Nevada Natural Heritage Program

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DRI
Desert Research Institute

NEVADA SPRINGS

CONSERVATION PLAN

ACKNOWLEDGEMENTS

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ABOUT THIS REPORT

Ash Springs, Pahranagat Valley, NV. © Christiana Manville

The purpose of this Plan is to summarize the current condition, identify future threats, and highlight necessary actions to conserve some of Nevada's most significant aquatic environments. It is intended to be used as a complementary guide to existing resources for spring management (e.g., Sada et al. 2001) and serve as a catalyst to advance conservation efforts for Nevada's spring systems and the plants and animals that need them to survive.

CRYSTAL SPRING

The Crystal Spring area was a principal stopover site on the Mormon Trail Alternate Route. Today, it is a major source of water for endangered and endemic species in Pahranagat Valley.

INTRODUCTION

Nevada is enigmatic to most people. It is the driest and most mountainous state in the union and saying 'Nevada' typically brings visions of vast expanses of sagebrush, wild horses, or casino-lined streets. What remains unknown to many is the incredible amount of biological diversity found across the state. With over 3,800 documented species of plants and animals, Nevada ranks 11th in species diversity among the United States. Found nowhere else in the world are 173 species—Nevada endemics. One-hundred sixty-five of these species occur only in spring-fed habitats (Appendix 1). Because arid environments host fragile ecosystems and a growing population places increased demands on the environment, over 15% of Nevada's species are considered at risk (Stein 2001).

Many of Nevada's high priority wetlands and endemic aquatic species are supported by springs, which are supplied by aquifers fed by precipitation on snow-capped mountains. Most of Nevada's springs have been used as water supplies for livestock, recreation, and domestic purposes and most are disturbed by non-native ungulates, diversion, ground water extraction, recreation, and/or invasive species. These influences have altered biological and physical characteristics of these systems and caused extinction of five species and extirpation of many populations of Nevada's endemic aquatic species (Sada and Vinyard 2002). Sada et al. (2005) and Fleishman et al. (2006) also showed that characteristics of spring-fed aquatic and riparian communities were altered (e.g., decreased biodiversity and functional characteristics of the communities) by human disturbance.

Springs

Springs are small-scale aquatic systems that occur where ground water reaches the surface (Meinzer 1923). More than 30,000 springs occur in Nevada. They range widely in size, water chemistry, morphology, landscape setting, and persistence. They occur from mountain tops to valley floors, some occur in clusters (spring provinces) but most are isolated from other aquatic and riparian systems. Some dry each year, some dry only during extended droughts, and a few persist for millennia. Nevada's spring-dwelling endemics are known from less than 450 sites (700 springs) and they only occupy persistent springs that are little affected by drought or scouring floods.

Arid land springs are distinct from springs in more temperate or humid regions because they are typically isolated from other waters, some are susceptible to drought, and aquifers in these regions are strongly influenced by high elevations, rugged topography, and diverse lithology (Thomas et al. 1996, Hershey et al. 2010). Geology, aquifer size, geography, climate, and the persistence of water constitute the hydrologic context for each spring. These factors also provide the fundamental natural elements that influence spring environments and structure

Don Sada (DRI) samples for springsnails.

Springs Conservation Plan: A Synthesis of Past and Present Field Data

1990: Desert Research Institute (DRI) initiated region-wide biogeographic inventory of desert springs to

- Describe the distribution of obligate spring-dwelling macroinvertebrate taxa
- Document the biodiversity of spring aquatic systems, and
- Note the disturbance conditions of aquatic and riparian systems.

2008: The DRI dataset includes over 1,500 survey records of Great Basin and Mojave Desert springs

2009: The Nevada Natural Heritage Program (NNHP) and DRI complete field surveys of over 300 springs of biological significance that were surveyed in the 1990s to

- Inventory vegetation and aquatic biota at important spring wetland sites
- Develop a spring wetland ecology database that would be available to agencies and the public through data requests to the Nevada Natural Heritage Program, and
- Inform development of a Springs Conservation Plan that reports on findings regarding the current condition of surveyed springs, future threats, and identifies conservation strategies.

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their biotic communities. Spring size also influences life at springs. Larger springs generally support higher biodiversity than small springs, but springs of all sizes are occupied by Nevada's endemic spring macroinvertebrates. Only large springs are inhabited by fish. Springs occupied by endemic species range in discharge from less than 1 liter per minute to thousands of liters per minute.

Interest in spring conservation and management began in the 1970s when spring fish extinctions in the arid western United States became well known. Most of these conservation programs focused on large springs occupied by fish, while small, fishless springs were largely ignored. The importance of small springs to Nevada's endemic life was unknown until the 1990s when R. Hershler (Smithsonian Institution), D. Sada (Desert Research Institute), and G. Vinyard (University of Nevada, Reno) documented physical characteristics and the condition of approximately 1,500 smaller, unstudied springs and ultimately described about 70 new springsnail species in the state (e.g, Hershler 1998).

Project Background

The purpose of the Springs Conservation Plan is to summarize the current condition of 283 high priority wetlands that are supported by springs, identify future threats, and highlight necessary actions to conserve some of Nevada's most significant aquatic environments. A large portion of Nevada's high priority, spring-fed wetlands are not specifically considered in this plan, but the basic elements of threats to springs and needs for management discussed herein are relevant for all springs in the state. This plan is not a technical reference on spring ecology, nor does it provide detailed discussion on field sampling spring systems and their associated species. It is intended to be used as a complementary guide to existing resources for spring management (e.g., Sada et al. 2001) and serve as a catalyst to move forward conservation efforts for Nevada's spring systems and the plants and animals that need them for survival.

The Nevada Natural Heritage Program (NNHP), The Nature Conservancy (TNC), and Desert Research Institute (DRI) partnered in 2008 to prepare this Springs Conservation Plan as a roadmap for prioritizing conservation actions for 283 springs of biodiversity significance. This project was funded by Nevada's Question 1 Bond Initiative and the Environmental Protection Agency. Detailed field surveys were conducted by NNHP and DRI staff, while TNC conducted current status and threat assessments in conjunction with the Springs Conservation Plan Working Group. This working group comprises a diverse group of agencies, including The Nevada Department of Wildlife, The National Park Service, The Bureau of Land Management and the Fish and Wildlife Service, in addition to TNC, DRI, and NNHP.

