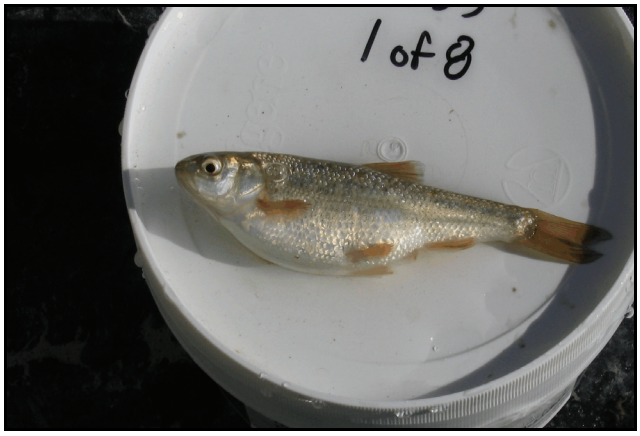
Ecological Evaluation of Selected Aquatic Ecosystems in the Biological Resources Study Area for the Southern Nevada Water Authority's Proposed Clark, Lincoln, and White Pine Counties Groundwater Development Project

F I N A L R E P O R T : V O L U M E 1

PR 987-1

March 2007



Submitted to:

Southern Nevada Water Authority
Department of Resources
1900 East Flamingo Road
Las Vegas, NV 89119

Submitted by:

M. Golden, E. Oborny, B. Albrecht, N. Norman,
J. Webster, S. Ripple, M. Robertson, and S. Herstein
BIO-WEST, Inc.
1063 West 1400 North
Logan, UT 84321

EcoAnalysts identified 24 taxa from 12 invertebrate orders in Wambolt Springs complex #2 and #3 (Appendix D, Appendix E). Crustaceans and mollusks dominated the community at this complex. The two Crustacea taxa (Osctracoda and *Hyallela* sp.) were the most dominant taxa, followed by the snail *Gyraulus* sp. and the Lake Valley springsnail (Hydrobiidae).

Other Fauna

We observed meadowlarks and sandhill cranes (*Grus canadensis*), as well as other unidentified songbirds during our surveys at the Wambolt Springs complex.

Disturbance

We characterized the Wambolt Springs complex #2 and #3 as slightly disturbed (Figure 18). While livestock use of the area was prevalent, damage was minimal. Additionally, at some point a berm was created, probably to pool water near the interface of the complex with a large marshy area. Sada (2005a) listed no diversion disturbance and slight to moderate cattle impacts.

Cave Valley

Cave Valley lies to the east of Lund, Nevada, between the Egan Range and the Schell Creek Range. The majority of Cave Valley is in Lincoln County, but the northern quarter of the valley is in White Pine County. The Hardy springsnail (*Pyrgulopsis marcida*) is known to occur in Cave Valley (Sada 2005a). The Hardy springsnail is endemic to Nevada and is on the State of Nevada's Rare (At-Risk) Species List (NVNHP 2004). The Hardy springsnail is a significant biological resource in Cave Valley.

Two aquatic systems of interest were identified in Cave Valley (Figure 19, Table 62). We were unable to sample either of these two systems, because access was not granted by the private landowner. Both aquatic systems of interest are in Lincoln County.

Table 62. Location, survey date, survey level, and ownership of aquatic systems of interest throughout Cave Valley in Lincoln County and White Pine County, Nevada.

SPRING NAME	NORTHING	EASTING	DATE SURVEYED	BIO-WEST SURVEY	OWNER
Cave Spring	4279238	691751	N/A	None/access	Private
Unnamed Spring at Parker Station	4282099	688176	N/A	None/access	Private

Note: UTM coordinates are in the NAD 83 projection system.

Figure 18. Wambolt Spring complex in Lake Valley, looking downstream from spring head #3 into the wetland area.

