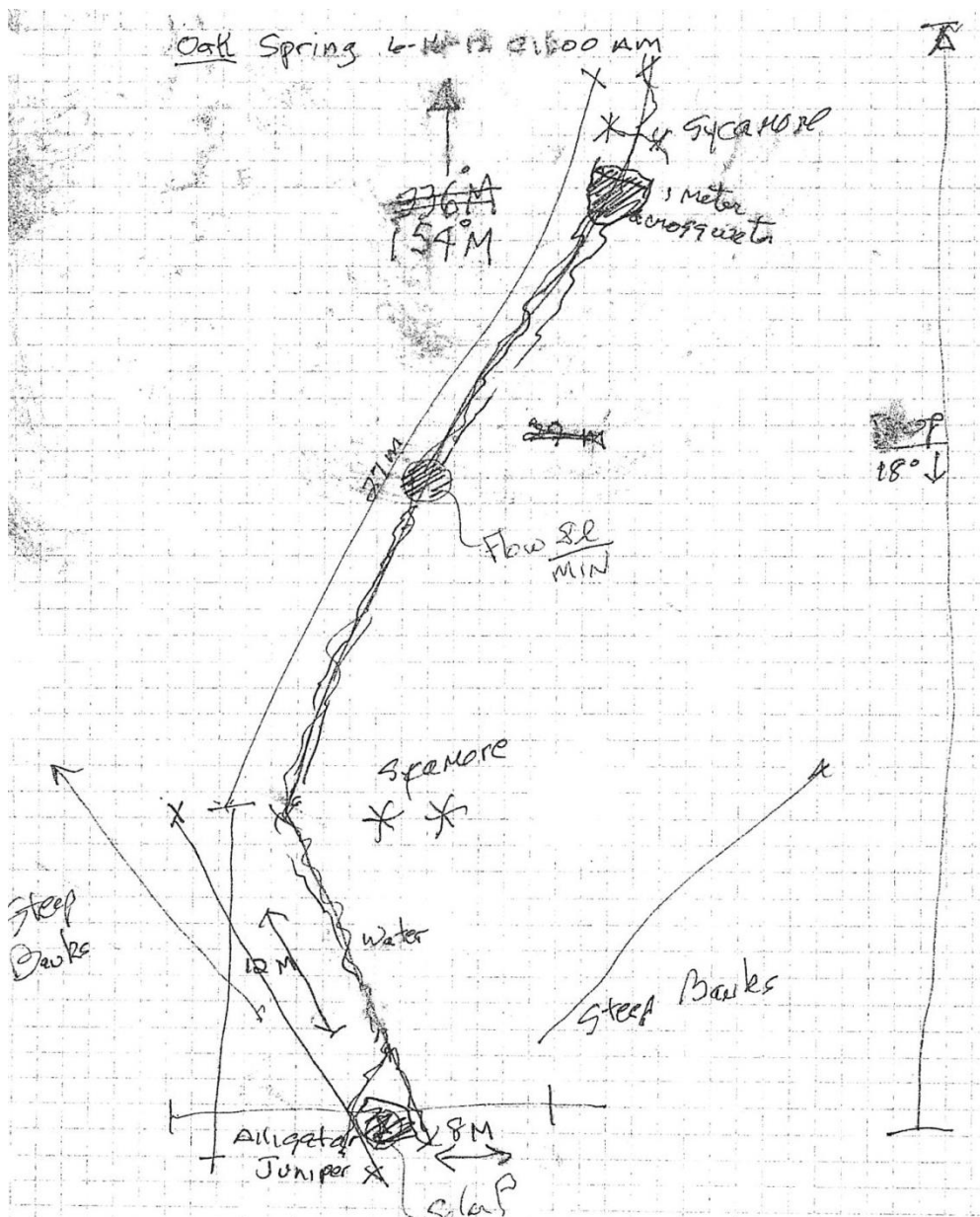


Fig 41.2 Oak Spring Sketchmap.

## 42. Paloma Spring Survey Summary Report, Site ID 11948

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Paloma Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31.36 latitude, -110.29 longitude in the Canelo Pass USGS Quad, measured using a Garmin GPS 12



GPS (NAD 83, 4 meters EPE). The elevation is approximately 1544 meters. Christopher Morris, Carianne Campbell, and Louise Misztal surveyed the site on 8/12/2013 for 01:10 hours, beginning at 12:14, and collected data in 6 of 12 categories.



**Fig 42.1 Paloma Spring.**

**Physical Description:** Paloma Spring has been developed into a cattle drinker and the actual source point is unknown. Spring is located in an oak-woodland canyon. The microhabitat associated with the spring covers 504 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 5208 meters. The site receives approximately 100% of available solar radiation,

**Survey Notes:** The site was heavily impacted by cattle. The only emergent water is in a cattle tank within a corral where there is a leaking valve and a broken float. Moisture inside the tank is primarily cow urine. We were not able to determine the original location of the spring source.

**Water:** Flow was measured at 0.018 L/s with a volumetric method, and measured by collecting water from the dripping cattle drinker valve.

**Table 42.1 Paloma Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.3
Specific Conductance uS/cm	411
Water Temperature °C	25
Dissolved Solids	

**Flora:** Surveyors identified 27 plant species at the site.

**Table 42.2 Paloma Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Mimosa aculeaticarpa var. biuncifera		N	U
Sporobolus			F
Evolvulus			
Ipomoea			
Quercus emoryi		N	
Amoreuxia palmatifida	GC	N	
Aristida	GC		U
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Cynodon dactylon	GC	I	WR
Cyperus	GC	N	W
Datura wrightii	GC	N	F
Dyschoriste schiedeana var. decumbens	GC		
Epilobium canum	GC	N	
Erigeron	GC	N	F
Eryngium heterophyllum	GC	N	
Euphorbia	GC		U
Muhlenbergia rigens	GC	N	U
Panicum obtusum	GC	N	WR
Schoenocrambe linearifolia	GC	N	U
Sida abutifolia	GC	I	
Solanum elaeagnifolium	GC	N	R
Arctostaphylos pungens	SC	N	U
Artemisia	SC	N	F
Rhus aromatica	SC	N	
Vitis arizonica	SC	N	R
Fraxinus velutina	TC	N	R

**Fauna:** Surveyors did not collect or observe any aquatic or terrestrial invertebrate specimens. Surveyors observed or reported signs of 4 vertebrate species.

**Table 42.4 Paloma Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
roadrunner	1	obs	
turkey vulture			
scrub jay			
spotted towhee			

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 17 null condition scores, and 18 null risk scores. Aquifer functionality and water quality are eliminated with no restoration potential and there is undetermined risk due to null scores

Geomorphology condition is very poor with very limited restoration potential and there is moderate risk.

Habitat condition is poor with limited restoration potential and there is moderate risk.

Biotic integrity is very poor with very limited restoration potential and there is high risk.

Human influence of site is good with significant restoration potential and there is moderate risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

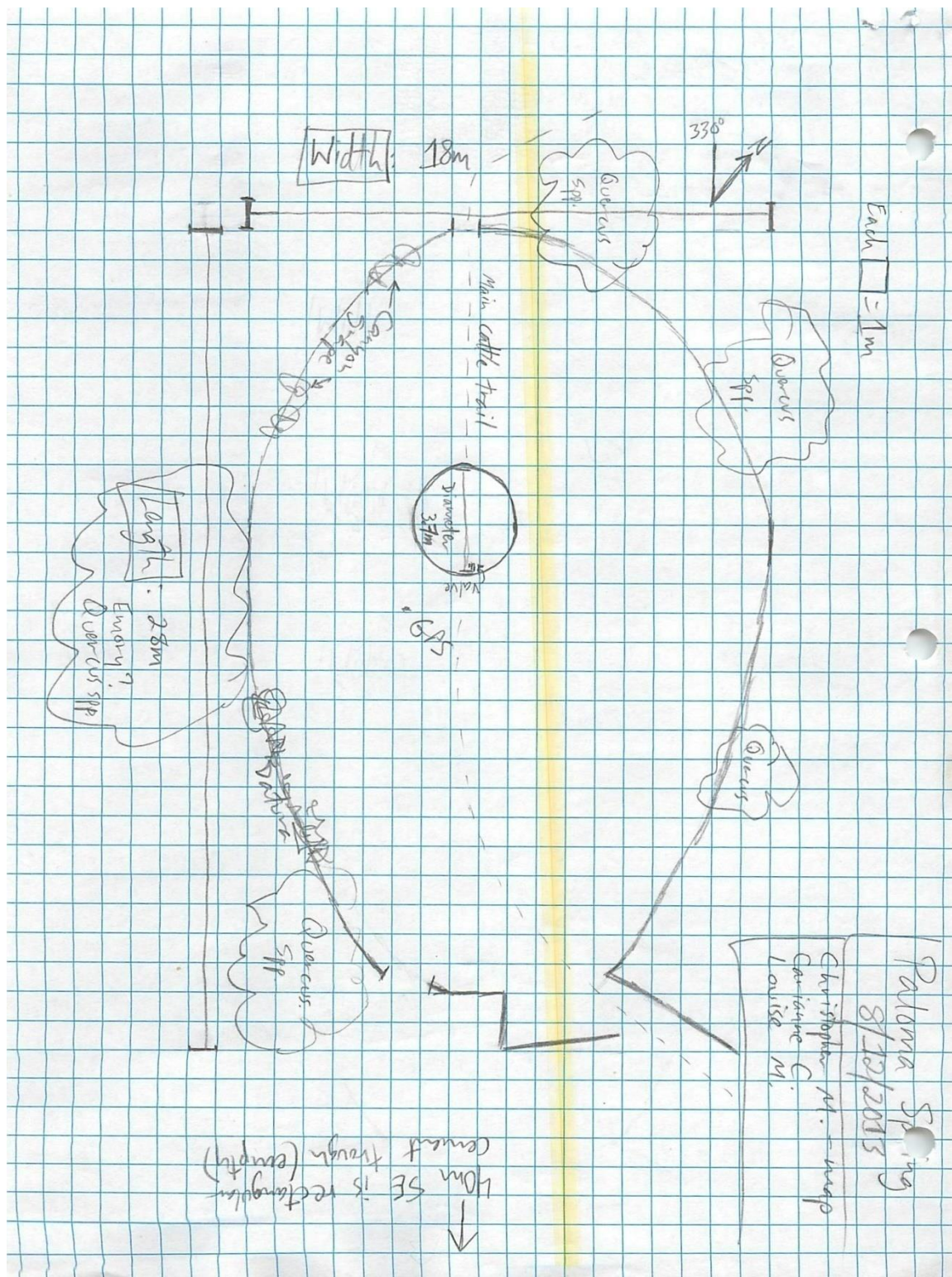
Overall, the site condition is very poor with very limited restoration potential and there is moderate risk.

**Table 42.5 Paloma Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	0.00	
Geomorphology	1.60	3.60
Habitat	2.00	3.50
Biota	1.50	4.00
Human Influence	3.88	3.00
Administrative Context		
Overall Ecological Score	1.27	3.7

**Management Recommendations:** This SEAP was scored based on limited information at the cattle tank. We were never able to find a source or a spring box.





**Fig 42.2 Paloma Spring Sketchmap.**



### 43. Papago Spring Survey Summary Report, Site ID 13012

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Papago Spring ecosystem is located in Santa Cruz County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 36' 27.712" latitude, -110 37' 55.612" longitude in the Mount Hughes USGS Quad, measured using a Garmin GPS(NAD 83, 4 meters EPE). The elevation is approximately 1572 meters. Nick Deyo, Michael Stock, Bill Beaver, and Julia Fonseca surveyed the site on 7/12/2012 for 00:40 hours, beginning at 14:20, and collected data in 7 of 12 categories.



**Fig 43.1 Papago Spring.**

**Physical Description:** Papago Spring is a hillslope spring. The spring was at the bottom of Cienega Creek. Calcium carbonate may indicate a former spring and the biofilm indicated a hillslope source. Spring is in an oak woodland canyon. There is a concrete dam just below the source. The microhabitat associated with the spring covers 333 m<sup>2</sup>

Papago Spring with a gravity flow force mechanism. The distance to the nearest spring is 4382 meters. The site receives approximately 92% of available solar radiation, with 6683 Mj annually.

**Survey Notes:** Water flowing in the stream was from the runoff of a recent rain. It was difficult to see any flow, although biofilm indicated a hillslope flow. Rain runoff interfered with discharge and water quality measurements. We think that this is the spring location because of a concrete dam, because a trail ends here, and because there is a pipe. We also noticed the presence of willows. There are no wetland soils and it is unclear whether the spring flow could be extant.

**Water:** Stormwater runoff made assessing the discharge impossible.

**Table 43.1 Papago Spring Water Quality with multiple readings averaged.**

Characteristic Method	Average Value
pH (field)	7.31
Specific conductance (field) (uS/cm)	411
Dissolved oxygen (field) % saturation	53
Temperature, water C	25

**Flora:** Surveyors identified 22 plant species at the site.

**Table 43.2 Papago Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Mimosa aculeaticarpa var. biuncifera		N	U
Sporobolus			F
Evolvulus			
Ipomoea			
Quercus emoryi		N	
Amoreuxia palmatifida	GC	N	
Aristida	GC		U
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Cynodon dactylon	GC	I	WR
Cyperus	GC	N	W
Datura wrightii	GC	N	F
Dyschoriste schiedeana var. decumbens	GC		
Epilobium canum	GC	N	
Erigeron	GC	N	F
Eryngium heterophyllum	GC	N	
Euphorbia	GC		U

Species	Cover Code	Native Status	Wetland Status
Muhlenbergia rigens	GC	N	U
Panicum obtusum	GC	N	WR
Schoenocrambe linearifolia	GC	N	U
Sida abutifolia	GC	I	
Solanum elaeagnifolium	GC	N	R
Arctostaphylos pungens	SC	N	U
Artemisia	SC	N	F
Rhus aromatica	SC	N	
Vitis arizonica	SC	N	R
Fraxinus velutina	TC	N	R

**Fauna:** A small flood and record rain impaired the observations. Surveyors did not collect or observe any aquatic or terrestrial invertebrate specimens. Surveyors observed or reported signs of 4 vertebrate species.

**Table 43.4 Papago Spring Vertebrates.**

Species Common Name	Qty	Detection Type
roadrunner	1	obs
turkey vulture		
scrub jay		
spotted towhee		

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 19 null condition scores, and 18 null risk scores. Aquifer functionality and water quality are undetermined due to null scores and there is undetermined risk due to null scores

Geomorphology condition is moderate with some restoration potential and there is low risk.

Habitat condition is moderate with some restoration potential and there is negligible risk.

Biotic integrity is moderate with some restoration potential and there is negligible risk.

Human influence of site is very good with excellent restoration potential and there is negligible risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is negligible risk.