NNHP maintains databases on the locations, biology, conservation, and management status of threatened, endangered, sensitive and at-risk species and biological communities, and noxious weed infestations. In 2006, NNHP published a Scorecard of the highest priority sites within the state as defined by high biodiversity coupled with high threats and urgent management needs. Approximately 75% of these sites are springs with endemic species. Often these sites are the single occurrence of a species in the world. They include some of the largest springs and spring complexes in the state.

However, Scorecard springs do not include many of the smaller springs surveyed in the 1990s. The current project went beyond the current Scorecard sites to include a selection of these smaller springs. Springs that occur on valley floors and range fronts were the primary focus. Field surveys were conducted following Level 1 survey protocols as described by Sada and Pohlman (2006) (which included all information compiled by earlier surveys), in addition to a detailed inventory of riparian vegetation at each spring. Although access to a number of sites on private lands was not approved, comparative surveys of 283 springs provided information to assess changes in the condition of springs as well as the distribution and abundance of springsnails over 20 years. Field surveys collected data for multiple attributes including presence/absence of springsnails, condition, size and amount of vegetation, type and amount of disturbance, and some water characteristics such as pH, temperature, and discharge amount.

Information for the plan was compiled by comparing the current and past condition of selected springs that were sampled by Hershler, Sada, and Vinyard (data maintained by D. Sada at DRI) in the 1990s and again in 2007 and 2008. Results of the 2007 and 2008 surveys are detailed later in the Springs Conservation Plan, but there was little difference in the 'global' condition of springs from the 1990s to 2007 – 2008. This comparison may be misleading, however, because the recent surveys also found that 14 springsnail populations had been extirpated since the 1990s because of invasive species, habitat alteration, and declining ground water tables.

Kings Pool outflow at Ash Meadows. © Cathy Wilson

Springs provide valuable water to wildlife in the desert but can be susceptible to overuse by large ungulates. Strategies, such as fencing the spring source and capturing water outside of the exclosure so it is available to wild horses and cattle, facilitate meeting multiple objectives for management and conservation. © Scott Deserti

The Springs Conservation Plan working group identified one conservation goal, seven measurable objectives, and six actions for conserving Nevada's springs of biodiversity significance.

Significant Spring Landscapes

Amargosa Desert

Railroad Valley

White River Valley

Pahranagat Valley

Upper Muddy River

Steptoe Valley

Soldier Meadow

Although large-scale assessments of habitat quality across the landscape may poorly represent the influence of changing conditions to Nevada's spring-dwelling endemics, it is clear that these species are susceptible to the continuing influences of degraded habitat conditions. Four key factors essential to the long-term viability of springs were identified and ranked on a scale of Poor to Very Good for each spring surveyed in 2007 and 2008. In summary:

- All natural physical characteristics were substantially represented at less than half of the springs (41%), and 13% of all springs were in currently Poor condition (i.e., physically altered to the extent that natural physical characteristics no longer exist or can be observed).

- There was no discernable change in ground water discharge at 98% of the springs.

- No highly invasive aquatic species were detected at most springs (79%) but at 5% of the springs, two or more 'highly invasive' aquatic species were present.

- The composition of native riparian plants was Good or Very Good at almost half (48%) of the springs. Vegetation was in Poor condition at 18% of the springs.

The condition of these springs is generally better than what was observed by Hershler, Sada and Vinyard who found few springs that had not been altered by diversion, recreation, or incompatible livestock use, and that characteristics of only 20% of springs were relatively natural (DRI Springs Database). Differences in these observations may be attributed to characteristics of springs visited in the recent and past surveys. The 2007 and 2008 surveys included only springs with Nevada endemics which are limited to valley floor and range front springs while earlier surveys included a wide variety of spring types, sizes, and locations, and many not occupied by rare species.

Conservation Planning

An interagency working group was created to develop the Springs Conservation Plan over the course of two years and four workshops. TNC's Conservation Action Planning (CAP) was employed to assess the current condition, evaluate future threats, and identify priority actions to conserve or restore springs that were surveyed in 2007 and 2008 (The Nature Conservancy 2007, Parish et al. 2003). The basic concepts of CAP follow the adaptive management framework of setting goals and priorities, developing strategies, taking action, and measuring results. Coordination with the field effort made for an unprecedented opportunity to develop a conservation plan that was informed by quantitative field data validated by expert opinion. The Springs Conservation Plan working group identified one conservation goal, seven measurable objectives, and six actions for conserving Nevada's springs of biodiveristy significance. Although the meausres of success are specific to the springs surveyed for this project, the working group established a framework for measuring health, assessing threats, and prioritizing action that can be applied across other desert spring systems.

Wiley Ranch, NV. © Susan Abele

COTTONWOOD SPRING AT
SHELDON NATIONAL WILDLIFE REFUGE, NV

The Sheldon National Wildlife Refuge, established in 1931, encompasses over 575,000 acres and represents one of the most ecologically intact landscapes in the Great Basin.

HOW DO WE DETERMINE IF A SPRING IS HEALTHY?

The Nature Conservancy's Conservation Action Planning methodology was used to assess current status of Nevada's Springs of Biodiversity Significance and establish the framework for how progress towards conservation of these springs will be measured.

The viability assessment methodology is an objective, consistent means for determining changes in the status of each spring over time, the ultimate measure of the success of conservation efforts. The assessment guides the identification of current and potential threats (i.e., conservation opportunities) and identifies past damage that must be undone (i.e., restoration opportunities). Established principles of ecology and conservation science are utilized and the best available information on biology and ecology is applied in an explicit, objective, consistent, and credible manner.

Key Ecological Attributes

The first step in the viability assessment for springs is identification of their key ecological attributes. Although there is likely an infinite number of attributes that could describe some characteristic of springs, key attributes identified during the viability assessment are a small set of ecological attributes that are *critical* to the spring's long-term viability and can be feasibly measured.