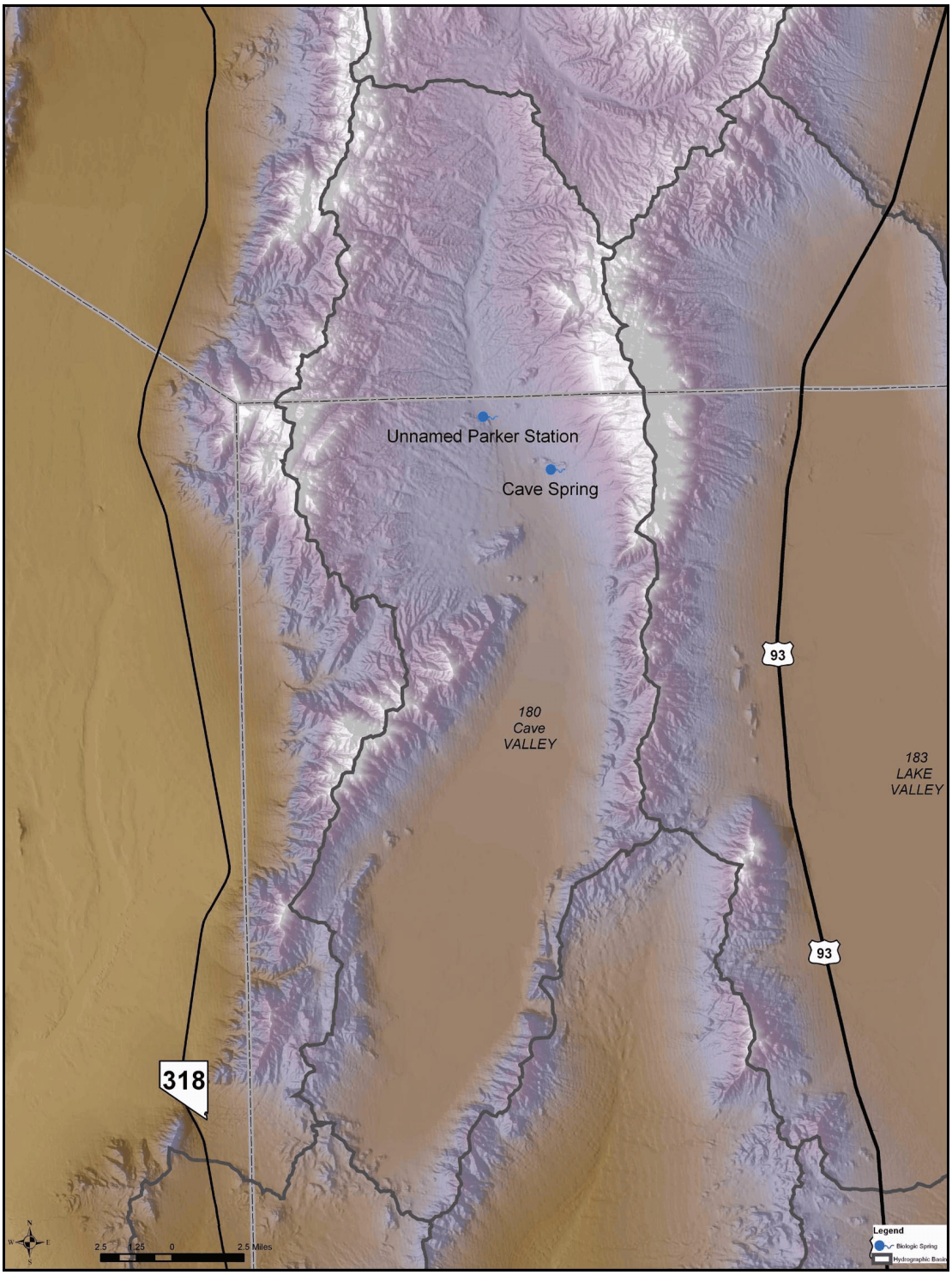


Figure 19. Map of locations of aquatic systems of interest in Cave Valley, Lincoln County and White Pine County, Nevada.