**Table 43.5 Papago Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality		
Geomorphology	3.00	2.00
Habitat	3.20	1.60

Category	Condition	Risk
Biota	3.50	1.50
Human Influence	5.29	1.43
Administrative Context		
Overall Ecological Score	3.23	1.7

**Management Recommendations:** Surveyors did not note any recommendations.



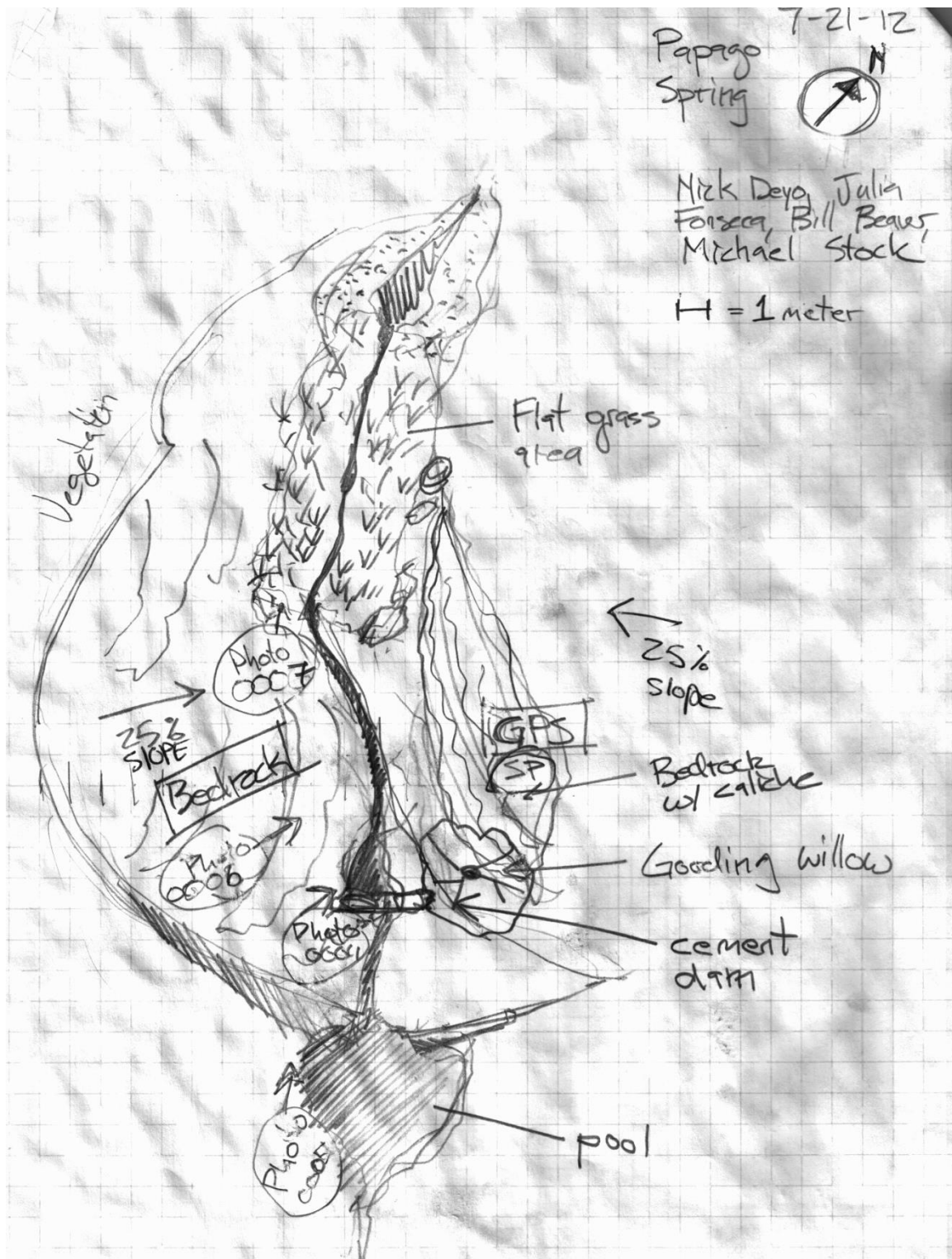
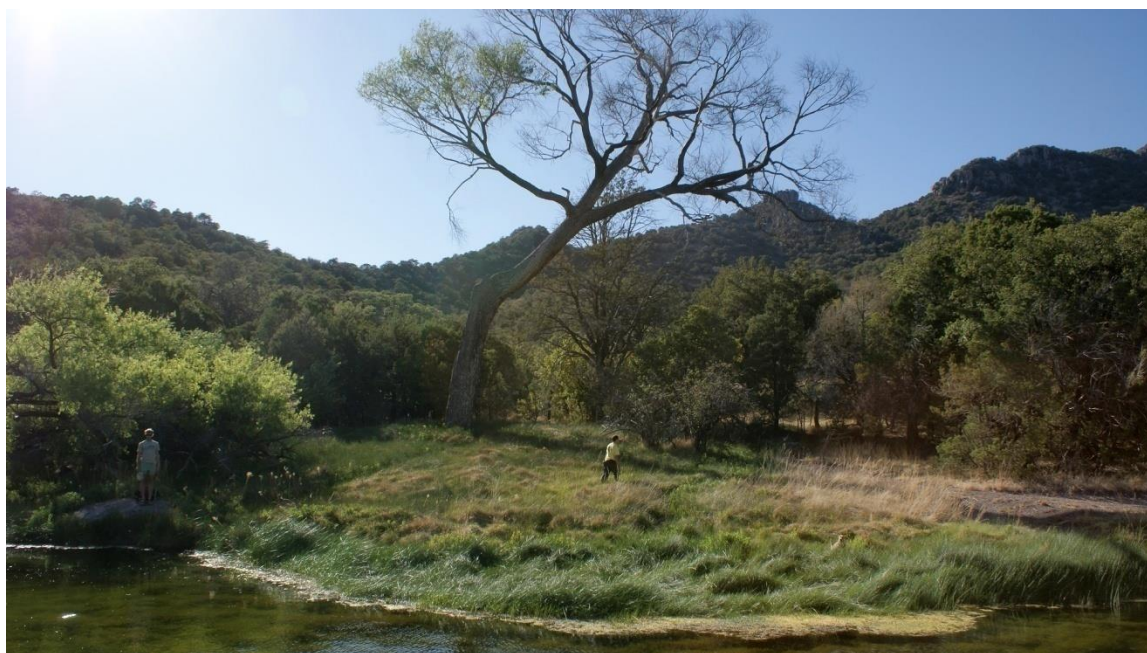


Fig 43.2 Papago Spring Sketchmap.

## 44. Peterson Ranch Pond Survey Summary Report, Site ID 16528

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Peterson Ranch Pond ecosystem is located in Cochise County in the Upper Santa Cruz Arizona 8-digit HUC, managed by a private US owner. The spring is located at 31 27' 26.475" latitude, -110 23' 52.078" longitude in the Huachuca Peak USGS Quad, measured using a GPS (NAD 83, 4 meters EPE). The elevation is approximately 1908 meters. Christopher Morris, Bill Beaver, Paul Condon, Louise Misztal, and Devin Myers surveyed the site on 6/16/2012 for 02:00 hours, beginning at 13:14, and collected data in 10 of 12 categories.



**Fig 44.1 Peterson Ranch Pond.**

**Physical Description:** Peterson Ranch Pond is a helocrene/anthropogenic perennial spring. This spring arises from an old springbox and flows into a narrow channel that feeds a 250 sq. meter wetland area. The spring outflow fills a large constructed pond (180 sq. meters) where Chiricahua leopard frogs have been introduced and are reproducing. This is an important area for Chiricahua leopard frog recovery efforts. The microhabitat associated with the spring covers 460 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

Peterson Ranch Pond with a gravity flow force mechanism. The distance to the nearest spring is 2088 meters. The site receives approximately 100% of available solar radiation, with 7240 Mj annually.

**Survey Notes:** Site is in good condition as there is a fence around it. The pond has had bullfrogs and bullrushes removed in the past and contained Chiricahua leopard

frogs. The site contained three microclimates: the pool (180 m squared), the channel (28 m squared) coming from the source, and a wet meadow (250 m squared).

**Water:** There was no measurable flow. Water quality was collected about 10m below the spring box in the flow measurement dam.

**Table 44.1 Peterson Ranch Pond Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.7
Specific Conductance uS/cm	550
Water Temperature °C	17.3
Dissolved Solids	

**Flora:** Surveyors identified 5 plant species at the site.

**Table 44.2 Peterson Ranch Pond Vegetation.**

Poly	Species	Cover Code	Native	Wetland
x	Chara sp	AQ		A
x	Mentha spicata	GC	I	
x	Sisyrinchium	GC	N	WR
x	Typha latifolia	GC	N	A
x	Juniperus deppeana	MC	N	U

**Fauna:** Surveyors collected or observed 5 aquatic and 0 terrestrial invertebrate specimens. These represented 5 aquatic and 0 terrestrial species. Surveyors observed or reported signs of 7 vertebrate species.

**Table 44.3 Peterson Ranch Pond Invertebrates.**

Species	Qty	Lifestage	Habitat
COL Erotylidae	1	Ad	A
COL Lycidae Lycus arizonensis	1	Ad	A
COL Nymphalidae Limenitidinae Adelpha Eulalia	1	Ad	A
ODO Aeshnidae Rhionaeschna multicolor	1	Ad	A
ODO Libellulidae Libellula saturata	1	Ad	A

**Table 44.4 Peterson Ranch Pond Vertebrates.**

Species Common Name	Qty	Detection Type
Blackneck garter snake	1	obs
Chiricahua Leopard frog	14	obs
tree lizard	1	obs
violet-green swallow	1	obs
common raven	1	obs
wild turkey	1	call
turkey vulture	1	obs

Species Common Name	Qty	Detection Type
hepatic tanager	1	obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 10 null condition scores, and 10 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is negligible risk.

Geomorphology condition is poor with limited restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is negligible risk.

Biotic integrity is good with significant restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 44.5 Peterson Ranch Pond Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.50	1.50
Geomorphology	2.40	2.60
Habitat	4.25	1.50
Biota	4.63	2.63
Human Influence	3.88	2.71
Administrative Context		
Overall Ecological Score	3.94	2.06

**Management Recommendations:** The pond associated with this spring has been important for Chiricahua leopard frog recovery efforts. It has been infested with invasive bullfrogs in the past and it is important that it continue to be monitored and managed to prevent recolonization by bullfrogs.

An adult bullfrog was seen on the site on 7/20/13 and more are calling. This is a good reference site for restoration.



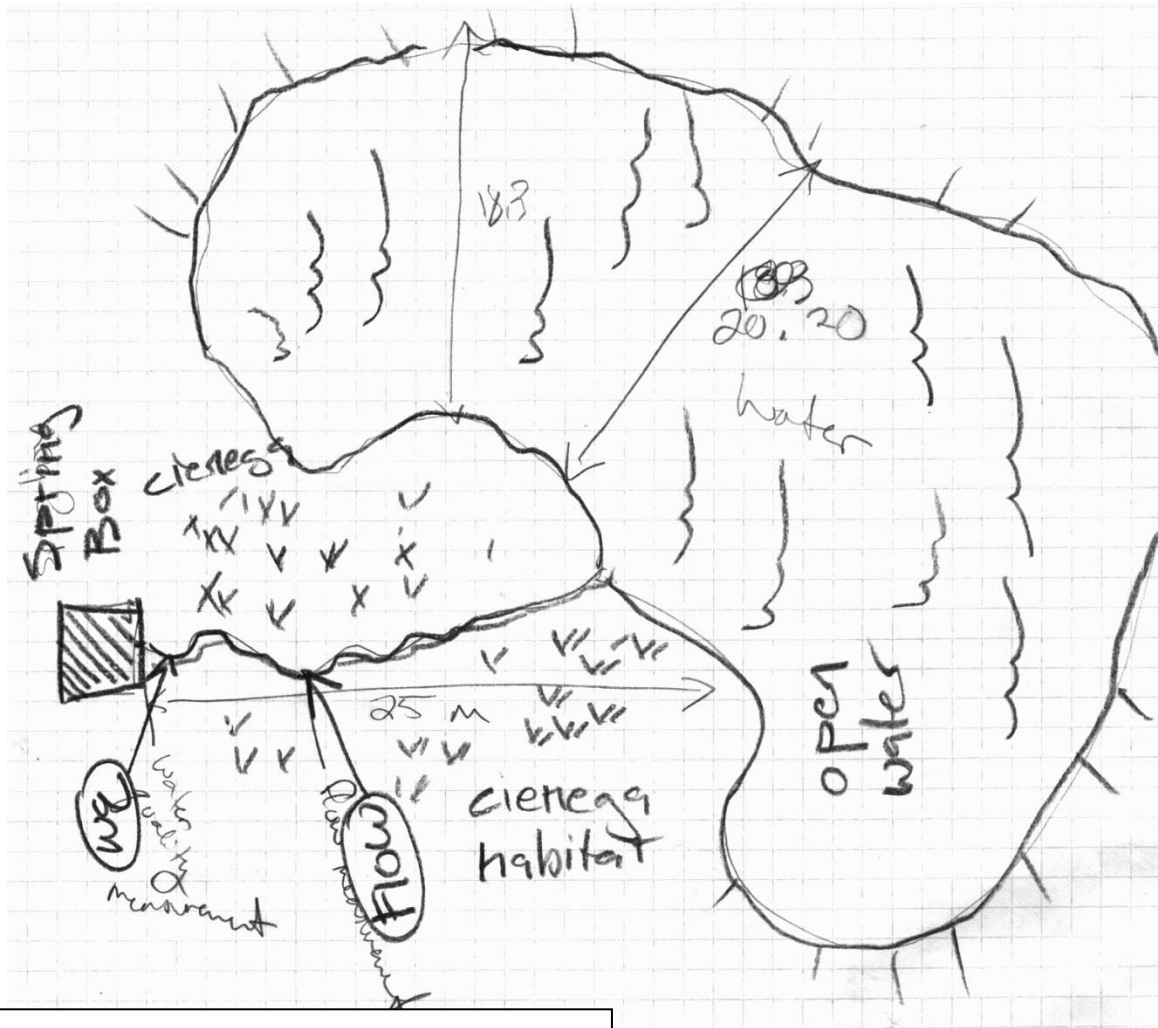


Fig 44.2 Peterson Ranch Pond Sketchmap.

#### 45. Questa Spring Survey Summary Report, Site ID 12932

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Questa Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, managed by a private US owner. The spring is located at 31.83 latitude, -110.69 longitude in the Empire Ranch USGS Quad, measured using a (NAD 83). The elevation is approximately 1394 meters. Louise Misztal, Paul Condon, Randy Serraglio, and Karen Lowry surveyed the site on 6/1/2012, and collected data in 0 of 12 categories.

**Physical Description:** There was no visible spring at the site and the area of the site was searched to no avail. There was a small flat area with thick Sacaton, grama and three awn.

The distance to the nearest spring is 1060 meters.

**Survey Notes:** Unable to find spring or evidence of spring at time of site visit.

**Water:** No water quality data were taken.

**Flora:** No vegetation data were reported.

**Fauna:** Surveyors observed or collected 0 invertebrate species and saw signs of 0 vertebrate species.

**Assessment:** Surveyors did not conduct an assessment at the site.

**Management Recommendations:** Surveyors did not note any recommendations.

#### 46. Ranger Station Spring Survey Summary Report, Site ID 13024

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Ranger Station Spring ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Nogales RD Coronado Ntnl Forest, managed by the US Forest Service. The spring is located at 31 35' 7.27" latitude, - 110 47' 39.875" longitude in the Patagonia USGS Quad, measured using a GPS (NAD 83, 5 meters EPE). The elevation is approximately 1367 meters. Louise Misztal, Ron Miller, Norma Miller, Mike Manning, Jim Chumbley, and Jonathan Paklaian surveyed the site on 2/2/2013 for 02:30 hours, beginning at 12:00, and collected data in 10 of 12 categories.



**Fig 46.1 Ranger Station Spring.**

**Physical Description:** Ranger Station Spring is a helocrene spring. This helocrene spring is located on a hillslope above a small steep drainage in primarily mesquite-scrub habitat with scattered oaks. The microhabitat associated with the spring covers 900 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 989 meters. The site receives approximately 98% of available solar radiation, with 7080 Mj annually.

**Survey Notes:** The site has relatively extensive spring dominated habitat with markedly different vegetation than the surrounds, but only a small area of mud/standing water. There is some erosion right above the spring emergence point. There is extensive old infrastructure in disrepair including piping and at least 4 large metal tanks down hill from the standing water. The site is dominated by bunch grass and herbaceous cover.

**Water:** There was no measurable flow. We were unable to measure water quality because we couldn't isolate enough flow and standing water was very stagnant.