Key ecological attributes can include biological composition, biotic interactions and processes, environmental regimes and constraints, and attributes of landscape structure and architecture that sustain composition and natural dynamics (Parrish et al. 2003). Because abundance and composition may lag in their responses to environmental impairments, it is important to include biotic interactions, environmental regimes, and landscape structure as key attributes. Consideration of key attributes that address more than just biotic composition will further ensure that crucial aspects of ecological integrity are managed for the conservation of all native biodiversity. The Springs Conservation Plan working group identified four key attributes: physical integrity; ground water; aquatic biota; and riparian species composition, structure and cover.

A number of additional key ecological attributes that have been identified by other project teams for spring ecosystems were considered by the working group. It was determined that the above was the most parsimonious set given the data being collected in the field for this plan. Where more intensive surveys are being conducted, it would be appropriate to add key attributes and indicators if it was determined they are 'key' to representing and tracking the viability of a spring.

Specific questions addressed during this assessment included:

"How do we define **viability** ('health') for each spring?"

"What is the current status of each spring?"

The Springs Conservation Plan working group identified four key ecological attributes:

- Physical integrity
- Ground water
- Aquatic biota
- Riparian species composition structure and cover

Key Attributes

Physical integrity

© Janel Johnson

Ground Water

© Janel Johnson

Aquatic biota

© Susan Abele

Riparian species composition structure and cover

© Susan Abele

Indicators

For each key ecological attribute, the basis for its measurement must be established. These measures are called indicators. Indicators must be measurable. Sometimes the measures may involve data collection at sample plots or along transects. Other indicators may involve measurable elements that are not quantitative, such as the seasonality of fire or flooding regime. Sometimes a single indicator can be used to assess two or more key ecological attributes. Indicators identified for this project include the following:

Key Attribute	Indicator
Physical integrity	Degree of physical alteration
Ground Water	Surface discharge
Aquatic biota	Nonnative aquatic species
Riparian species composition, structure, and cover	Relative abundance of plant functional groups and recruitment

Good indicators meet the following criteria:

- Strongly relate to the status of the key ecological attribute
- Might provide an early warning to serious stresses
- Are not significantly affected by other threats off the site
- Are efficient and affordable to measure

Key Attributes and Indicators for the Springs Conservation Plan

Physical integrity – Because the physical habitat of a spring often responds more quickly to changing conditions than that of the biotic communities, physical integrity was identified as a key attribute by the working group. Some indicators of physical integrity may include substrate composition, aerial extent, open water, and aquatic vegetation cover. The working group identified a unified indicator of *degree of physical alteration* that was ranked by combining a number of parameters that were collected in the field for this project.

Ground Water – The presence of water is a major factor influencing biological composition and productivity at a spring and is directly related to the availability of ground water to the system. Although an obvious requirement for aquatic species and systems, ground water was explicitly identified as a key attribute in order to evaluate whether availability had changed since previous visits to a spring and to assess potential future threats to a spring. Although threats to ground water may occur at a distance, impacts may be observed locally at a spring which could be expressed as a reduction or elimination of *surface discharge*.

Aquatic biota – Native aquatic animals were discussed by the working group as a key attribute. Indicators discussed included fish size class, structure and distribution or macroinvertebrate composition and abundance. Because this project was only collecting aquatic biota data for springsnails, it was decided that no key attribute data for native aquatic animals would be used for the viability assessment. Because invasive aquatic animals are sources of stress to aquatic ecosystems and may be more readily documented, *nonnative aquatic species* were evaluated for each spring.

Riparian species composition, structure, and cover – The vegetation at a spring provides immediate insight into past and, potentially, ongoing disturbances. A major component of this project was mapping and characterizing vegetation communities at the springs. The *relative abundance of plant functional groups and recruitment* was identified as an indicator and was directly measured during the field surveys. Four plant functional groups were identified with Categories 1 and 2 being 'less desirable' (e.g., nonnative, invasives) and Categories 3 and 4 being 'more desirable' in aquatic and wet meadow systems. In addition, the amount of *bare ground* was considered in the ranking the current status of vegetation at the springs.

Establishing Indicator Ratings

Ecosystems naturally vary over time. The acceptable range defines the limits of this variation that constitute the minimum conditions for persistence (note that persistence may still require human management interventions). This concept of an acceptable range of variation establishes the minimum criteria for identifying a spring as viable or not. When all key attributes of a spring are maintained or restored within some explicitly delineated range of variation over space and time, it is considered viable. If a key attribute lies outside this acceptable range, it is a degraded key attribute and the spring is not considered resilient enough to persist into the future. Managing springs within the acceptable range of variation is important for ensuring persistence and integrity of biological diversity.

Once an acceptable range of variation for an attribute has been estimated, a viability rating scale can be specified. This scale involves establishing boundaries for an indicator based on thresholds.

Indicator Ratings:

Very Good – Ecologically desirable status; requires little intervention for maintenance

Good – Indicator within acceptable range of variation; some intervention required for maintenance

Fair – Outside acceptable range of variation; requires human intervention

Poor – Restoration increasingly difficult; may result in extirpation of spring and/or associated species

Desert dace habitat at Soldier Meadow. © FWS

Key Attribute: Riparian species composition, structure, and cover

Plant species were assigned to one of four categories to assess vegetation condition at springs.

See Appendix 2 for plants documented during Springs Conservation Plan field surveys and their respective categories. Although these assignments were developed by botanical experts, categories may change in the future as more is learned about some of these species.