Physical Data and Water Quality

While we were unable to survey the aquatic systems of interest in Cave Valley, some physical and water quality data were available from surveys performed in June 1992 (Sada 2005a). Cave Spring appears to be considerably smaller than the Unnamed Spring at Parker Station (Table 63). Dissolved oxygen and conductivity differences between the two systems indicate that the Unnamed Spring at Parker Station probably has a deeper groundwater source than Cave Spring (Table 64).

Table 63. Type of system, maximum depth, maximum wetted width, length of survey plots, and measured discharge listed in Sada (2005a) for the aquatic systems of interest in Cave Valley, White Pine County, Nevada.

SYSTEM NAME	SYSTEM TYPE	MAXIMUM DEPTH (cm)	MAXIMUM WETTED WIDTH (m)	LENGTH (m)	DISCHARGE (l/s)
Cave	Rheocrene	3	2	N/A	N/A
Unnamed Parker Station	Helocrene	100	15	N/A	N/A

Table 64. Selected water quality parameters listed in Sada (2005a) for the aquatic systems of interest in Cave Valley White Pine County, Nevada.

SYSTEM NAME	LOCATION	TEMPERATURE (C)	DISSOLVED OXYGEN (mg/l)	CONDUCTIVITY (mS/cm)	pH
Cave	Source	12.1	9.2	116	7.8
Unnamed Parker Station	Source	14	3.2	454	7.7

Summary of Available Biological Information

Sada (2005a) indicated that both systems had watercress present and that the Unnamed Spring at Parker Station had 95% cover of EAV. They listed no EAV cover at Cave Spring. Snails in the subclass Pulmonata were the only organisms listed for Cave Spring. In addition to snails in the subclass Pulmonata, Sada (2005a) found that the Hardy springsnail was abundant at the Unnamed Spring at Parker Station. They also listed amphipods and the fingernail clam *Pisidium* sp. as present at the Unnamed Spring at Parker Station. They listed no fish or amphibian presence at either system. Hitchcock (2001) did not sample for northern leopard frogs in Cave Valley, but the species is found in several surrounding valleys, so it may be present in Cave Valley, too. Sada (2005a) listed both springs as highly disturbed by cattle and possibly excavated at one time. The June 1992 surveys listed in Sada (2005a) represent the only data we found pertaining to the aquatic communities at the aquatic systems of interest in Cave Valley.

Dry Lake Valley

Dry Lake Valley is in Lincoln County to the west of the towns of Pioche and Panaca, Nevada. The Burnt Springs Range borders Dry Lake Valley to the east, and the North Pahroc Range borders Dry Lake Valley to the west. The Flag springsnail has been found in Dry Lake Valley. The Flag springsnail is a significant biological resource in Dry Lake Valley, because it is endemic to Nevada and is on the State of Nevada Rare (At-Risk) Species List (NVNHP 2004).

Four aquatic systems of interest were identified in Dry Lake Valley (Figure 24, Table 76). We completed a Level 2 survey at Coyote Spring. Both Bailey and Fence Springs were visited in September 2004 and determined to be mountain block springs, so we completed a Level 1 survey at each location (Figure 25). Meloy Spring was not surveyed because we were unable to obtain access to this private property from the landowner. Meloy Spring also appears to be in the mountain block.

Physical Habitat and Water Quality Data

Physical habitat and water quality data were collected at Coyote Spring, Bailey Spring, and Fence Spring, and some physical habitat and water quality information was available from a June 1992 survey of Meloy Spring (Sada 2005a). When we visited Coyote Spring during the June/July 2004 reconnaissance trip and again in August 2006, we found a highly modified system. The springs were piped into two concrete stock tanks. The tanks are 6 m x 6 m squares adjoined in the middle. The south tank was dry when we were there. An additional steel tank was present on a knoll to the east of the concrete tanks. The vegetation around the knoll and the hose exiting the tank suggested that water can somehow emanate from this tank, too. It appeared as though a spring once originated from the hillside to the west (near the dwelling and grove of cottonwoods) and flowed through the area with the stock tanks.

Table 76. Location, survey date, survey level, and ownership of aquatic systems of interest throughout Dry Lake Valley in Lincoln County, Nevada.