**Table 46.1 Ranger Station Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	
Specific Conductance uS/cm	
Water Temperature °C	16.
Dissolved Solids	

**Flora:** Surveyors identified 13 plant species at the site. Also noted here is sprangle top.

**Table 46.2 Ranger Station Spring Vegetation.**

Species	Cover Code	Native	Comments	Wetland
Rhus virens var. choriophylla		N		
Setaria				
Ziziphus obtusifolia		N		
Ambrosia	GC			F
Cynodon dactylon	GC	I		WR
Muhlenbergia rigens	GC	N		U
Panicum obtusum	GC	N		WR
Sambucus	GC			F
Celtis laevigata var. reticulata	MC	N		R
Baccharis sarothroides	SC	N		R
Juniperus monosperma	SC	N		U
Prosopis velutina	SC	N		F
Ribes	SC		currant	F

**Fauna:** No other invertebrates except mosquito larvae were detected. Surveyors observed or reported signs of 6 vertebrate species.

**Table 46.3 Ranger Station Spring Vertebrates.**

Species	Common Name	Qty	DetectionType	Comments
Northern Cardinal		1	obs	male
yellow-eyed junco			obs	
mule deer			sign	tracks
javelina			sign	tracks
ruby-crowned kinglet		2	obs	
sparrow				

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 11 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is negligible risk.

Biotic integrity is very good with excellent restoration potential and there is negligible risk.

Human influence of site is good with significant restoration potential and there is low risk.



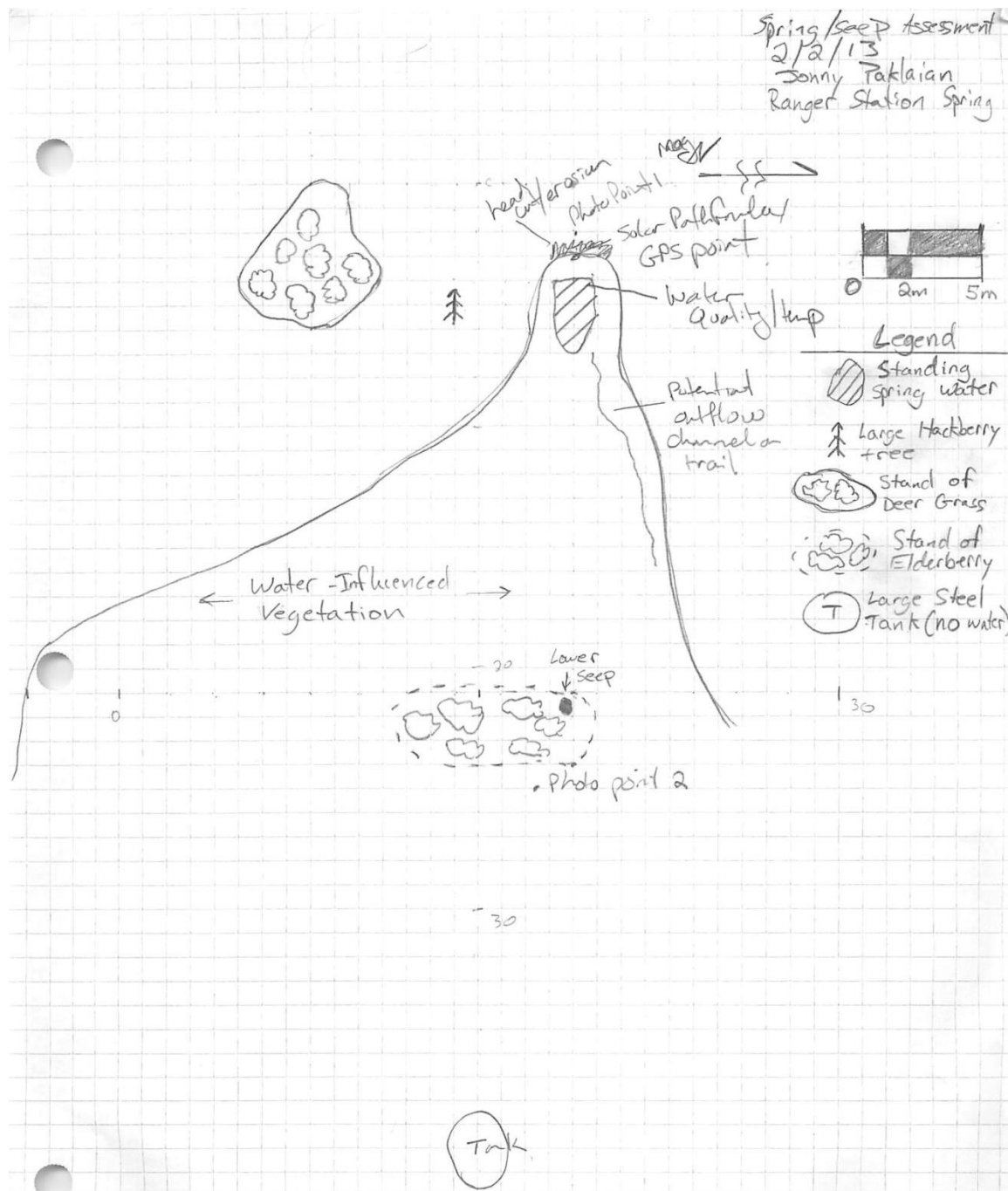
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 46.4 Ranger Station Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.17	2.50
Geomorphology	4.40	2.00
Habitat	4.40	1.40
Biota	5.33	1.67
Human Influence	4.44	2.13
Administrative Context		
Overall Ecological Score	4.33	1.89

**Management Recommendations:** Site appears to have exclosure fencing which should be maintained. There is extensive old infrastructure for piping water from spring site to multiple large tanks downhill. There is some erosion and downcutting at the spring emergence that could be addressed and may be effecting spring flow.



**Fig 46.2 Ranger Station Spring Sketchmap.**

## 47. Redrock South Spring Unnamed Survey Summary Report, Site ID 13008

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Redrock South Spring Unnamed ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31° 34' 3.223" latitude, -110° 41' 17.316" longitude in the Mount Hughes USGS Quad, measured using a map (NAD 83). The elevation is approximately 1517 meters. Nick Deyo, Christopher Morris, and Bill Beaver surveyed the site on 12/27/2012 for 01:53 hours, beginning at 11:37, and collected data in 9 of 12 categories.



**Fig 47.1 Redrock South Spring Unnamed.**

**Physical Description:** Redrock South Spring Unnamed is a rheocrene spring. This spring emerges from a rocky outcrop in an upper watershed drainage. Little flow was noted and there are many dilapidated pipes on the site. The microhabitat associated with the spring covers 420 m<sup>2</sup>.

The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 318 meters. The site receives approximately 97% of available solar radiation, with 7004 Mj annually.

**Survey Notes:** The site had little flow or pooled water and appeared heavily grazed. It appeared as though there had been more water at the site in the past. There was an absence of wetland plants.

**Water:** Water quality data was collected in a small pool (40cm x 20cm x 8cm). There was no perceptable flow.

**Table 47.1 Redrock South Spring Unnamed Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.0
Specific Conductance uS/cm	111
Water Temperature °C	19.7
Dissolved Solids	

**Flora:** Mostly upland vegetation was found at the site with the exception of the Salix gooddingii and deer grass. Surveyors identified 11 plant species at the site.

**Table 47.2 Redrock South Spring Unnamed Vegetation.**

Species	Cover Code	Native	Wetland
Agave schottii	GC	N	
Bothriochloa barbinodis	GC	N	F
Bouteloua curtipendula	GC	N	U
Bouteloua gracilis	GC	N	U
Gossypium thurberi	GC	N	
Muhlenbergia rigens	GC	N	U
Schoenocrambe	GC		
Fouquieria splendens	SC	N	
Juniperus	SC	N	U
Prosopis velutina	SC	N	F
Salix gooddingii	SC	N	R

**Fauna:** Surveyors collected or observed Aphelocoma for invertebrate specimens. One Mexican Jay was observed.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 11 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is negligible risk.

Habitat condition is moderate with some restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.



**Table 47.3 Redrock South Spring Unnamed Assessment Scores.**

<b>Category</b>	<b>Condition</b>	<b>Risk</b>
Aquifer Functionality & Water Quality	3.17	2.33
Geomorphology	3.80	1.60
Habitat	3.20	2.00
Biota	4.00	2.00
Human Influence	4.13	2.00
Administrative Context		
Overall Ecological Score	3.54	1.98

**Management Recommendations:** Surveyors did not note any management recommendations.

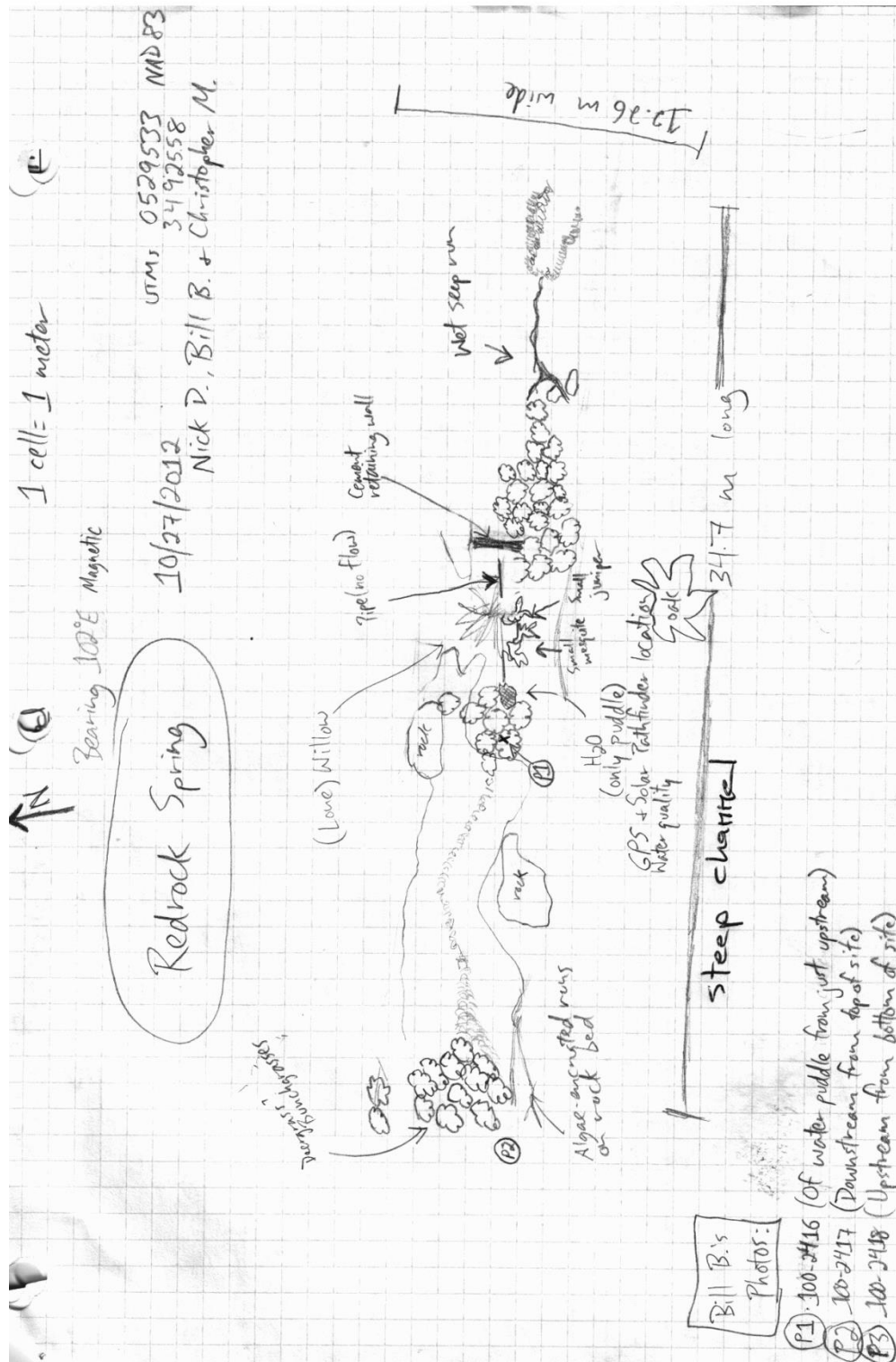


Fig 47.2 Redrock South Spring Unnamed Sketchmap.

## 48. Sansimon Mine unnamed Survey Summary Report, Site ID 13011

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Sansimon Mine unnamed ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 31' 54.826" latitude, -110 41' 43.606" longitude in the Mount Hughes USGS Quad, measured using a map (NAD 83). The elevation is approximately 1429 meters. Christopher Morris, Ron Miller, and Norma Miller surveyed the site on 8/22/2012 for 03:45 hours, beginning at 08:22, and collected data in 9 of 12 categories.



**Fig 48.1 Sansimon Mine unnamed.**

**Physical Description:** Sansimon Mine unnamed is a hanging garden spring. The spring issues from shallow cave in a rock outcropping and is highly developed. Nearly all of the water at the site is piped to two cement cattle drinkers. However, the area directly adjacent to the spring is fenced off from cattle. The microhabitat associated with the spring covers 45 m<sup>2</sup>.

The emergence environment is a cave, with a flow force mechanism. The distance to the nearest spring is 3317 meters. The site receives approximately 81% of available solar radiation, with 5856 Mj annually.

**Survey Notes:** This site is highly altered with nearly all of the spring water being piped to two cattle drinkers. It appeared as though there has been little use of the site in recent years.

**Water:** Only temperature was taken at this site.

**Table 48.1 Sansimon Mine unnamed Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	
Specific Conductance uS/cm	
Water Temperature °C	18.3
Dissolved Solids	

**Flora:** Surveyors identified 11 plant species at the site.

**Table 48.2 Sansimon Mine unnamed Vegetation.**

Species	Cover Code	Native	Wetland
Agave palmeri	GC	N	
Bouteloua curtipendula	GC	N	U
Carex sp	GC	N	W
Cynodon dactylon	GC	I	WR
Digitaria ischaemum	GC	I	
Populus fremontii	MC	N	R
Quercus arizonica	MC	N	R
Baccharis salicifolia	SC	N	R
Celtis ehrenbergiana	SC	N	
Dasyllirion wheeleri	SC	N	
Nolina microcarpa	SC	N	U

**Fauna:** Surveyors collected or observed 1 aquatic and 11 terrestrial invertebrate specimens. Surveyors observed or reported signs of 7 vertebrate species.

**Table 48.3 Sansimon Mine unnamed Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
HEM Corixidae	1	Ad	A	Spot
HEM Gerridae	1	Ad	T	Spot
LEP Lycaenidae Leptotes marina	1	Ad	T	Spot
LEP Nymphalidae Chlosyne	1	Ad	T	Spot
LEP Nymphalidae Texola elada	1	Ad	T	Spot
LEP Papilionidae Papilio	1	Ad	T	Spot
LEP Papilionidae Papilio multicaudata	1	Ad	T	Spot
LEP Pieridae Colias eurytheme	1	Ad	T	Spot
LEP Pieridae Colias philodice	1	Ad	T	Spot
LEP Pieridae Phoebis sennae	1	Ad	T	Spot
ODO Lestidae Lestes	1	Ad	T	Spot
ODO Libellulidae Libellula saturata	1	Ad	T	Spot



**Table 48.4 Sansimon Mine unnamed Vertebrates.**

Species Common Name	Qty	Detection Type
Bridled Titmouse	1	obs
house wren	1	obs
Bewick's wren	1	obs
hepatic tanager	1	obs
woodpecker	1	obs
mourning dove	1	obs
common raven	1	obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores.

Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is moderate risk.