Category 1: Invasives

Category 2: Non-natives (non-invasive) or upland species (native or not)

Category 3: Disturbance (mostly grazing or channel modification) tolerant native wetland species

Category 4: Disturbance intolerant native wetland species

The following rating scale was applied in the final stages of the viability assessment to determine the current status of a spring. The indicator ratings defined by the Springs Conservation Plan working group follows:

Key Attribute	Indicator	Poor	Fair	Good	Very Good
Physical Integrity	Degree of physical alteration	Physically altered to the extent that natural physical characteristics no longer exist or can be observed	Retains some elements of natural physical characteristics	All natural physical characteristics are represented to a substantial degree	All natural physical characteristics are represented and unaltered
Ground Water	Surface discharge	Existing discharge greatly reduced, insufficient to maintain natural spring ecosystem	Existing discharge reduced, sufficient to maintain some of the natural spring ecosystem but at a reduced quality	Existing discharge is near historic rates and natural variability; sufficient to maintain natural spring ecosystem	No discernable changes in discharge
Aquatic biotica	Nonnative aquatic species	Two or more 'highly invasive' aquatic species present	One or more 'highly invasive' aquatic species present	One nonnative but no 'highly invasive' aquatic species present	No nonnative or highly invasive aquatic species
Riparian species composition, structure, and cover	Relative abundance of plant functional groups and recruitment	Invasive nonnative species	Noninvasive nonnatives; upland plants	Native riparian plants that increase with disturbance	Native riparian plants that decrease with disturbance

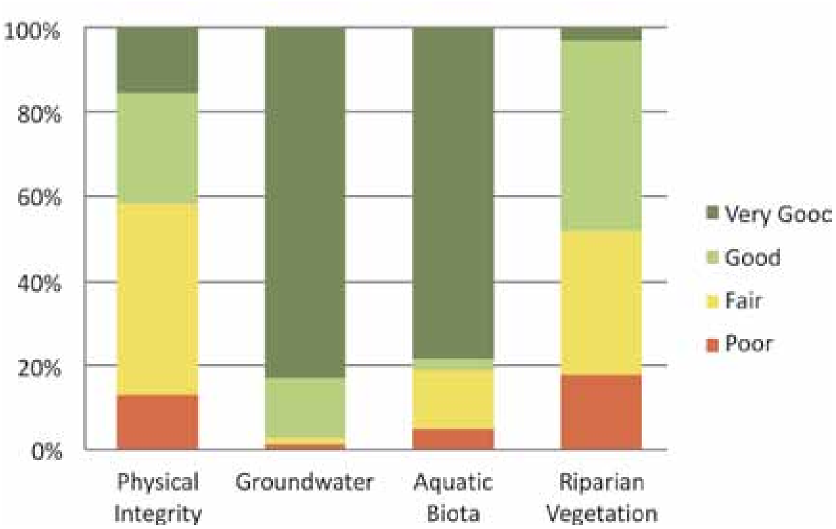
In summary, a complete viability assessment involves:

1. identifying the key ecological attributes;
2. selecting indicators for each attribute;
3. building a rating scale for each indicator based on a hypothesis about its acceptable range of variation;
4. determining the current status of each attribute using the rating scale and data from field surveys;
5. recording any issues, gaps in knowledge, or assumptions;
6. reviewing and adjusting assessments as necessary.

It is important to emphasize the iterative nature of Conservation Action Planning and its individual steps, including the viability assessment. Over the course of four workshops, the Springs Conservation Plan working group went back and forth through the steps before completing this initial assessment. Assessing ecological health can involve a continuing series of successive approximations over months or years. The working group refined the key attributes and ranked current condition of each indicator for each spring primarily using the field survey data.

Are Nevada's Springs of Biodiversity Significance Healthy?

The springs surveyed for the Springs Conservation Plan should represent some of the healthiest springs in Nevada, because they have continued, in some cases over millennia, to support rare aquatic species. Even so, there was variability observed in the current condition of springs.



Current condition of 283 Springs of Biodiversity Significance in Nevada. Condition was rated on a scale of Poor to Very Good (see table on page 12 for definitions of indicator ratings).

Results from the Field

Physical Integrity

All natural physical characteristics were substantially represented at less than half of the springs (41%), and 13% of the springs were ranked in Poor condition (i.e., physically altered to the extent that natural physical characteristics no longer exist or can be observed).

Ground Water

There was no discernable change in discharge at 98% of the springs.

Aquatic biota

No highly invasive aquatic species were detected at most springs (79%) but at 5%, two or more highly invasive aquatic species were present.

Riparian vegetation

The composition of native riparian plants was Good or Very Good at almost half (48%) of the springs. Vegetation was in Poor condition at 18% of the springs.

The current condition of key attributes at each spring surveyed for this project is provided in Appendix 3. Ownership/management and hydrologic region are included. In order to protect privacy of landowners who provided access to their property for surveys, spring names and locations are intentionally withheld. This table is intended to provide a snapshot view of the condition of the surveyed springs and serve as a guide to identify potential springs for conservation and restoration actions. Requests for specific information on location of field note number records can be submitted to the Nevada Natural Heritage Program.

Highly altered spring source

Dry spring resulting from excessive ground water pumping

SURFACE WATER DIVERSION

WHAT ARE THE CONCERNS FOR THE FUTURE?

Recreation is a potential source of stress to spring systems. © Susan Abele

Some environmental stresses can impair, degrade, or destroy spring ecosystems. Stresses affecting desert spring systems may impact one or more of the key ecological attributes, and varying sources can directly contribute to these stresses. Distinguishing between stresses and sources of stress is a key feature of the CAP methodology. For example, surface water diversions can be a source of multiple stresses to springs including: altering physical integrity; creating conditions that favor nonnative aquatic species; or degrading habitat conditions for native riparian vegetation.

The Springs Conservation Plan working group evaluated the stresses to the project's springs and their potential sources using The Nature Conservancy's ranking methodology and guidelines (Low 2003). This step helped identify the various factors that immediately affect Nevada's spring systems of biodiversity significance and then ranked them so that conservation actions could be identified where they are most needed.

Nine primary **sources of stress** for springs of biodiversity significance were identified. These sources were either currently happening, or have high potential to occur in the near future.

Sources of Stress to Nevada's Springs

1. Surface Water Diversions
2. Channel Modification
3. Operation and Presence of Dams or Impoundments
4. Excessive Ground Water Withdrawal
5. Incompatible Grazing Practices
6. Wild Horses and Burros
7. Invasive Species – Aquatic Animals
8. Invasive Species – Plants
9. Incompatible Recreation Use

Severity of damage: What level of damage to the conservation target can reasonably be expected within ten years under current circumstances? Total destruction, serious or moderate degradation, or slight impairment?

Scope of damage: What is the geographic scope of impact to the conservation target expected within ten years under current circumstances? Is the stress pervasive throughout the target occurrences or localized?