SPRING NAME	NORTHING	EASTING	SURVEY DATE	BIO-WEST SURVEY LEVEL	OWNER
Bailey Spring	4227770	698974	9/18/2004	Level 1	BLM
Coyote Spring	4211323	687714	8/24/2006	Level 2	BLM
Fence Spring	4228232	700066	9/18/2004	Level 1	BLM
Meloy Spring[a]	4236040	700892	N/A	None/access	Private

Note: UTM coordinates are in the NAD 83 projection system.
[a]Data taken from Sada (2005a).

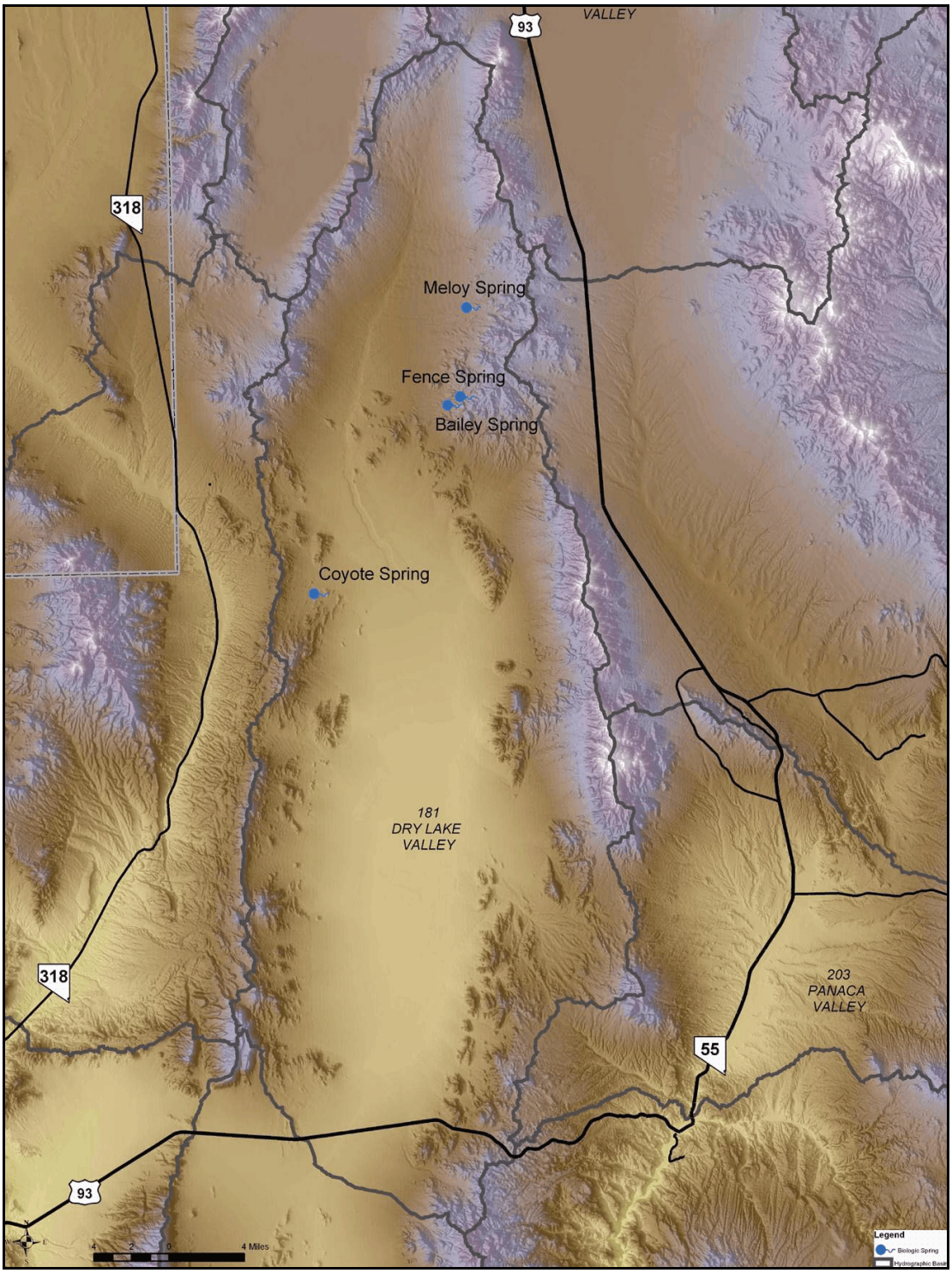


Figure 24. Aquatic systems of interest throughout Dry Lake Valley in Lincoln County, Nevada.