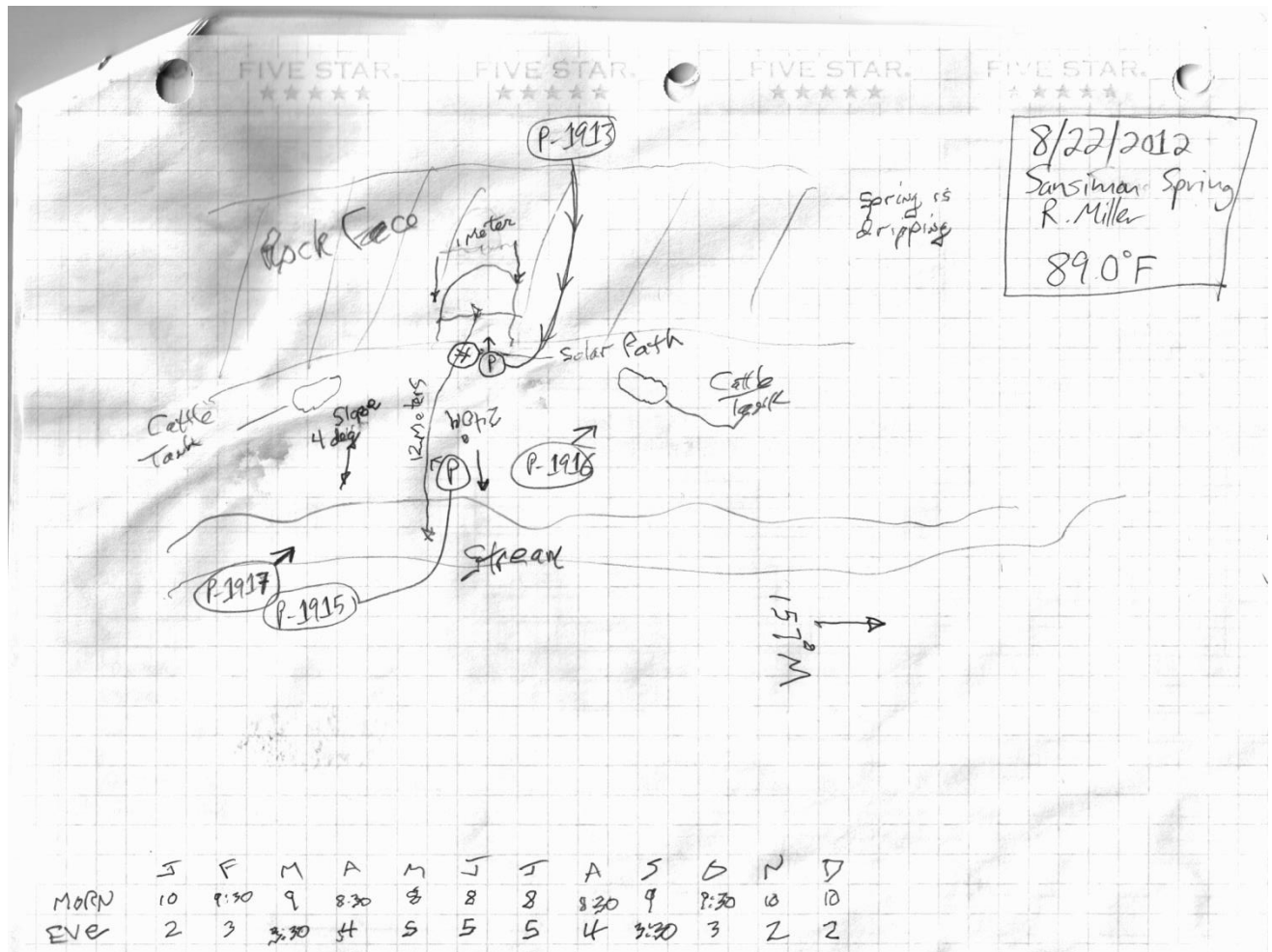
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 48.5 Sansimon Mine unnamed Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.33	2.00
Geomorphology	3.80	2.00
Habitat	4.00	2.60
Biota	5.25	2.00
Human Influence	4.38	2.86
Administrative Context		
Overall Ecological Score	4.10	2.15

**Management Recommendations:** This site is highly altered and no longer resembles its natural state. If the permittee is no longer using the cattle infrastructure at the site, restoration of the site to a more healthy ecological condition would be valuable. Water is making its way out of the spring box and creating a nice little moist run/wetland down to the creekbed. There is a lot of water available, but access to this USFS parcel is through a private ranch.



**Fig 48.2 Sansimon Mine unnamed Sketchmap.**

## 49. Sawmill Spring Survey Summary Report, Site ID 17072

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Sawmill Spring ecosystem is located in Santa Cruz County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 43' 44.501" latitude, -110 49'

16.97" longitude in the Mount Wrightson USGS Quad, measured using a Garmin GPS (NAD 83, 4.5 meters EPE). The elevation is approximately 2133 meters. Julia Fonseca, Karen Lowry, John Stansbury, and Dale Turner surveyed the site on 5/19/2012 for 01:50 hours, beginning at 12:50, and collected data in 7 of 12 categories.



**Fig 49.1 Sawmill Spring.**

**Physical Description:** Sawmill Spring is a hillslope spring. The microhabitat associated with the spring covers 336 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The emergence environment is subaerial, with a gravity flow force mechanism. The distance to the nearest spring is 262 meters.

**Survey Notes:** None recorded.

**Water:** Flow was measured at 0.6 L/s with a volumetric method. Measurement was taken at the spring box and seep head.

**Table 49.1 Sawmill Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	
Specific Conductance uS/cm	
Water Temperature °C	14.
Dissolved Solids	

**Flora:** Surveyors identified 13 plant species at the site.

**Table 49.2 Sawmill Spring Vegetation.**

Species	Cover Code	Native	Wetland
Aquilegia	GC		W
Carex sp	GC	N	W
Carex ultra	GC	N	
Eleocharis	GC	N	W
Juncus sp	GC	N	W
Mimulus	GC		W
moss	NV	N	F
Juniperus	SC	N	U
Quercus	SC		U
Arbutus arizonica	TC	N	
Fraxinus velutina	TC	N	R
Juglans major	TC	N	R
Pinus strobiformis	TC	N	

**Fauna:** There was no fauna recorded at this site due to time constraints. Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 49.3 Sawmill Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.17	2.00
Geomorphology	3.80	2.00
Habitat	4.40	1.80
Biota	4.50	2.00
Human Influence	4.56	1.88
Administrative Context		



Category	Condition	Risk
Overall Ecological Score	4.22	1.95

**Management Recommendations:** The spring is next to Sawmill Canyon trail and is at risk of trampling by people. The development at the spring may need maintenance to maintain flow. Fire in the area has reduced the canopy cover but that may allow other species to thrive. It will be important to monitor the spring for health and continue to protect the site from grazing.

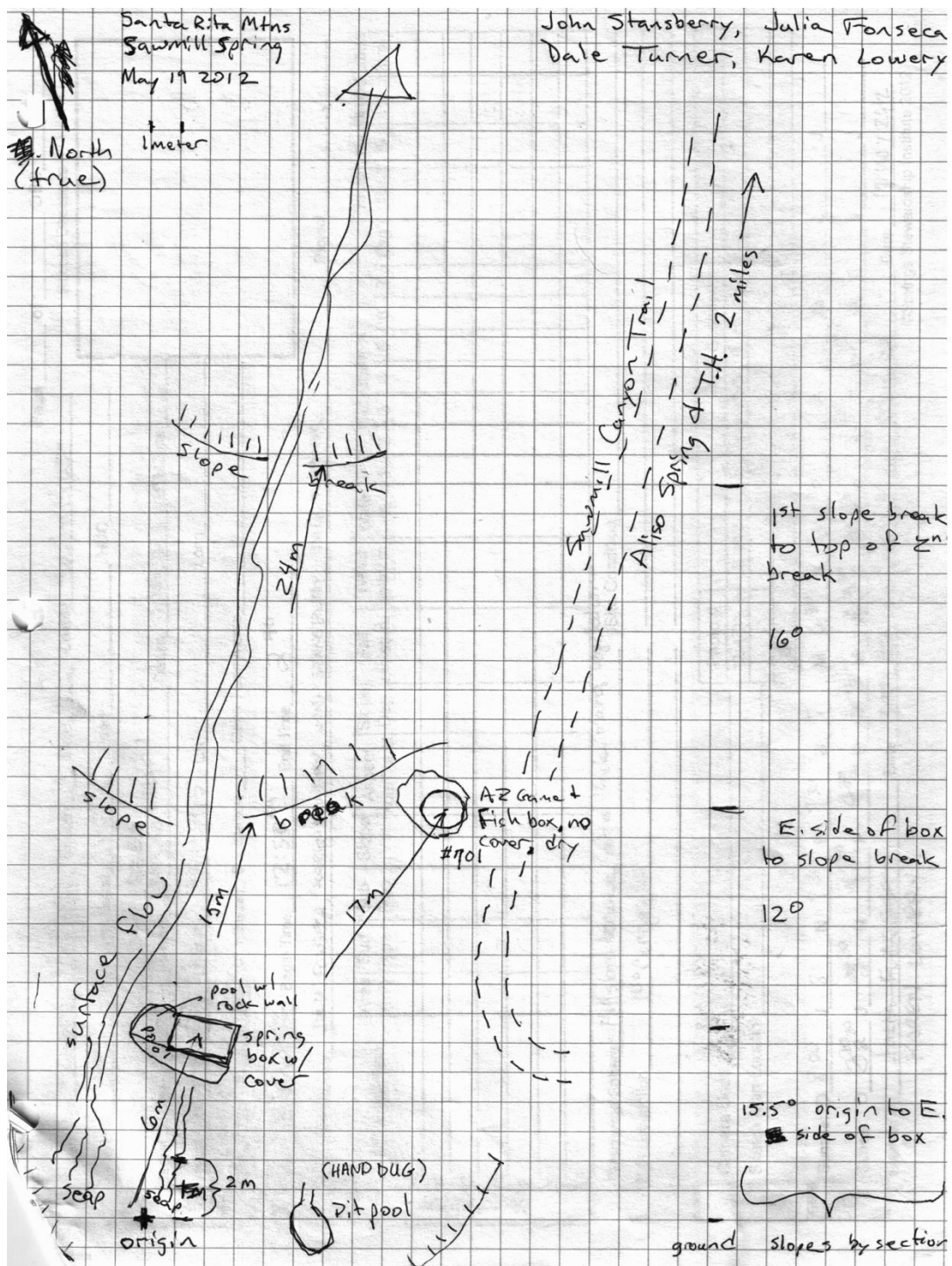


Fig 49.2 Sawmill Spring Sketchmap.

## 50. Scholefield Spring Survey Summary Report, Site ID 12935

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Scholefield Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 51' 43.82" latitude, -110 43' 11.01" longitude in the Empire Ranch USGS Quad, measured using a GPS (NAD 83, 5 meters EPE). The elevation is approximately 1492 meters. Dale Turner, Aida Castillo, Glenn Furnier, and Julia Fonseca surveyed the site on 5/20/2012 for 01:50 hours, beginning at 10:10, and collected data in 8 of 12 categories.



**Fig 50.1 Scholefield Spring.**

**Physical Description:** Scholefield Spring is a mound-form spring. This spring is located on a piedmont slope that is dissected by small gullies, which are incised into dark soils that look like old cienega soils (prehistoric). There is a plastic pipe that is cut and dry. A steel pipe emerges next to the plastic pipe which has dampness in it. There is also a steel barrel within the cienega which sticks up out of the ground several feet. At the downstream end of the site, outside of a fence there is an old cattle drinker with taverine deposits on it. There is evidence of old excavation at

the site, which was probably done to expose the spring flow. The microhabitat associated with the spring covers 416 m<sup>2</sup>.

The emergence environment is subaerial, with a flow force mechanism. The distance to the nearest spring is 1351 meters. The site receives approximately 100% of available solar radiation, with 7231 MJ annually.

**Survey Notes:** The site has some evidence of past excavation, but remains the same since a previous visit in 2006. The proximity of the site to the proposed Rosemont mine may effect the springs aquifer. Travertine deposits on an old cattle drinker indicate there was more flow in the past.

**Water:** There was no measurable flow. Water quality was taken with a thermometer and by observation. The water in a small pool appeared slightly turbid, and was brownish with a strong odor of decay. The water quality appeared similar to a visit in 2006.

**Table 50.1 Scholefield Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	
Specific Conductance uS/cm	
Water Temperature °C	16.8
Dissolved Solids	

**Flora:** There is evidence of Celtis recruitment. Surveyors identified 14 plant species at the site.

**Table 50.2 Scholefield Spring Vegetation.**

Species	Cover Code	Comments	Wetland Status
Condalia			
Carex ultra	GC	dominant species	
Clematis drummondii	GC		
Dicliptera resupinata	GC		
Sisymbrium irio	GC		F
Solanum elaeagnifolium	GC		R
Sporobolus	GC		F
Celtis laevigata var. reticulata	MC		R
Juniperus	SC		U
Prosopis velutina	SC		F
Rhus trilobata	SC		F
Vitis arizonica	SC		R
Ziziphus obtusifolia	SC		
Salix gooddingii	TC		R

**Fauna:** No invertebrates were documented at this location. Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens. One Broad-billed Hummingbird was observed at the site.



**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is high risk.

Geomorphology condition is moderate with some restoration potential and there is high risk.

Habitat condition is good with significant restoration potential and there is moderate risk.

Biotic integrity is very good with excellent restoration potential and there is moderate risk.

Human influence of site is very good with excellent restoration potential and there is moderate risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is high risk.

**Table 50.3 Scholefield Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.50	4.50
Geomorphology	3.20	4.60
Habitat	4.20	3.40
Biota	4.88	3.50
Human Influence	5.25	3.43
Administrative Context		
Overall Ecological Score	3.94	4.

**Management Recommendations:** Surveyors did not note any management recommendations.

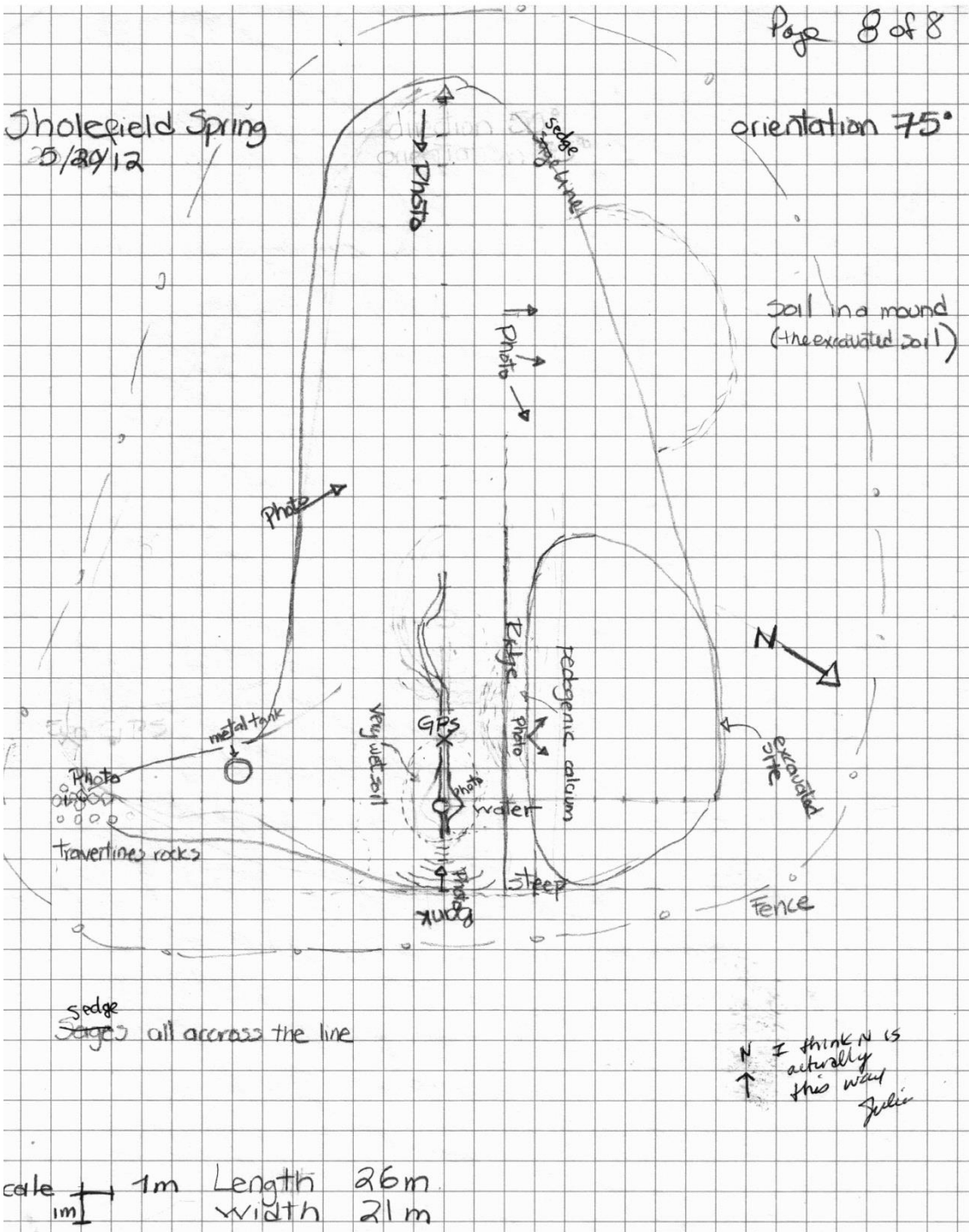


Fig 50.2 Scholefield Spring Sketchmap.