Ranking Stresses

Every stress impairs a key ecological attribute of a conservation target. The stresses to consider should be either current stresses or have high potential to occur in the next ten years under current circumstances and management. The relative seriousness of a stress is a function of the severity and scope of damage.

Based upon the best available knowledge and expert judgments, the Springs Conservation Plan working group ranked each stress for Nevada's spring systems of biodiversity significance.

Stresses	Severity	Scope	Stress Rank
Altered physical integrity	High	Very High	High
Decreased water quantity from source	High	High	High
Nonnative aquatic species	High	High	High
Altered riparian species composition, structure and cover	Medium	High	Medium

Stress Ranking Guidelines

Severity of Damage – what level of damage can reasonably be expected within ten years under current circumstances (given the continuation of the existing management/conservation situation)	
Very High	The stress is likely to *destroy* or *eliminate* spring systems
High	The stress is likely to *seriously degrade* spring systems
Medium	The stress is likely to *moderately degrade* spring systems
Low	The stress is likely to *only slightly impair* spring systems

Scope of Damage – what is the geographic scope of impact on the spring systems that can reasonably be expected within ten years under current circumstances (given the continuation of the existing situation)	
Very High	The stress is likely to be *very widespread or pervasive in its scope*, and affect spring systems *throughout Nevada*
High	The stress is likely to be *widespread in its scope*, and affect spring systems at *many spring sites* in Nevada
Medium	The stress is likely to be localized in its scope, and affect spring systems at *some sites* in Nevada
Low	The stress is likely to be very localized in its scope, and affect spring systems at a *limited number of sites* in Nevada

Stress Rank Matrix				
Scope	**Severity**			
	Very High	**High**	**Medium**	**Low**
Very High	Very High	High	Medium	Low
High	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
Low	Low	Low	Low	–

Ranking Sources

For each stress to a given conservation target, there are one or more causes or sources. The sources of stress to consider should be happening now, or have a high potential to occur in the near future. A ten-year horizon works well for looking at most threats, with a couple of exceptions (e.g., global climate change and some invasive species). In order to design effective conservation strategies, sources must be well-defined. The relative seriousness of a source is a function of the degree of contribution and irreversibility of the stress.

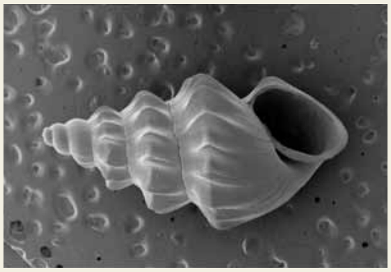
Sources were ranked based upon the best available knowledge and judgments by the Springs Conservation Plan working group in the same manner as the stresses.

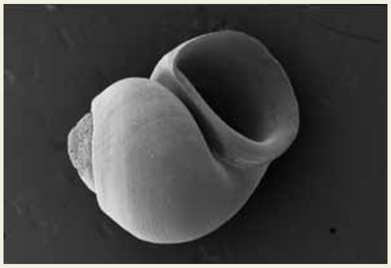
Source Ranking Guidlines

Contribution – Expected contribution of the source, acting alone, to the full expression of a stress (as determined in the stress assessment) under current circumstances (i.e., given the continuation of the existing management/conservation situation)	
Very High	The source is a *very large* contributor of the particular stress
High	The source is a *large* contributor of the particular stress
Mediumn	The source is a *moderate* contributor of the particular stress
Low	The source is a *low* contributor of the particular stress

Irreversibility – Reversibility of the stress caused by the source of stress	
Very High	The source produces a stress that is not reversible, for all intents and purposes (e.g., wetland converted to shopping center)
High	The source produces a stress that is reversible, but not practically affordable (e.g., wetland converted to agriculture)
Mediumn	The source produces a stress that is reversible with a reasonable commitment of additional resources (e.g., ditching and draining of wetland)
Low	The source produces a stress that is easily reversible at relatively low cost (e.g., ORVs trespassing in a wetland)

Source Rank Matrix				
Scope	**Severity**			
	Very High	**High**	**Medium**	**Low**
Very High	Very High	High	High	Medium
High	Very High	High	Medium	Medium
Medium	High	Medium	Medium	Low
Low	High	Medium	Low	Low





Nevada endemic springsnail shells.
© Robert Hershler

Degree of contribution to the stress: The contribution of a particular source to a given stress, assuming the continuation of the existing management / conservation situation.

Irreversibility of the stress: The reversibility of the stress caused by the source. Does the source produce a stress that is irreversible, reversible at extremely high cost, or reversible with moderate or little investment?

Surface Water Diversions				
	Altered physical integrity	**Decreased water quantity from source**	**Nonnative aquatic species**	**Altered riparian species composition, structure and cover**
Contribution	Very High	-	Low	Medium
Irreversibility	High	-	Very High	High
Threat Rank	High	-	Medium	Low

Channel Modification				
	Altered physical integrity	**Decreased water quantity from source**	**Nonnative aquatic species**	**Altered riparian species composition, structure and cover**
Contribution	Very High	-	Low	Medium
Irreversibility	Medium	-	Very High	Medium
Threat Rank	High	-	Medium	Low

Operation and Presence of Dams or Impoundments				
	Altered physical integrity	**Decreased water quantity from source**	**Nonnative aquatic species**	**Altered riparian species composition, structure and cover**
Contribution	High	-	Low	Low
Irreversibility	High	-	Very High	High
Threat Rank	High	-	Medium	Low

1. Surface Water Diversions

Surface water diversions are developed at springs for multiple purposes. Commonly, pipes are installed to deliver water for livestock and agriculture. Water diversion has been identified as the most common threat to fishes and other aquatic species in the Great Basin (Sada and Vinyard 2002). Surface water diversions create functional changes in the spring system by decreasing water volume and reducing soil moisture. Irreversibility is ranked high because eliminating the threat often involves purchase of water rights which can be expensive or unattainable.

2. Channel Modification

Channel modification can include altering a springbrook to redirect flow or result from clearing undesirable vegetation. Frequency of modification can affect the potential contribution of this source of stress. For example, if an area is being maintained to eliminate undesirable vegetation, species such as springsnails will likely be less impacted if an area is 'modified' (i.e., dug out) every ten years versus annually. Irreversibility often requires active restoration efforts that can be costly and therefore, more difficult to successfully implement at larger springs. However, it is more feasible to restore physical integrity of a spring system and channel(s) than removing more permanent structures such as diversions or dams.