Figure 25. Top to bottom: Bailey Spring (a), and Fence Spring (b), in Dry Lake Valley.

Bailey, Fence, and Meloy Springs were all fairly small, shallow systems (Table 77). While Bailey and Meloy Springs had similar water temperatures at their sources, we found lower dissolved oxygen levels and higher conductivities at Bailey Spring (Table 78).

Table 77. Type of system, maximum depth, maximum wetted width, length of survey plots, and measured discharge found at aquatic systems of interest in Dry Lake Valley, Lincoln County, Nevada.

SYSTEM NAME	SYSTEM TYPE	MAXIMUM DEPTH (cm)	MAXIMUM WETTED WIDTH (m)	LENGTH (m)	DISCHARGE (l/s)
Bailey Spring	Rheocrene	7	9.95	48	N/A
Coyote Spring	unknown	50.5	6.1	97	N/A
Fence Spring	Rheocrene	1	3.2	37	N/A
Meloy Spring[a]	Rheocrene	2	1	N/A	N/A

Table 78. Selected water quality parameters measured at the main source of aquatic systems of interest in Dry Lake Valley, Lincoln County, Nevada.

SYSTEM NAME	LOCATION	TEMPERATURE (C)	DISSOLVED OXYGEN (mg/l)	CONDUCTIVITY (µS/cm)	pH
Bailey Spring	Source	13.4	4.3	760	7.44
Coyote Spring	Source	26.4	10.3	366	8.60
Fence Spring[a]	N/A	N/A	N/A	N/A	N/A
Meloy Spring[b]	Source	14.2	9.3	507	7.40

[a]Not enough water to obtain an accurate measurement of water quality parameters.
[b]Data taken from Sada (2005a).

Aquatic Vegetation

We identified only one species of SAV, horsehair algae, in Coyote Spring, which was abundant (100% coverage). We identified four taxa of EAV including only trace amounts of sweetclover, foxtail barley, curly dock, and an unknown species of grass. There were three tree species observed at the site, abundant Freemont cottonwood (*Populus fremontii*) (80%), skunkbrush (*Rhus trilobata*) (20%), and uncommon water jacket (*Lycium andersonii*).

Vegetation Mapping

We mapped vegetation at Bailey Spring and Fence Spring in September 2005 and Coyote Spring vegetation in August 2006. These systems are small (less than 1 acre). Nine species were identified among the three springs (Appendix C). All vegetation at Bailey Spring was classified as Adventive Plant Herbaceous Alliance (Table 79). The primary vegetation at Fence Spring was skunkbrush). A small amount of Torrey's rush (*Juncus torreyi*) was present during mapping efforts at Fence Spring. Coyote Spring was primarily Fremont Cottonwood Vegetation Association and a smaller area with the Skunkbrush Sumac Vegetation Association.

Fish

We did not survey for fish at Bailey Spring or Fence Spring, because we surveyed them using Level 1 protocols. However, we felt that no fish habitat was available at either of these sites. The only fish habitat available at Coyote Spring was in the stock tank. Water clarity was high and you could see to the bottom of the tank. No fish were observed.

Amphibians

We observed four large (> 250 mm) adult tiger salamanders (*Ambystoma tigrinum*) in the stock tank at Coyote Spring. During surveys for small mammals around Coyote Spring in May 2005, SNWA personnel also observed tiger salamanders, as well as Great Basin spadefoot toad, in the concrete stock tanks (A. Ambos 2006, pers. comm.). They also observed four or five approximately 25-mm-long adult salamanders and dozens of larvae (approximately 5-10 cm). In addition to many tadpoles in puddles near one of the stock tanks, SNWA personnel also observed four adult Great Basin spadefoot toads.