## 51. Silver Spring

### Survey Summary Report, Site ID 12907

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Silver Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 52' 59.88" latitude, -110 28' 3.967" longitude in the Mescal USGS Quad, measured using a Garmin GPS (NAD 83, 5 meters EPE). The elevation is approximately 1402 meters. Christopher Morris, Dennis Caldwell, Sami Hammer, Julia Fonseca, Joe Cisero, and Chris S. surveyed the site on 12/8/2012 for 00:16 hours, beginning at 15:19, and collected data in 5 of 12 categories.



Fig 51.1 Silver Spring.

**Physical Description:** Silver Spring is a rheocrene spring.

The distance to the nearest spring is 180 meters.

**Survey Notes:** There was no water at this site other than some moist ground. The channel was dominated with Sycamore and Ash.

**Water:** There was no flow or standing water from which to measure water quality.

**Flora:** Surveyors identified 9 plant species at the site.

**Table 51.1 Silver Spring Vegetation.**

Species	Cover Code	Native	Wetland
Carex spissa	GC	N	
Muhlenbergia rigens	GC	N	U
Schizachyrium scoparium	GC	N	F
Juniperus deppeana	MC	N	U
Platanus wrightii	MC	N	R
Prosopis velutina	SC	N	F
Rhus virens	SC	N	
Ziziphus oblongifolius	SC	N	R
Fraxinus velutina	TC	N	R

**Fauna:** Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens. No vertebrate species were observed or recorded.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 11 null risk scores. Aquifer functionality and water quality are very poor with very limited restoration potential and there is low risk.

Geomorphology condition is very good with excellent restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is good with significant restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 51.2 Silver Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	0.75	2.50
Geomorphology	4.80	2.00
Habitat	3.80	2.40
Biota	4.75	2.13
Human Influence	4.63	2.29
Administrative Context		
Overall Ecological Score	3.53	2.26



**Management Recommendations:** Surveyors did not note any management recommendations.

## 52. Smitty Spring

### Survey Summary Report, Site ID 12900

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Smitty Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, managed by the State. The spring is located at 31 55' 24.247" latitude, -110 30' 20.57" longitude in the The Narrows USGS Quad, measured using a Brinn's GPS GPS (NAD 83, 3.05 meters EPE). The elevation is approximately 1230 meters. B. Powell, J. Fonseca, D. Carter, I. Rodden, M. Rice, and D. Scalero surveyed the site on 6/28/2012, beginning at 13:20, and collected data in 8 of 12 categories.



**Fig 52.1 Smitty Spring.**

**Physical Description:** Smitty Spring is a rheocrene spring. The spring emerges from within the creek bed. The microhabitat associated with the spring covers 35 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 1284 meters. The site receives approximately 100% of available solar radiation, with 7240 Mj annually.

**Survey Notes:** The spring has been altered by recent human activity possibly road grading. The erosion potential is very high at this site.

**Water:** We collected water quality information at the pool at the head of the spring at a depth of 10 inches.

**Table 52.1 Smitty Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.6
Specific Conductance uS/cm	1
Water Temperature °C	24.2
Dissolved Solids	579

**Flora:** Surveyors identified 25 plant species at the site.

**Table 52.2 Smitty Spring Vegetation.**

Species	Cover Code	Native	Comments	Wetland
unknown Graminoid (grass or grasslike)				
Carex spissa var. ultra				
Adiantum capillus-veneris	GC	N		W
Carex chihuahuensis	GC	N	?	
Chenopodium	GC			F
Elymus elymoides	GC	N		F
Mimosa sp	GC			U
Sporobolus contractus	GC	N		F
Typha	GC			A
Celtis laevigata var. reticulata	MC	N		R
Populus fremontii	MC	N		R
Acacia constricta	SC	N		
Baccharis salicifolia	SC	N		R
Baccharis sarothroides	SC			R
Frangula californica	SC	N		U
Hymenoclea	SC			R
Juniperus monosperma	SC	N		U
Rhus microphylla	SC	N		
Rhus trilobata	SC	N		F
Salix Sp	SC	N	seep or coyote	R
Vitis arizonica	SC	N		R
Zizyphus obtusifolia	SC	N		
Fraxinus velutina	TC	N		R
Juglans major	TC	N		R
Salix gooddingii	TC	N		R

**Fauna:** Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens. Surveyors observed or recorded signs of 13 vertebrate species.

**Table 52.4 Smitty Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
yellow-breasted chat	1	obs	
mule deer		sign	tracks
bell's vireo	1		
javelina			
Bewick's wren			
house finch			
verdin			
ash-throated flycatcher			
Common ground dove			
cooper's hawk	1	obs	nesting/aggressive behavior
summer tanager			
pyrrhuloxia			
cassin's kingbird			

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 26 null condition scores, and 26 null risk scores.

**Table 52.5 Smitty Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.33	3.83
Geomorphology	2.00	4.40
Habitat	3.50	2.75
Biota	5.29	2.86
Human Influence	4.38	3.57
Administrative Context		
Overall Ecological Score	3.53	3.46

**Management Recommendations:** Surveyors did not note any management recommendations.

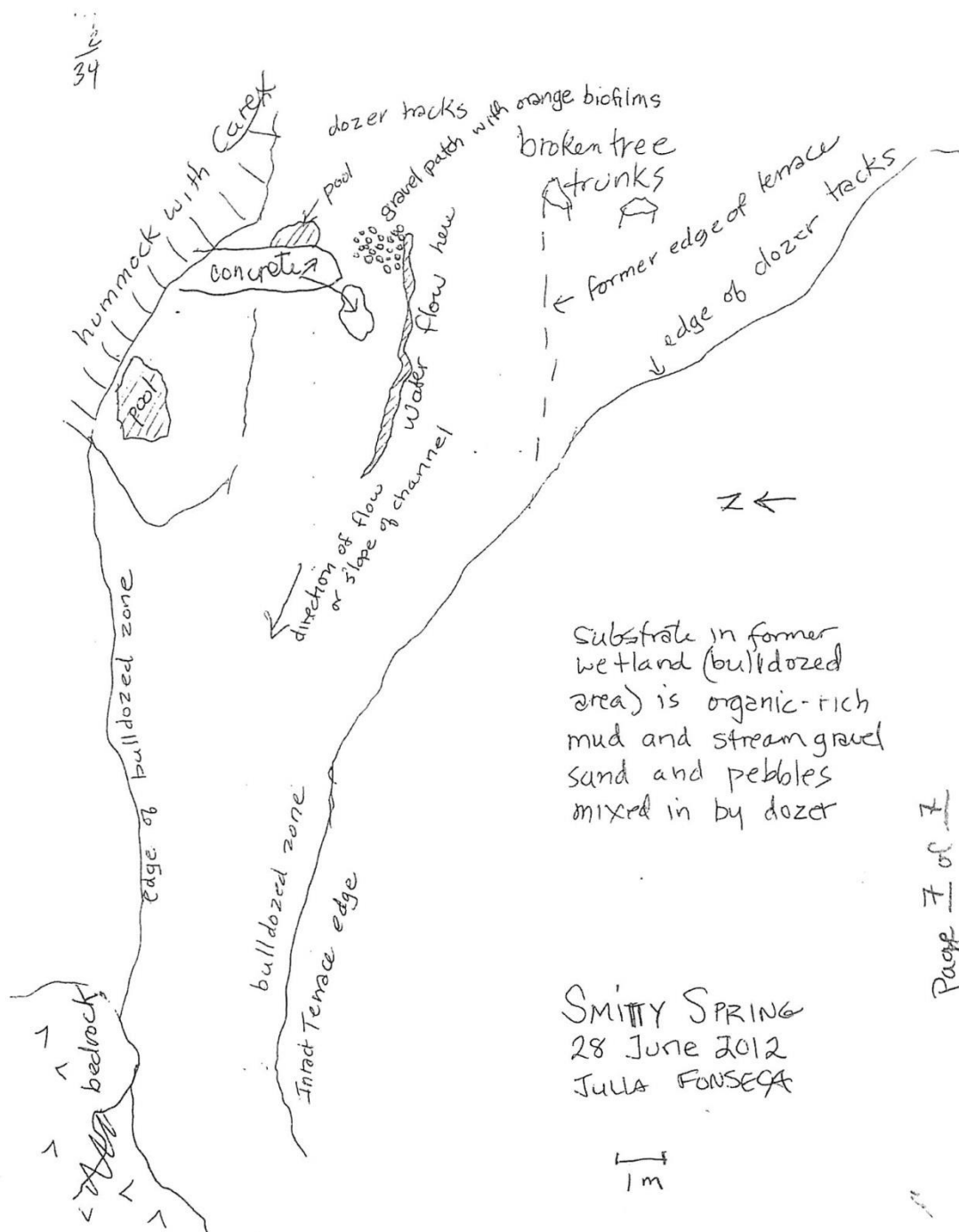


Fig 52.2 Smitty Spring Sketchmap.



### 53. Sycamore Canyon Unnamed Upper Survey Summary Report, Site ID 19153

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Sycamore Canyon Unnamed Upper ecosystem is located in Cochise County in the Upper San Pedro Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 23' 56.185" latitude, -110 23' 49.862" longitude in the Huachuca Peak USGS Quad, measured using a Garmin GPS 12 GPS (NAD83, 8 meters EPE). The elevation is approximately 1062 meters. Nick Deyo, Christopher Morris, and Trevor Hare surveyed the site on 11/6/2012 for 01:50 hours, beginning at 15:20, and collected data in 9 of 12 categories.



**Fig 53.1 Sycamore Canyon Unnamed Upper.**

**Physical Description:** Sycamore Canyon Unnamed Upper is a rheocrene spring. This rheocrene spring is in a channel in upper Sycamore Canyon with numerous pools and wetland vegetation below the spring emergence. This is a substantial aquatic/wetland habitat site in the Huachuca Mountains. The microhabitat associated with the spring covers 468 m<sup>2</sup>.

The emergence environment is subaerial, with a gravity flow force mechanism. It is mixed dominated. The distance to the nearest spring is 205 meters. The site receives approximately 94% of available solar radiation, with 6840 Mj annually.

**Survey Notes:** Site was moderately grazed with numerous wetland habitat patches. There was lots of water and longfin dace and turtles at the site. There were also signs of crayfish. There are likely green sunfish in the system according to the FS District Biologist.

**Water:** Flow was measured at 0.052 L/s with a volumetric method. Measurement was taken at the bottom of the spring reach approximately 50 meters downstream of the spring emergence.

**Table 53.1 Sycamore Canyon Unnamed Upper Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.6
Specific Conductance uS/cm	50
Water Temperature °C	15.2
Dissolved Solids	

**Flora:** Surveyors identified 17 plant species at the site.

**Table 53.2 Sycamore Canyon Unnamed Upper Vegetation.**

Species	Cover Code	Native Status	Wetland Status
<i>Quercus emoryi</i>		N	
<i>Bouteloua curtipendula</i>	GC	N	U
<i>Carex</i> sp	GC	N	W
<i>Claytonia</i>	GC	N?	F
<i>Lilaeopsis schaffneriana</i> var. <i>recurva</i>	GC	N	
<i>Muhlenbergia rigens</i>	GC	N	U
<i>Toxicodendron radicans</i>	GC	N	WR
<i>Juniperus deppeana</i>	MC	N	U
<i>Platanus wrightii</i>	MC	N	R
<i>Arctostaphylos</i>	SC	N	U
<i>Baccharis salicifolia</i>	SC	N	R
<i>Pinus edulis</i>	SC	N	U
<i>Rhus trilobata</i>	SC	N	F
<i>Vitis arizonica</i>	SC	N	R
<i>Arbutus arizonica</i>	TC	N	
<i>Fraxinus velutina</i>	TC	N	R
<i>Salix gooddingii</i>	TC	N	R

**Fauna:** Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens. Surveyors observed or reported signs of 4 vertebrate species.

**Table 53.3 Sycamore Canyon Unnamed Upper Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
longfin dace	30	obs	photo
Sonoran mud turtle	2	obs	
Blackneck garter snake	1	obs	
virile crayfish	1	sign	highly invasive

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are good with significant restoration potential and there is low risk.

Geomorphology condition is moderate with some restoration potential and there is moderate risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is very good with excellent restoration potential and there is negligible risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 53.4 Sycamore Canyon Unnamed Upper Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.17	1.83
Geomorphology	3.60	3.00
Habitat	4.20	2.20
Biota	4.88	2.63
Human Influence	4.89	1.75
Administrative Context		
Overall Ecological Score	4.21	2.41

**Management Recommendations:** This is a substantial and important wetland habitat in the Huachuca Mountains and cattle should be managed to protect the aquatic and wetland species found here. There were some erosional features that were noticed but it is undetermined if these are part of the natural function of the ecosystem, or they are of management concern. This is a likely site for Chiricahua leopard frog reintroduction. There was migrant traffic at the site and some trash. Small headcuts at the site should be monitored. There were invasive crayfish at the site but it would be difficult to eradicate. We recommend a re-survey for plants.