3. Operation and Presence of Dams or Impoundments

Dams and impoundments alter the physical integrity of a spring system by creating more of a pool of water versus a wetted area with one or more springbrooks that extend for meters from the spring source. Although some species may prefer deeper water habitats, many spring-dependent species rely upon the natural physical integrity of an undammed system. Depending upon the use of the area, a dammed spring may be too expensive to restore if water rights need to be purchased in order to remove the structure.

Incompatible grazing, particularily when duration is overextended, can deplete vegetation of spring systems © Janel Johnson

4. Excessive Ground Water Withdrawal

Geologically, Nevada is broken into valleys by intervening mountain ranges. Most of the valleys contain alluvial sediments that are often very permeable aquifers. These aquifers are recharged by springtime runoff of snowmelt from the adjacent mountain ranges. In addition to the valley aquifers, there are regional aquifers that facilitate ground water transport between valleys. Regional aquifer waters are often ancient and are not as affected by annual precipitation as valley aquifers. Development of the regional aquifer in eastern Nevada has been proposed to diversify the water portfolio of southern Nevada residents, particularly in Las Vegas. In addition, ground water development proposed to support the Nuclear Repository at Yucca Mountain would tap into the regional aquifer. Reversing negative impacts from excessive ground water withdrawal are difficult due to inherent delays in detection of pumping impacts and the subsequent lag time required for recovery of discharge at a spring (Bredehoeft 2011). In addition to 'industrial and urban' uses, ground water is critical in supporting agriculture in Nevada. Teasing apart the sources of excessive ground water withdrawal poses challenges to identifying necessary actions for affected springs. Excessive ground water withdrawal, no matter the source, can cause reductions in discharge at a spring (e.g., decreasing depth or eliminating flow altogether) and result in a lower water table that affects riparian vegetation (Patten et al. 2008).

Excessive Ground Water Withdrawal: Agricultural				
	Altered physical integrity	Decreased water quantity from source	Nonnative aquatic species	Altered riparian species composition, structure and cover
Contribution	-	High	-	Medium
Irreversibility	-	High	-	High
Threat Rank	-	High	-	Low

Excessive Ground Water Withdrawal: Energy, Industrial, and Urban				
	Altered physical integrity	Decreased water quantity from source	Nonnative aquatic species	Altered riparian species composition, structure and cover
Contribution	-	High	-	Medium
Irreversibility	-	Very High	-	Very High
Threat Rank	-	High	-	Medium

5. Incompatible Grazing Practices

Varying opinions have been stated on the potential effect domestic livestock may have on a spring system. Some have stated that grazing is a required disturbance for spring systems and that without it, overgrowth of vegetation can result in extirpation of local fish populations (Kodric-Brown and Brown 2007). Conversely, the presence of grazing has been tied to higher percentages of invasive plants, increased erosion, and higher sediment loads in spring systems (Perla and Stevens 2008). Riparian areas with unstable soils, fragile vegetation, threatened and endangered plants and/or animals, etc. require special livestock management prescriptions (Leonard et al. 1997). Without these prescriptions, incompatible grazing at springs of biodiversity significance can be a very high contributor to altered physical integrity (e.g., trampling and compaction can alter geomorphology at a spring) and can affect the riparian vegetation by overuse or facilitating colonization of invasive species in disturbed soils.

Incompatible Grazing Practices				
	Altered physical integrity	Decreased water quantity from source	Nonnative aquatic species	Altered riparian species composition, structure and cover
Contribution	Very High	-	-	High
Irreversibility	Low	-	-	Low
Threat Rank	High	-	-	Low

6. Wild Horses and Burros

Wild horses and burros tend to congregate around springs which can result in trampling of vegetation that serves as a buffer to prevent silt and elevated levels of nutrients from entering into the spring system (Sada et al. 2001). In addition, fecal material can increase nutrient levels and lead to eutrophication of a system. Although some areas of the Great Basin and Mojave Desert are heavily impacted by wild horses and burros, they are not a high source of stress for springs surveyed during this project. The irreversibility rank is higher for wild horses and burros than it is for livestock because they are not managed (i.e., herded away from water sources) and have a higher potential for impacting an area.

Wild Horses and Burros				
	Altered physical integrity	Decreased water quantity from source	Nonnative aquatic species	Altered riparian species composition, structure and cover
Contribution	Low	-	-	Low
Irreversibility	Medium	-	-	Medium
Threat Rank	Low	-	-	Low

Invasive Aquatic Animals				
	Altered physical integrity	Decreased water quantity from source	Nonnative aquatic species	Altered riparian species composition, structure and cover
Contribution			High	
Irreversibility			Very High	
Threat Rank	-	-	High	-

Invasive Plants				
	Altered physical integrity	Decreased water quantity from source	Nonnative aquatic species	Altered riparian species composition, structure and cover
Contribution				High
Irreversibility				High
Threat Rank	-	-	-	Medium

Incompatible Recreation Use				
	Altered physical integrity	Decreased water quantity from source	Nonnative aquatic species	Altered riparian species composition, structure and cover
Contribution	Low		High	Low
Irreversibility	Low		Very High	Low
Threat Rank	Low		High	Low

7. Invasive Species-Aquatic Animals (nonrecreation introductions)

Introductions of invasive aquatic animals have resulted in reductions and extirpations of native aquatic species. The most widely introduced vertebrate is likely the mosquito fish (*Gambusia affinis*) which is used as a biological control agent (Courtenay et al. 1984). In western springs, crayfish (*Pacifastacus lenusculus*) are believed to be another commonly introduced invertebrate. Typically, the more disturbed a site is, the more readily it is colonized by nonnative aquatic species. Irreversibility is ranked Very High because some aquatic invasive species (e.g., crayfish) have no known effective control treatments.