Springsnails and Other Invertebrates

We did not find springsnails at Bailey Spring, Coyote Spring, or Fence Spring. Meloy Spring has a population of the Flag springsnail. Survey results from June 1992 listed in Sada (2005a) show that the Flag springsnail was abundant in Meloy Spring. The Flag springsnail is only known to occur in one other location, Flag Springs in White River Valley. Ten other systems in Dry Lake Valley were surveyed, but no other springsnail populations were found (Sada 2005a).

At Coyote Spring we collected three different taxa of aquatic invertebrates (Appendix D and Appendix E). EcoAnalysts found that seed shrimp (Ostracoda) dominated the collection, comprising over 99% of the sample. Beetles (Coleoptera) and midges (Diptera/Chironomidae) were also identified in the collection.

Table 79. The proportion of the area mapped (less than 1 acre) comprised of each association (alliance) at aquatic systems of interest throughout Dry Lake Valley in Lincoln County, Nevada.

ASSOCIATIONS / ALLIANCES[a] IN DRY LAKE VALLEY	BAILEY SPRING (0.05 ACRE [0.02 HECTARE])	COYOTE SPRING (0.77 ACRE [0.31 HECTARE])	FENCE SPRING (0.05 ACRE [0.02 HECTARE])
Open Water/ Undesignated Alliance		1.29%	
Adventive Plant Herbaceous / Undesignated Alliance	100%	3.89%	
Juncus torreyi (Torrey's Rush) Herbaceous Vegetation / Undesignated Alliance			18%
Populus fremontii Mixed Herbaceous Woodland / *Populus fremontii* Seasonally Flooded Woodland		70.13%	
Rhus trilobata (Skunkbush Sumac) Intermittently Flooded Shrubland / *Rhus trilobata* Intermittently Flooded Shrubland		24.68%	82%

[a] Note that within each cell describing the associations and alliances, the associations are shown first and alliances second.

Other Fauna

When we visited Coyote Springs on our reconnaissance trip, we found that the north tank had dense algal growth. We also found evidence of both bird and cattle use of the tanks. No algae was present on the surface of the water during our August 2006 Level 2 survey at Coyote Springs. In addition to the tiger salamanders we observed in the tank, we also saw short-eared owls (*Asio flammeus*), American crows (*Corvus brachyrhynchos*), an unidentified warbler, and a dead raptor or owl decaying in the tank.

Disturbance

As we stated above, we found Coyote Spring to be highly disturbed by diversion and livestock (Figure 26). It appeared that the original spring head was to the west of the stock tanks and had been excavated, piped, and buried.

Figure 26. Coyote Spring in Dry Lake Valley.

Delamar Valley

Hubbs and Miller (1948) speculated that Delamar Valley may have been a tributary to the pluvial White River system, although we could find no records of fishes collected from this valley. Delamar Valley is located in Lincoln County just west of Caliente, Nevada. The valley is bounded by the Delamar Mountains to the east and the Pahroc Range to the west. Grassy Spring was the only aquatic system of interest identified in Delamar Valley (Figure 27, Table 80).

Table 80. Location, survey level, and ownership of Grassy Spring in Delamar Valley, Lincoln County, Nevada.

SPRING NAME	NORTHING	EASTING	SURVEY DATE	BIO-WEST SURVEY LEVEL	OWNER
Grassy Spring	4157322	694969	9/18/2004	Level 2	BLM

Note: UTM coordinates are in the NAD 83 projection system.

Physical Habitat and Water Quality Data

Grassy Spring consisted of a small piped spring head that emptied into a circular stock tank. The tank had overflowed into a pond approximately19 m in diameter (Table 81). When we visited Grassy Spring in September 2004, the discharge volume from the pipe was low. However, we did note that the system was larger in the past, indicating that in higher water years the spring may have greater discharge. Sada (2005a) listed considerably higher dissolved oxygen levels (7.5 mg/l) at Grassy Spring from a June 1992 survey, but the remainder of our water quality measurements were similar to those from that 1992 survey (Table 82).