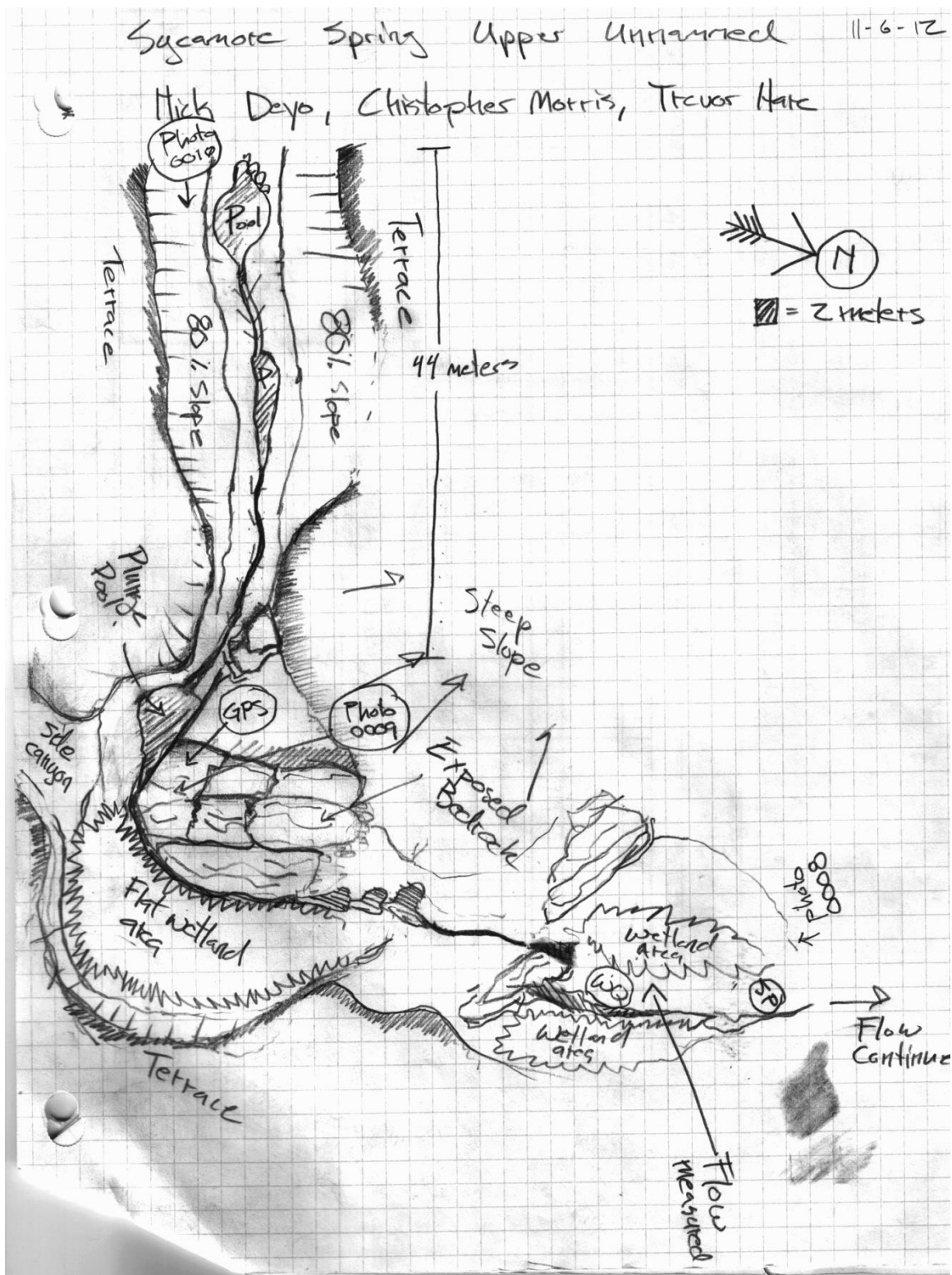


Fig 53.2 Sycamore Canyon Unnamed Upper Sketchmap.



## 54. Sycamore Spring Survey Summary Report, Site ID 15312

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Sycamore Spring ecosystem is located in Cochise County in the Upper San Pedro Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 23' 50.603" latitude, -110 23' 50.882" longitude in the Huachuca Peak USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 3 meters EPE). The elevation is approximately 1696 meters. Louise Misztal, Christopher Morris, Randy Serraglio, and Paul Condon surveyed the site on 6/16/2012 for 01:55 hours, beginning at 11:05, and collected data in 8 of 12 categories.



**Fig 54.1 Sycamore Spring.**

**Physical Description:** Sycamore Spring is a rheocrene spring. This is a rheocrene spring that emerges in a side drainage to Sycamore Canyon right next to a large sycamore tree. The mapped location of the spring is downstream from an extensive stretch of perennial water. The microhabitat associated with the spring covers 165 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The emergence environment is subaerial, with a gravity flow force mechanism. It is mixed dominated. The distance to the nearest spring is 205 meters. The site receives approximately 98% of available solar radiation, with 7095 Mj annually.

**Survey Notes:** The spring site at this visit is reduced to a small muddy area, but there are signs that there is likely a larger pool here in wetter times of the year. The site all around the the spring emergence is completely trampled by cows, there is lots of cow poop and the vegetation is heavily browsed. The site has a muddy depressed area that appears would form a pool in wetter seasons and that has a clear outflow channel dominated by gravel. The emergence point is surrounded by notable erosion and downcutting. There is bunch-grass dominated cienega like habitat above and below the emergence site.

**Water:** Surveyors did not record water quality data.

**Flora:** Surveyors identified 13 plant species at the site.

**Table 54.1 Sycamore Spring Vegetation.**

Species	Cover Code	Native	Comments	Wetland Status
Carex sp	GC	N		W
Equisetum hyemale	GC	N		WR
Juncus sp	GC	N		W
Lilaeopsis schaffneriana var. recurva	GC	N	lots present	
Mimulus	GC			W
Muhlenbergia rigens	GC	N		U
Polypogon monspeliensis	GC	I		WR
Juniperus deppeana	MC	N		U
Platanus wrightii	MC	N		R
Arctostaphylos pungens	SC	N		U
Baccharis salicifolia	SC	N		R
Rhus sp	SC			U
Arbutus arizonica	TC	N		

**Fauna:** Surveyors observed 1 terrestrial invertebrate specimen- LEP Nymphalidae Adelpha Eulalia. Surveyors observed or recorded signs of 9 vertebrate species.

**Table 54.2 Sycamore Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
Sonoran mud turtle	1	obs	
black-headed grosbeak	2	obs	male and female
hepatic tanager		obs	
Blue Grosbeak		obs	
brown-crested flycatcher		obs	
Dusky-capped Flycatcher		obs	
spiny lizard		obs	

Species Common Name	Qty	Detection Type	Comments
tree lizard		obs	
sulphur-bellied Flycatcher	2	obs	male and female

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is moderate risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

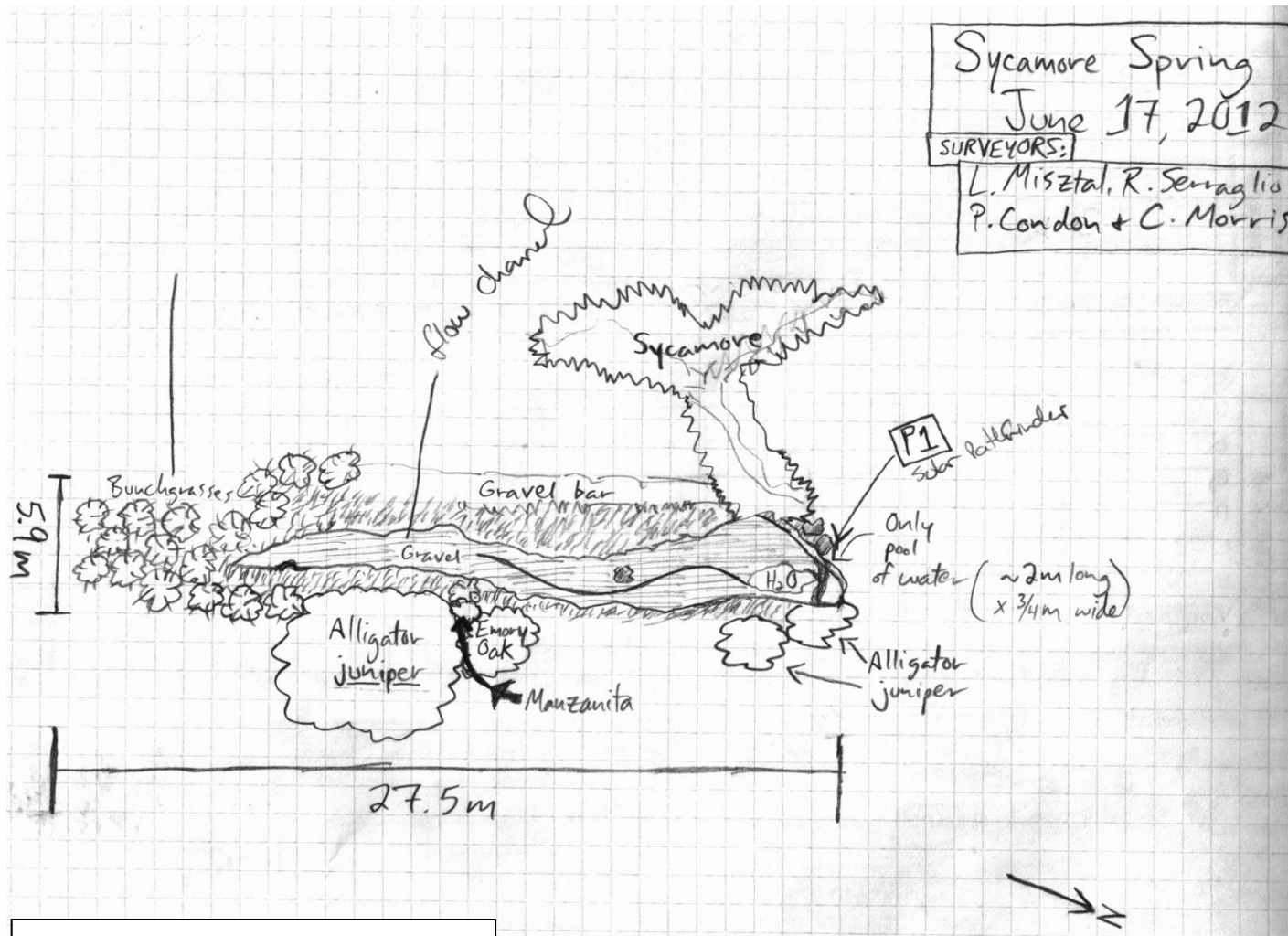
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 54.3 Sycamore Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.67	2.33
Geomorphology	4.40	2.80
Habitat	4.00	2.20
Biota	5.13	2.00
Human Influence	4.56	2.38
Administrative Context		
Overall Ecological Score	4.30	2.33

**Management Recommendations:** At the time of visit this site was heavily impacted by cows. Consider season and other factors in management of this area, and potentially fence cows out. The emergence point of the spring showed significant erosion and downcutting. Depending on management objectives, this erosion should be stabilized to prevent drying of upstream cienega habitat. There is a path that passes close to the spring source. Monitor human use to ensure it does not contribute to further erosion/downcutting.



**Fig 54.2 Sycamore Spring Sketchmap.**



## 55. Tunnel Spring

### Survey Summary Report, Site ID 12976

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Tunnel Spring ecosystem is located in Santa Cruz County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 42' 7.36" latitude, -110 47' 34.011" longitude in the Mount Wrightson USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83). The elevation is approximately 1693 meters. Matt Pollock, Eric Linzemeyer, Bill Beaver, Paul Condon, and Christopher Morris surveyed the site on 5/19/2013 for 00:20 hours, beginning at 16:55, and collected data in 1 of 12 categories.

**Physical Description:** Tunnel Spring is an artificial tank that is being fed by a long system of piping coming from a diversion tunnel .2 miles uphill (piping down from upper tunnel spring).

The distance to the nearest spring is 1905 meters.

**Survey Notes:** The tank has water in it at the time of visit.

**Water:** No water quality data were taken.

**Table 55.1 Tunnel Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	8.2
Specific Conductance uS/cm	
Water Temperature °C	19.
Dissolved Solids	

**Flora:** Surveyors identified 0 plant species at the site.

**Fauna:** Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens. 0 vertebrate species were observed.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 40 null condition scores, and 41 null risk scores. Aquifer functionality and water quality are very good with excellent restoration potential and there is low risk.

Geomorphology condition is very poor with very limited restoration potential and there is low risk.

Habitat condition is very good with excellent restoration potential and there is undetermined risk due to null scores

Biotic integrity is undetermined due to null scores and there is undetermined risk due to null scores

Human influence of site is undetermined due to null scores and there is undetermined risk due to null scores

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 55.2 Tunnel Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	5.00	2.00
Geomorphology	1.00	2.00
Habitat	5.00	
Biota		
Human Influence		
Administrative Context		
Overall Ecological Score	3.67	2.

**Management Recommendations:** Although this site is not actually a spring in itself it could be valuable frog habitat as a stopover water source, but frogs do not currently have a way to get in and out of the tank. You could install a frog ladder if there is a better measure of flow and it is high enough it may be possible to install a flow splitter and create wetland habitat on the site, but it would have to be fenced to keep cattle out. It is currently used for livestock management and is part of the range-management plan. It is in proposed Jaguar Critical Habitat.

## 56. Tunnels Unnamed

### Survey Summary Report, Site ID 16557

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Tunnels Unnamed ecosystem is located in Cochise County in the Upper San Pedro Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 22' 12.814" latitude, - 110 17' 43.246" longitude in the Montezuma Pass USGS Quad, measured using a Garmin GPS (NAD 83, 6.0999999 meters EPE). The elevation is approximately 2086 meters. Nick Deyo, Norma Miller, Ron Miller, Tim Allen, Caroline Bainstein, and Lauri Fleming surveyed the site on 6/16/2012 for 00:47 hours, beginning at 13:43, and collected data in 9 of 12 categories.



**Fig 56.1 Tunnels Unnamed.**

**Physical Description:** Tunnels Unnamed is a rheocrene spring. This spring is at the top of a steep canyon in a oak woodland. It is .5 km above an abandoned mine, also with water in it. Water seeps from a steep rock face and pools in a 10m x 10m patch of wetland vegetation. The microhabitat associated with the spring covers 117 m<sup>2</sup>.

The distance to the nearest spring is 744 meters. The site receives approximately 78% of available solar radiation, with 5635 Mj annually.

**Survey Notes:** The site appears to be in good condition. There is evidence of grazing further down in the canyon, but cattle do not appear to reach the upper reaches of the canyon where the spring is.

**Water:** Water quality was measured at the pool below the top of the spring at a depth of 6 inches.

**Table 56.1 Tunnels Unnamed Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.1
Specific Conductance uS/cm	692
Water Temperature °C	17.4
Dissolved Solids	

**Flora:** Surveyors identified 17 plant species at the site.

**Table 56.2 Tunnels Unnamed Vegetation.**

Species	Cover Code	Native Status	Comments	Wetland Status
algae sp	AQ	N		A
Aquilegia chrysantha	GC	N	"Golden AZ Columbine"	W
Bouvardia	GC		"Smooth bouvardia"	
Carex subfusca	GC	N		W
Cirsium arizonicum	GC	N		F
Equisetum	GC	N		WR
Festuca	GC			U
Galium	GC	I		F
Lobelia	GC		"Mountain lobelia"	
Mentha	GC			WR
Woodsia cochisensis	GC	N		
Yucca xschottii	GC	N		
Juniperus scopulorum	MC	N		U
Quercus arizonica	MC	N		R
Actaea	SC			
Agave	SC		"Schott's agave?"	
Pinus discolor	TC	N	"Border pine"	

**Fauna:** Surveyors were unable to assess faunal diversity. Surveyors collected or observed 0 aquatic and 2 terrestrial invertebrate specimens. Surveyors observed 3 vertebrate species.

**Table 56.3 Tunnels Unnamed Invertebrates.**

Species	Qty	Habitat	Species detail
HEM Miridae Phytocoris	1	T	
OPIL		T	"long-bodied spider"

**Table 56.4 Tunnels Unnamed Vertebrates.**

Species Common Name	Qty	Detection Type
canyon wren	1	obs
Bewick's wren	1	obs
hepatic tanager	1	obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 29 null condition scores, and 29 null risk scores.