8. Invasive Species-Plants

Invasive plant species affect riparian vegetation diversity and also have the ability to alter hydrology of a spring system by placing increased water demands on the system. Saltcedar (*Tamarix* spp.), purple loosestrife (*Lythrum salicaria*), Canada thistle (*Cirsium arvense*), knapweed (*Centaurea* spp.), and perennial pepperweed (*Lepidium latifoliom*) are the most commonly introduced plants affecting western wetlands (Sada et al. 2001). Sites that have been highly disturbed are vulnerable to invasive plant colonization which can displace native vegetation. Eradication of invasives can be very difficult and costly.

9. Incompatible Recreation Use

Recreational use of springs can include bathing, camping, and fishing. Bathing and camping are not considered imminent threats to the springs surveyed for this plan, but recreational fishing is a primary source for the introductions of 'bait' or nonnative aquatic species into a spring system. Once these nonnative aquatic animal species are established in a spring they are difficult, if not impossible, to eradicate. Increases in recreational use could result in soil compaction, removal of vegetation, increased erosion due to camping along edges of springs, diversions to create soaking 'tubs', and elimination of native aquatic biota from use of bleach and soap (Sada et al. 2001).

Once nonnative aquatic animal species are established in a spring they are difficult, if not impossible, to eradicate.

American bullfrog, *Rana catesbeiana.* © FWS

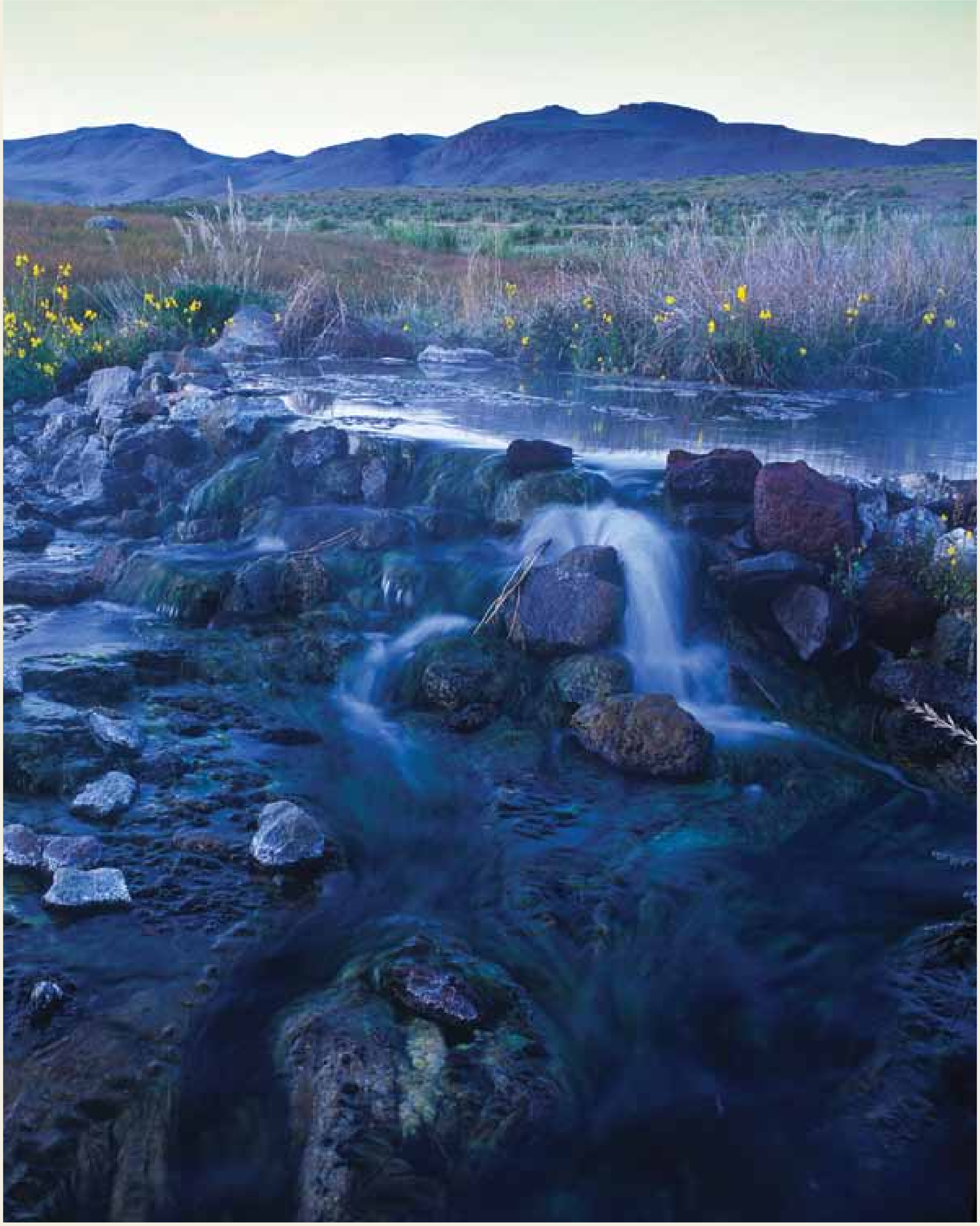
Bullfrogs are native to the eastern United States and have been both intentionally and unintentionally introduced to areas outside of their range. They are voracious predators and feed on anything that they can fit into their mouths. They directly compete with other native amphibians and have directly contributed to declines in native species.

Convict cichlid, *Amatitlania nigrofasciata.* Pahranagat Valley, NV. © Susan Abele

Convict cichlids are native to the lakes and streams of Central America. They are one of many popular aquarium fish that have been released into native freshwater systems. They've made their way into spring systems in Nevada and, where they occur, prey upon native aquatic species. They are a hardy species that can adapt to just about any water condition which is why they succeed as a highly evasive species in native springs or in a home aquarium.

Melanoides tuberculata. © Bill Frank

Melanoides has made it into the United States, and Nevada, from its native range in Northern Africa and southern Asia. Their ability to replace native snails in spring ecosystems is the primary concern for their presence in Nevada. Research has determined the lethal water temperature, about 50 degrees Celsius (120 degrees Fahrenheit), for disinfecting fishing gear and research equipment which may inadvertently spread snails to uninfested waters.