Table 81. Type of system, maximum depth, maximum wetted width, length of survey plots, and measured discharge for Grassy Spring in Delamar Valley, Lincoln County, Nevada.

SYSTEM NAME	SYSTEM TYPE	MAXIMUM DEPTH (cm)	MAXIMUM WETTED WIDTH (m)	LENGTH (m)	DISCHARGE (l/s)
Grassy Spring	Unknown	64	19	52	0.02

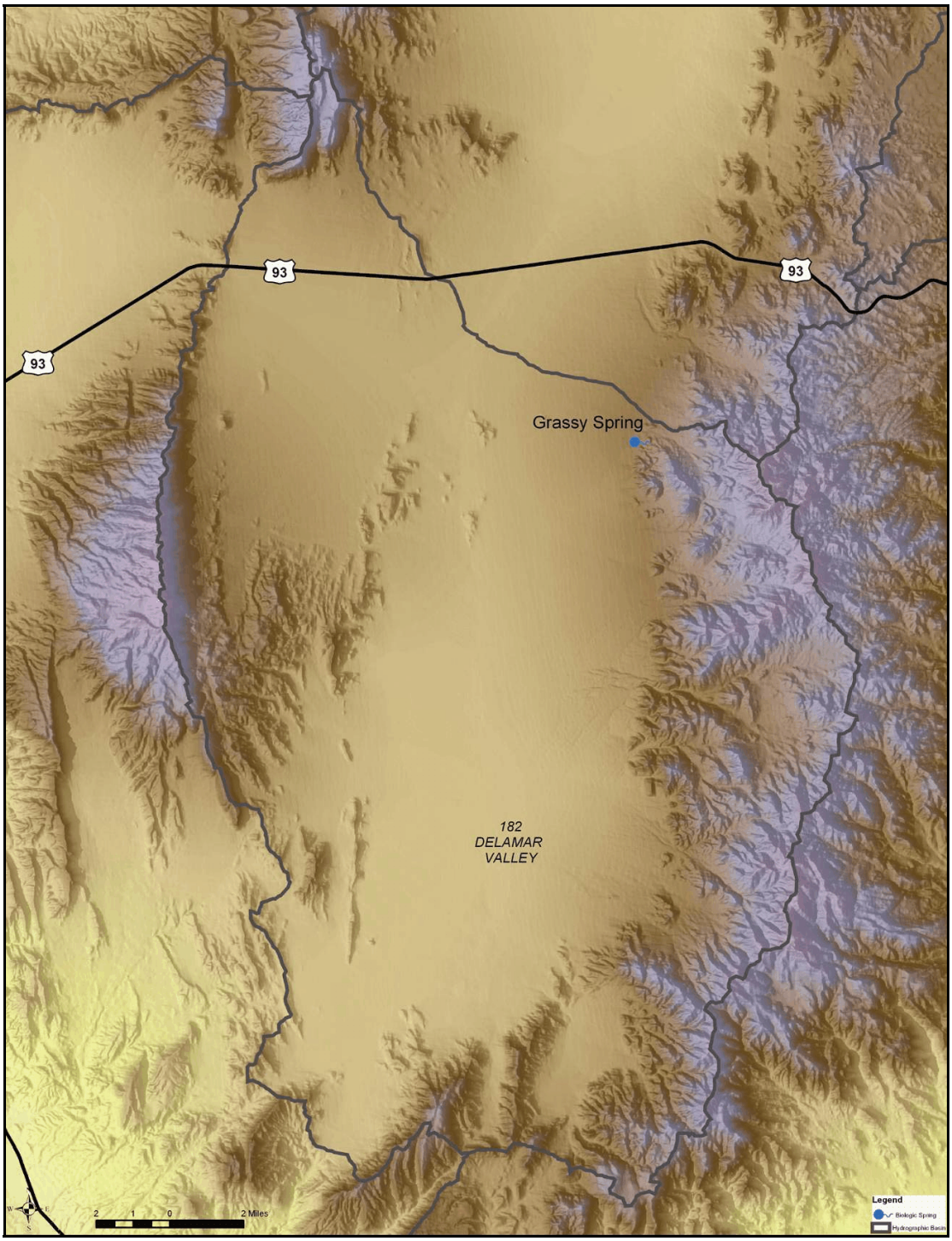


Figure 27. Map of locations of aquatic systems of interest in Delamar Valley, Lincoln County, Nevada.