**Table 56.5 Tunnels Unnamed Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	4.40	1.20
Geomorphology	4.60	1.40
Habitat	3.40	1.80
Biota	5.75	1.25



Category	Condition	Risk
Human Influence	5.38	1.43
Administrative Context		
Overall Ecological Score	4.54	1.41

**Management Recommendations:** Surveyors did not note any management recommendations.

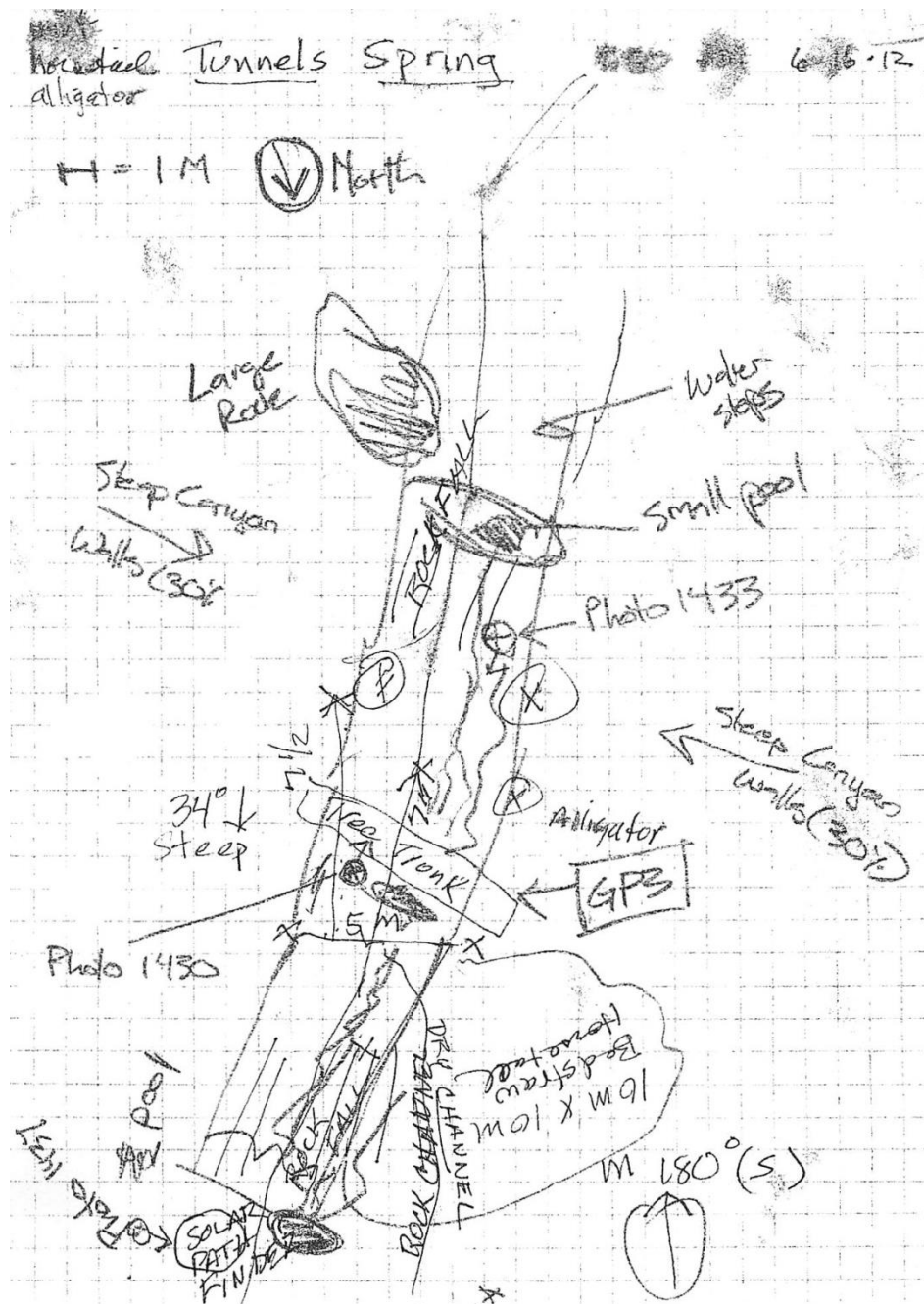


Fig 56.2 Tunnels Unnamed Sketchmap.

## 57. Unseen Spring

### Survey Summary Report, Site ID 17935

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Unseen Spring ecosystem is located in Pima County in the 8-digit HUC. The spring is located at 31.89 latitude, -110.54 longitude in the USGS Quad, measured using a (NAD 83). The elevation is approximately 1269 meters. Louise Misztal, Carianne Campbell, and Randy Serraglio surveyed the site on 10/4/2013 for 00:15 hours, beginning at 15:00, and collected data in 0 of 12 categories.

**Physical Description:** There was no indication of a spring anywhere near the coordinates of this spring. There was the start of a channel on a steep hillslope that looks like it could have been a hillslope spring a long time ago, but no remnant features/vegetation to confirm this.

The distance to the nearest spring is 1433 meters.

**Survey Notes:** We were unable to locate the spring site.

**Water:** No water quality data were taken.

**Flora:** Surveyors identified 0 plant species at the site.

**Fauna:** Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens, and no vertebrate species.

**Assessment:** No assessment was done.

**Management Recommendations:** Surveyors did not note any management recommendations.

## 58. Upper Walker Tank Unnamed

### Survey Summary Report, Site ID 17064

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Upper Walker Tank Unnamed ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 40' 20.473" latitude, -110 49' 2.169" longitude in the Mount Wrightson USGS Quad, measured using a GPS (NAD 83, 13 meters EPE). The elevation is approximately 1720 meters. Matt Pollock, Matt Rotunno, Austin Carey, and Trevor Best surveyed the site on 7/1/2012 for 02:00 hours, beginning at 12:00, and collected data in 9 of 12 categories.



**Fig 58.1 Upper Walker Tank Unnamed.**

**Physical Description:** Upper Walker Tank Unnamed is a rheocrene perennial spring. There is a bedrock channel and a series of pools. Vegetation is limited by the bedrock along water's edge. The microhabitat associated with the spring covers 80 m<sup>2</sup>.

The distance to the nearest spring is 2108 meters. The site receives approximately 79% of available solar radiation, with 5734 Mj annually.

**Survey Notes:** There is very little evidence of animal or human traffic at this site. It is free of litter and debris with little disturbance at the spring head. Overall this is a very healthy spring.

**Water:** Flow was measured at 0.075 L/s with a volumetric method. Water quality was collected at a depth of 8 cm.

**Table 58.1 Upper Walker Tank Unnamed Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.5
Specific Conductance uS/cm	



Characteristic Measured	Average Value
Water Temperature °C	26.5
Dissolved Solids	

**Flora:** No botanist was present on this survey. Surveyors identified 4 plant species at the site.

**Table 58.2 Upper Walker Tank Unnamed Vegetation.**

Species	Cover Code	Comments	Wetland Status
Populus		"cottonwoods"	WR
unknown	GC	cacti	
unknown grass	GC	several species	
Salix Sp	SC		R

**Fauna:** Some specimens were collected. Various aquatic insects were seen. Surveyors collected or observed 1 aquatic and 1 terrestrial invertebrate specimens. 2 vertebrate species were observed.

**Table 58.3 Upper Walker Tank Unnamed Invertebrates.**

Species	Qty	Lifestage	Habitat	Method
HEM		Ad	T	Spot
HEM Gerridae		Ad	A	Spot

**Table 58.4 Upper Walker Tank Unnamed Vertebrates.**

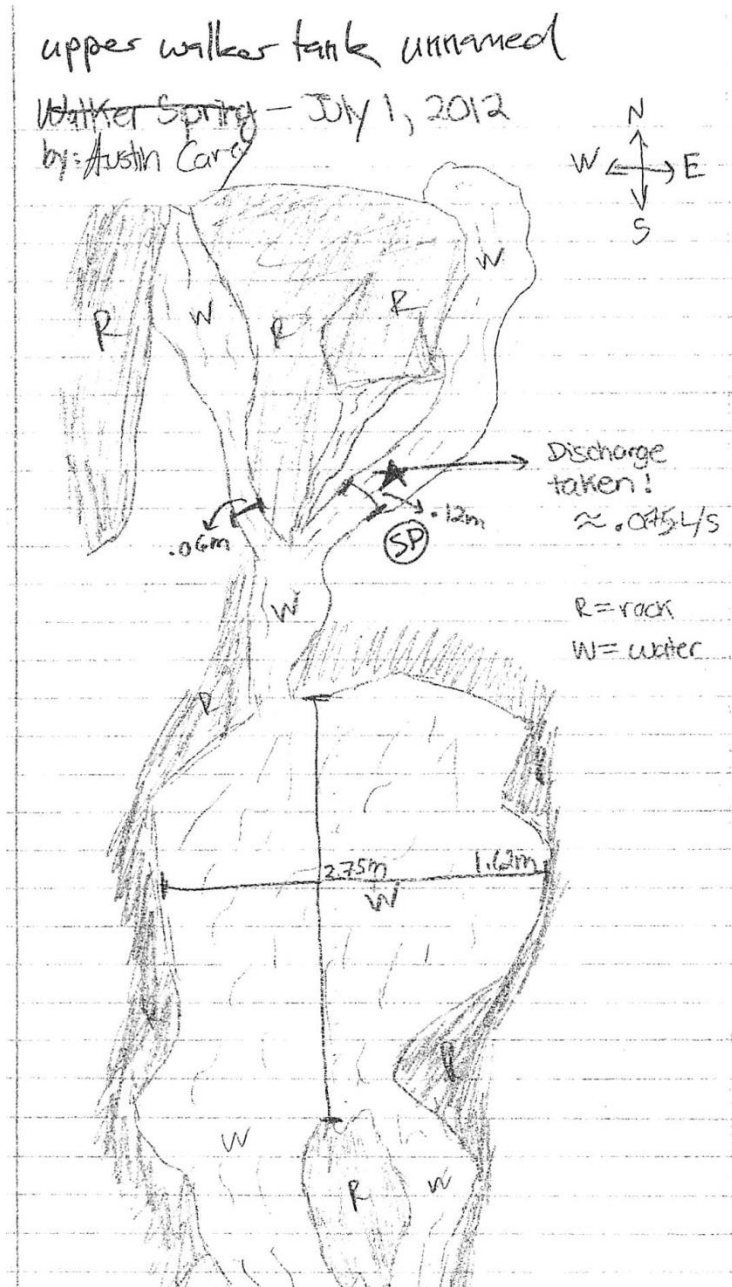
Species	Common Name	Qty	Detection Type
Bank Swallow		1	obs
coyote		1	obs

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 25 null condition scores, and 25 null risk scores.

**Table 58.5 Upper Walker Tank Unnamed Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.50	2.00
Geomorphology	4.60	2.20
Habitat	4.20	2.20
Biota	4.00	1.00
Human Influence	5.13	1.57
Administrative Context		
Overall Ecological Score	4.08	1.85

**Management Recommendations:** Surveyors did not note any management recommendations.



**Fig 58.2 Upper Walker Tank Unnamed Sketchmap.**

### 59. Van Trap Spring Survey Summary Report, Site ID 12883

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Van Trap Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 32° 4' 30.291" latitude, -110° 33' 13.481" longitude in the Rincon Peak USGS Quad, measured using a Garmin GPS (NAD 83, 3 meters EPE). The elevation is approximately 1412 meters. Glenn Furnier, Norma Miller, Karen Lowery, Christopher Morris, Nick Deyo, and Susan Qasho surveyed the site on 11/21/2012 for 00:56 hours, beginning at 14:14, and collected data in 9 of 12 categories.



**Fig 59.1 Van Trap Spring.**

**Physical Description:** Van Trap Spring is a hillslope spring. There is a wet spot originating from metamorphic rock in an 80 degree slope. This was the only water present. The microhabitat associated with the spring covers 20 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 1180 meters. The site receives approximately 96% of available solar radiation, with 6894 Mj annually.

**Survey Notes:** The site has been severely impacted by cows. The riparian-dominated habitat is 18.3 m long. There is old piping at the site that has fallen into disuse and is no longer capturing flow.

**Water:** The pH was measured at the site.

**Table 59.1 Van Trap Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.0
Specific Conductance uS/cm	
Water Temperature °C	
Dissolved Solids	

**Flora:** Surveyors identified 12 plant species at the site.

**Table 59.2 Van Trap Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Bouteloua barbata	GC	N	U
Cynodon dactylon	GC	I	WR
Eragrostis intermedia	GC	N	
Muhlenbergia rigens	GC	N	U
Celtis laevigata var. reticulata	MC	N	R
Populus fremontii	MC	N	R
Quercus arizonica	MC	N	R
Vauquelinia californica	MC	N	
Nolina microcarpa	SC	N	U
Opuntia	SC	N	U
Prosopis velutina	SC	N	F
Salix gooddingii	TC	N	R

**Fauna:** Surveyors collected or observed 0 aquatic and 2 terrestrial invertebrate specimens. Surveyors observed or recorded signs of 3 vertebrate species.

**Table 59.3 Van Trap Spring Invertebrates.**

Species	Habitat	Method	Species detail
HYM	T	Spot	photo more than 1
HYM Formicidae	T	Spot	more than 1



**Table 59.4 Van Trap Spring Vertebrates.**

Species Common Name	Qty	Detection Type	Comments
domestic cow	1	sign	scat
Gila woodpecker	1	obs	
chipping sparrow	2	obs	

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 10 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is moderate with some restoration potential and there is low risk.

Habitat condition is moderate with some restoration potential and there is low risk.

Biotic integrity is moderate with some restoration potential and there is low risk.

Human influence of site is very good with excellent restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 59.5 Van Trap Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.00	2.17
Geomorphology	3.00	2.40
Habitat	3.00	2.40
Biota	3.75	2.63
Human Influence	4.88	1.86
Administrative Context		
Overall Ecological Score	3.19	2.4

**Management Recommendations:** This site did not have any pooled water at the time of assessment, but would benefit from fencing to reduce impacts from herbivory. Site is very difficult to access.



## 60. Wakefield Spring Survey Summary Report, Site ID 12903

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Wakefield Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, managed by the State. The spring is located at 31 55' 50.778" latitude, -110 29' 54.95" longitude in the Mescal USGS Quad, measured using a GPS (NAD 83, 5 meters EPE). The elevation is approximately 1228 meters. B. Powell, J. Fonseca, D. Carter, I. Rodden, M. Price, and D. Scalero surveyed the site on 6/28/2012 for 03:25 hours, beginning at 09:30, and collected data in 10 of 12 categories.



Fig 60.1 Wakefield Spring.

**Physical Description:** Wakefield Spring is a limnocrone spring. This site consists of a cave at the base of the canyon wall and a moist slope covered in *Carex*. The microhabitat associated with the spring covers 5 m<sup>2</sup>. Geomorphic diversity is 0.0, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 1284 meters. The site receives approximately 72% of available solar radiation, with 5202 Mj annually.

**Survey Notes:** No notes were taken.

**Water:** Flow was measured at 0.031 L/s with a volumetric method. Measurements were taken within hillside spring source.

**Table 60.1 Wakefield Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	6.9
Specific Conductance uS/cm	
Water Temperature °C	20.9
Dissolved Solids	319

**Flora:** Surveyors identified 35 plant species at the site.

**Table 60.2 Wakefield Spring Vegetation.**

Species	Cover Code	Native Status	Comments	Wetland Status
<i>Acacia constricta</i>		N		
<i>Rhus microphylla</i>		N		
<i>Adiantum capillus-veneris</i>	GC	N		W
<i>Carex ultra</i>	GC	N		
<i>Eragrostis curvula</i>	GC	I		
<i>Marrubium vulgare</i>	GC	I	?	F
<i>Maurandella antirrhiniflora</i>	GC		snapdragon vine?	U
<i>Mimosa</i> sp	GC		prob <i>M.dysocarpa</i>	U
<i>Muhlenbergia porteri</i>	GC	N		U
<i>Penstemon</i>	GC	N	"laevigatus?"	U
<i>Rhus virens</i> var. <i>choriophylla</i>	GC	N		
<i>Sporobolus contractus</i>	GC	N		F
<i>Sporobolus wrightii</i>	GC	N		
<i>Toxicodendron radicans</i>	GC	N		WR
unknown grass	GC		in area of pond water	
<i>Celtis laevigata</i> var. <i>reticulata</i>	MC	N		R
<i>Morus nigra</i>	MC			R
<i>Platanus wrightii</i>	MC	N		R
<i>Populus fremontii</i>	MC	N		R
<i>Acacia greggii</i>	SC	N		F



Species	Cover Code	Native Status	Comments	Wetland Status
Baccharis salicifolia	SC	N		R
Condalia warnockii	SC	N		
Dasyilirion wheeleri	SC	N		
Hymenoclea	SC		salsola or monogyra?	R
Juniperus	SC	N	species 2	U
Juniperus monosperma	SC	N	species 1	U
Mortonia scabrella	SC	N		
Phoradendron	SC		mistletoe sp	
Prosopis velutina	SC	N		F
Tamarix	SC	I		WR
Vitis arizonica	SC	N		R
Zizyphus obtusifolia	SC	N	?	
Fraxinus velutina	TC	N		R
Juglans major	TC	N	saplings	R
Salix gooddingii	TC	N		R

**Fauna:** Surveyors observed 1 terrestrial ODO invertebrate specimen that was red. Surveyors observed or recorded signs of 19 vertebrate species.

**Table 60.3 Wakefield Spring Vertebrates.**

Species Common Name	Qty	Detection Type
mourning dove	1	obs
Common ground dove	1	obs
house finch	1	obs
Gambel's quail	1	obs
bell's vireo	1	obs
yellow warbler	1	obs
ash-throated flycatcher	1	obs
Broad-billed Hummingbird	1	obs
brown-headed cowbird	1	obs
javelina	1	obs
coyote	1	obs
Blue Grosbeak	1	obs
skunk	1	obs
northern mockingbird	1	obs
Dusky-capped Flycatcher	1	obs
hooded oriole	1	obs
summer tanager	1	obs
deer		sign
domestic cow		

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 9 null condition scores, and 9 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is low risk.

Habitat condition is good with significant restoration potential and there is low risk.

Biotic integrity is very good with excellent restoration potential and there is low risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is good with significant restoration potential and there is low risk.

**Table 60.4 Wakefield Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.50	2.00
Geomorphology	4.40	2.00
Habitat	4.20	2.00
Biota	5.13	2.00
Human Influence	4.38	2.29
Administrative Context		
Overall Ecological Score	4.31	2.

**Management Recommendations:** Surveyors did not note any management recommendations.

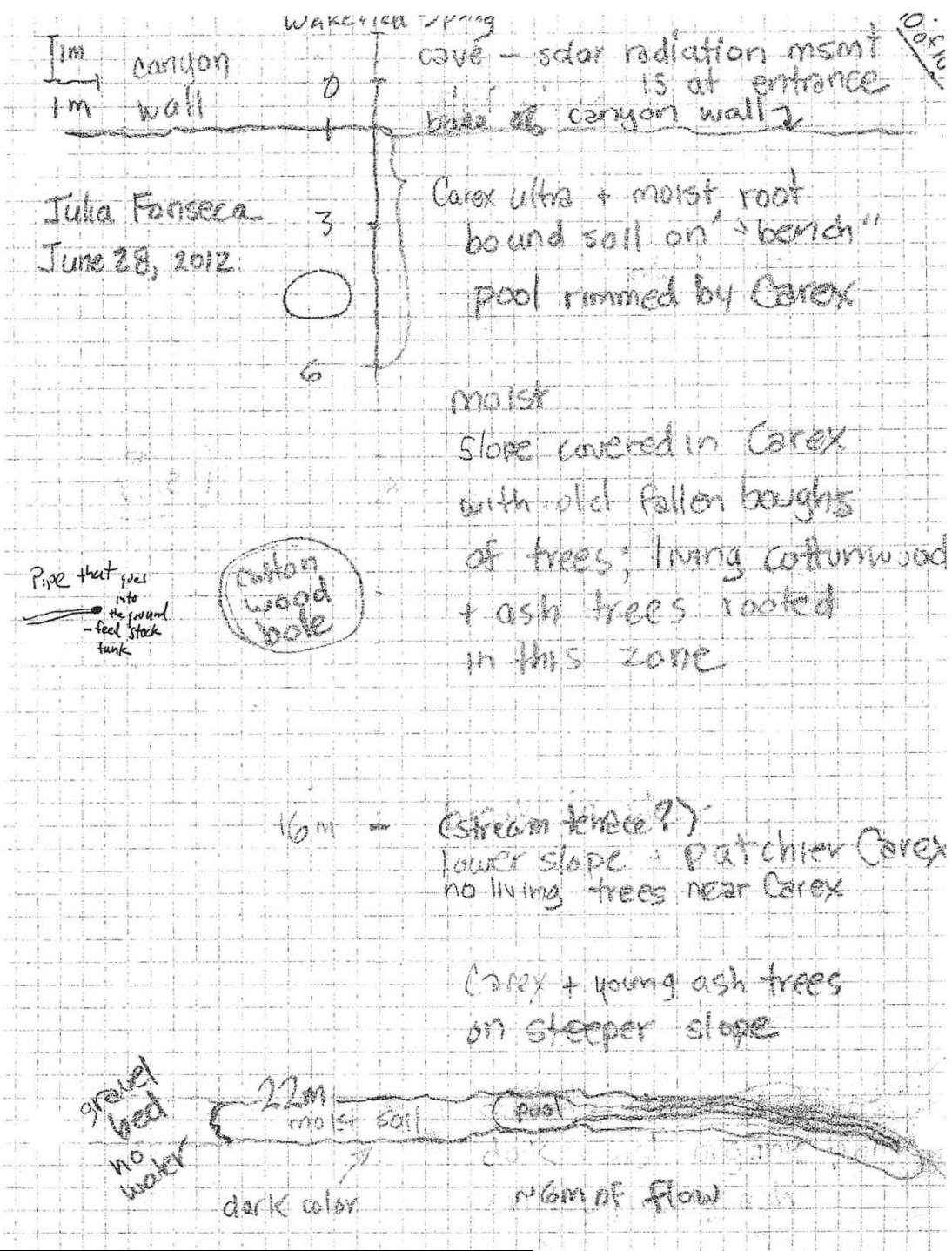


Fig 60.2 Wakefield Spring Sketchmap.

## 61. Walker BN Unnamed Survey Summary Report, Site ID 17065

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Walker BN Unnamed ecosystem is located in Santa Cruz County in the Upper Santa Cruz Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 40' 33.36" latitude, -110 48' 55.46" longitude in the Mount Wrightson USGS Quad, measured using a (NAD 83). The elevation is approximately 1836 meters. Matt Pollock, Matt Rotunno, Austin Carey, and Trevor Birt surveyed the site on 7/1/2012 for 01:30 hours, beginning at 10:00, and collected data in 0 of 12 categories.

**Physical Description:** No spring was found despite a thorough search.

The distance to the nearest spring is 993 meters.

**Survey Notes:** No evidence of a spring found. USFS says this site was filled in after the Florida Fire but used to have canyon tree frogs and water. It is on the USFS list for restoration in the next 5 years.

**Water:** No water quality data were taken.

**Flora:** Surveyors identified 0 plant species at the site.

**Fauna:** Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens, and 0 vertebrate species.

**Assessment:** No assessment was done.

**Management Recommendations:** Surveyors did not note any management recommendations.

## 62. Willow Spring Survey Summary Report, Site ID 12948

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Willow Spring ecosystem is located in Pima County in the Rillito Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31.83 latitude, -110.46 longitude in the Apache Peak USGS Quad, measured using a Garmin GPS 12 GPS (NAD 83, 7 meters EPE). The elevation is approximately 1610 meters. Nick Deyo, John Stansberry, Tim Allen, Keith Shallcross, and Bill Beaver surveyed the site on 3/17/2013 for 00:37 hours, beginning at 12:36, and collected data in 6 of 12 categories.





**Fig 62.1 Willow Spring.**

**Physical Description:** Willow Spring is a rheocrene spring. It is a heavily developed site in an oak woodland canyon. All water emerges from a pipe. There are lots of unused pipes and a 1 meter diameter dry tank. The microhabitat associated with the spring covers 885 m<sup>2</sup>. Geomorphic diversity is 0.17, based on the Shannon-Weiner diversity index.

The distance to the nearest spring is 3453 meters.

**Survey Notes:** The site is completely developed with most of the infrastructure in disrepair. A small amount of water frips from a pipe.

**Water:** WATER WAS COLLECTED THAT HAD BEEN COLLECTING IN A SECTION OF PIPE STARTED @ 12:34.

**Table 62.1 Willow Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.2
Specific Conductance uS/cm	576
Water Temperature °C	18.8
Dissolved Solids	

**Flora:** Surveyors identified 13 plant species at the site.

**Table 62.2 Willow Spring Vegetation.**

Species	Cover Code	Native Status	Wetland Status
Nolina			F
Opuntia			U
Agave schottii	GC	N	
Bouteloua curtipendula	GC	N	U
Muhlenbergia rigens	GC	N	U
Cercocarpus	MC		U
Juniperus scopulorum	MC	N	U
Quercus arizonica	MC	N	R
Ceanothus greggii	SC	N	U
Frangula californica	SC	N	U
Gutierrezia sarothrae	SC		F
Pinus discolor	TC	N	
Salix gooddingii	TC	N	R

**Fauna:** Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens. 0 vertebrate species were observed or reported at the site.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 11 null condition scores, and 12 null risk scores. Aquifer functionality and water quality are poor with limited restoration potential and there is moderate risk.

Geomorphology condition is poor with limited restoration potential and there is moderate risk.

Habitat condition is poor with limited restoration potential and there is moderate risk.

Biotic integrity is poor with limited restoration potential and there is moderate risk.

Human influence of site is good with significant restoration potential and there is low risk.

Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is poor with limited restoration potential and there is moderate risk.

**Table 62.3 Willow Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	2.00	3.00
Geomorphology	2.20	3.00
Habitat	2.20	3.75
Biota	2.43	3.14
Human Influence	4.00	2.71
Administrative Context		

Category	Condition	Risk
Overall Ecological Score	2.21	3.22

**Management Recommendations:** There are dead willows at the spring source. The source had been fenced and at this point is now in disrepair.





### 63. Yaqui Spring Survey Summary Report, Site ID 15344

Submitted December 23, 2013 by Sky Island Alliance

**Location:** The Yaqui Spring ecosystem is located in Cochise County in the Upper San Pedro Arizona 8-digit HUC, within Sierra Vista RD, Coronado Ntnl. Forest, managed by the US Forest Service. The spring is located at 31 20' 18.806" latitude, -110 17' 19.612" longitude in the Montezuma Pass USGS Quad, measured using a map (NAD 83). The elevation is approximately 1741 meters. Nick Deyo, Ron Miller, Norma Miller, and John Anderson surveyed the site on 6/16/2012 for 00:15 hours, beginning at 17:00, and collected data in 6 of 12 categories.



Fig 63.1 Yaqui Spring.

**Physical Description:** Yaqui Spring is a rheocrene spring. This site is a small pool with little vegetation. The microhabitat associated with the spring covers 1 m<sup>2</sup>. The site has 1 microhabitat, A -- a 1 sqm pool.

The distance to the nearest spring is 735 meters. The site receives approximately 100% of available solar radiation, with 7240 MJ annually.

**Survey Notes:** This area is heavily grazed. The surveyors were caught in a storm, thus the survey was cut short.

**Water:** Water quality measurements were taken from the pool at a depth of 4 inches because no flow was noted.

**Table 63.1 Yaqui Spring Water Quality with multiple readings averaged.**

Characteristic Measured	Average Value
pH	7.9
Specific Conductance uS/cm	870
Water Temperature °C	20.8
Dissolved Solids	

**Flora:** Incomplete plant list due to storm. Surveyors identified 4 plant species at the site.

**Table 63.2 Yaqui Spring Vegetation.**

Species	Cover Code	Comments	Wetland Status
Sporobolus	GC	"sacaton"	F
Juniperus scopulorum	MC		U
Rhus virens var. choriophylla	SC		
Vitis arizonica	SC		R

**Fauna:** No fauna noted. Surveyors collected or observed 0 aquatic and 0 terrestrial invertebrate specimens.

**Assessment:** Assessment scores were compiled in 6 categories and 41 subcategories, with 21 null condition scores, and 20 null risk scores. Aquifer functionality and water quality are moderate with some restoration potential and there is low risk.

Geomorphology condition is good with significant restoration potential and there is negligible risk.

Habitat condition is very poor with very limited restoration potential and there is negligible risk.

Biotic integrity is very good with excellent restoration potential and there is moderate risk.

Human influence of site is moderate with some restoration potential and there is negligible risk.

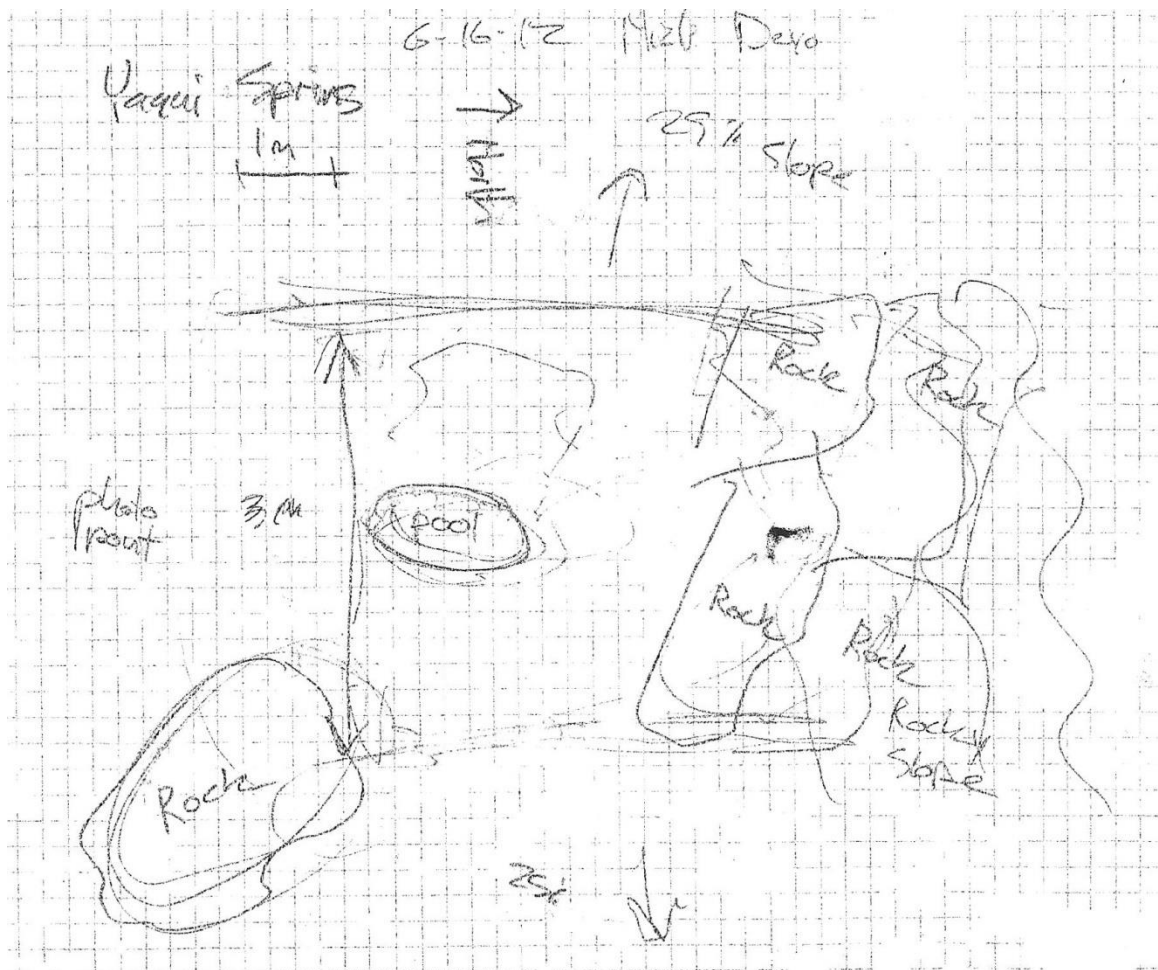
Administrative context status is undetermined due to null scores and there is undetermined risk due to null scores

Overall, the site condition is moderate with some restoration potential and there is low risk.

**Table 63.3 Yaqui Spring Assessment Scores.**

Category	Condition	Risk
Aquifer Functionality & Water Quality	3.00	2.00
Geomorphology	3.80	1.40
Habitat	1.75	1.40
Biota	5.00	3.00
Human Influence	3.00	1.71
Administrative Context		
Overall Ecological Score	3.39	1.95

**Management Recommendations:** Surveyors did not note any management recommendations.



**Fig 63.2 Yaqui Spring Sketchmap.**