Table 82. Selected water quality parameters measured at the main source and termination of our sampling site at Grassy Spring in Delamar Valley, Lincoln County, Nevada.

SYSTEM NAME	LOCATION	TEMPERATURE (C)	DISSOLVED OXYGEN (mg/l)	CONDUCTIVITY (mS/cm)	pH
Grassy Spring	Source/terminus	15.19/11.51	3.96/5.38	615/1198	7.46/8.65

Aquatic Vegetation

We only identified four species of aquatic vegetation at Grassy Spring. Muskgrass was the dominant SAV (75%), and horsehair algae (25%) was the only other SAV present. Around the terminal pond the EAV was an even mixture of rabbit-foot grass and spikerush (50% each).

Vegetation Mapping

We mapped vegetation surrounding Grassy Spring in September 2005. Most of the area at Grassy Spring was classified as open water with no vegetation (Table 83). The primary vegetation association at Grassy Spring was hardstem bulrush (*Schoenoplectus acutus*).

Table 83. The proportion of the 0.2 acre mapped comprised of each association (alliance) at Grassy Spring in Delamar Valley, Lincoln County, Nevada.

ASSOCIATIONS/ALLIANCES IN DELAMAR VALLEY	GRASSY SPRING 0.23 ACRE (0.092 HECTARE)
Open Water / Undesignated Alliance	65.6%
Schoenoplectus acutus (Hardstem Bulrsuh) Herbaceous Vegetation/ *Schoenoplectus acutus* - *Schoenoplectus tabernaemontani* (Softstem Bulrush) Semipermanently Flooded Herbaceous	22.6%
Non-rooted Aquatic Plant and Algae Vegetation / Undesignated Alliance	11.8%

Fishes

We did not sample for fish at Grassy Spring, because we felt adequate fish habitat was not available. In addition, we could visually observe nearly all of the aquatic habitat during our survey, and we observed no fish. Sada (2005a) did not observe fish during surveys in June 1992.

Amphibians

We did not observe any amphibians during our survey of Grassy Spring, but Sada (2005a) found unknown tadpoles in Grassy Spring during surveys in June 1992. In May 2005 SNWA personnel observed eight adult Great Basin spadefoot toad using the area in and around Grassy Spring (A. Ambos 2006, pers. comm.).

Springsnails and Other Invertebrates

No springsnails were collected or observed in surveys at Grassy Spring in Delamar Valley. Sada (2005a) found no springsnails in June 1992 surveys of Grassy Spring. In fact, EcoAnalysts only found nine taxa representing five orders of aquatic invertebrates in our sample at Grassy Spring (Appendix D, Appendix E). Over 85% of the organisms identified were seed shrimp. Sada (2005a) listed surveys of three other systems in Delamar Valley, but during those surveys no springsnail populations or other notable aquatic species were found.

Other Fauna

We observed pronghorn, coyote, and rabbit tracks around Grassy Spring.

Disturbance

Grassy Spring was highly disturbed (Figure 28). The original spring was piped into a stock tank, which overflowed into a pond. Based on our vegetation survey, it appeared as though the seepage from the tank varied as a result of large, seasonal water fluctuations. Sada (2005a) suggested, based on the invertebrate community, that the seepage was probably ephemeral. The paucity of taxa in our invertebrate samples and the predominance of vagile or drought-tolerant taxa supports these observations.

Figure 28. Top to bottom: Grassy Spring source (a), and terminus (b), in Delamar Valley.