SOLDIER MEADOW

From 1846 through the 1860s, pioneers traveled the Lassen/Applegate trail which passed through the Black Rock Desert. Soldier Meadow was an important stopover site along this dangerous, desolate stretch of trail where emigrants found scarce water and feed for their animals.

TAKING ACTION TO CONSERVE NEVADA'S SPRINGS

In order to provide a vision for achieving conservation success, the Springs Conservation Plan working group identified one goal. The goal includes a representation component (how much is enough?) and a quality component (what is the desired level of viability for high priority springs?). The assumption behind the goal setting process was that the conservation of multiple springs, particularly those in the seven significant spring landscapes, will provide a safety net for long term persistence of springs and their dependent species in Nevada. In addition to the quantitative and qualitative components, the goal identified by the working group includes a timeframe for conservation action.

Fifty-one of the 283 springs surveyed for the Springs Conservation Plan were in Good or Very Good condition (i.e., no key attributes were rated Fair or Poor; Appendix 3). Of these, 27 were located within the seven significant spring landscapes (total of 152 springs surveyed in significant landscapes). If future conservation efforts focus on springs within these landscapes, the goal set by the working group will be exceeded. Although these significant landscapes were highlighted in the goal, the working group recognized the importance of efforts across the state as integral to conserving Nevada's aquatic biodiversity.

Goal: By 2025, 50% of Nevada's 283 high priority springs and all springs in seven significant spring landscapes are in Good or Very Good condition in terms of physical integrity, surface discharge, native aquatic species, and native riparian vegetation.

To achieve this goal:

1. Maintain the 51 springs currently in Good condition (no attributes rated Fair or Poor; denoted by * in Appendix 3)
2. Improve vegetation condition of 75 springs from Fair to Good, where no other attributes are rated Poor
3. At 50 springs, improve physical integrity from Fair to Good, where no other attributes are rated Poor
4. Address Poor attributes that can readily be addressed, especially the Poors in physical integrity and vegetation attributes
5. Reduce, control, and eradicate highly invasive, nonnative aquatic species
6. Prevent introductions of nonnative aquatic species
7. Ensure that ground water withdrawal will not adversely affect (i.e., cause decline in condition rating) surface discharge currently in Very Good, Good or Fair condition. Adverse effect defined as decline in condition rating from Good to Fair or from Fair to Poor.

Goal: By 2025, 50% of Nevada's 283 high priority springs and all springs in seven significant spring landscapes are in 'Good' or 'Very Good' condition in terms of physical integrity, surface discharge, native aquatic species, and native riparian vegetation.

Calico Basin/Red Spring Boardwalk Project in southern Nevada. © Susan Abele

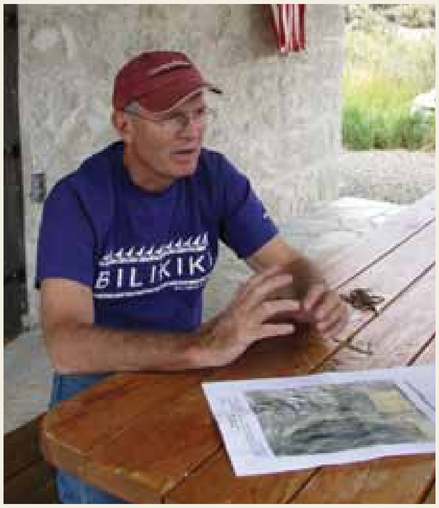
Red Rock Canyon National Conservation Area, managed by the Bureau of Land Management, is on the western edge of the Las Vegas Valley. Boardwalks in the Red Spring area allow visitors to enjoy the site and experience interpretive areas while sensitive spring habitat is protected.

Actions

1. Develop and maintain relationships with land manager/owner of Good springs.
   a. Document and share effective management strategies
   b. Analyze field data to inform why springs may be in Good condition (e.g., bigger springs with a lot of water appear to be correlated with Good condition)
2. Employ strategies to reduce livestock disturbance to smaller springs
   a. Fence, provide alternate water sources (e.g., changing point of diversion, alternate delivery points), and maintain
   b. Manage season, intensity and duration of livestock grazing
   c. Provide incentives for employing strategies
   d. Garner support for springs conservation and restoration from key agency personnel (e.g., Field Office Manager, Range Conservationist) and grazing permittees
   e. Review and provide input for allotment management plans (AMPs) that promote compatibility between grazing practices and conservation objectives for high priority springs
3. Prevent or restore conditions of altered physical integrity
   a. Locate point of diversion on a spring away from source in order to provide natural habitat for spring dependent species
   b. Avoid digging or decrease frequency of clearing vegetation and short circuit succession by planting shrubs/trees to shade out undesirable, choking vegetation
   c. Place impoundments as far from the spring source as possible
   d. Concentrate recreational use and access in one area versus dispersed access. Methods may include relocating picnic areas, creating boardwalks, or establishing a foot path for spring access.

Visitors take a stroll along the Calico Basin/Red Spring boardwalk. © Susan Abele

4. Design and implement restoration projects to favor endemic species
   a. Develop a better understanding of how spring systems function ecologically and what species needs are
   b. Structure restoration actions to benefit the suite of native species that occur at a site
   c. Support continued research and development of tools to eradicate invasive nonnatives (e.g., species specific toxins)
5. For proposed agency actions, encourage stipulated agreements or similar binding mechanisms that
   a. Include active early warning monitoring
   b. Keep incompatible ground water development out of watersheds with priority spring sites
   c. Provide information to decision makers
   d. Acquire water rights or easements, where opportunities arise, to support fish and wildlife
6. Work with landowners to encourage maintenance of native fauna in their springs
   a. Identify multi-stakeholder partnerships for conservation action in key landscapes for conservation
   b. Identify conservation and restoration funding programs for private lands
   c. Encourage/inform 'sacrifice ponds', directing actions where they have lesser effects. (e.g., work with landowner to select location and also species of fish used to stock the pond that present lower risk to native species)
   d. With public agencies, employ site management strategies that reduce/prevent introductions of nonnative species. Examples may include managing access and education.



Private landowner, Mike Powell, discusses future restoration projects on his land. © Susan Abele

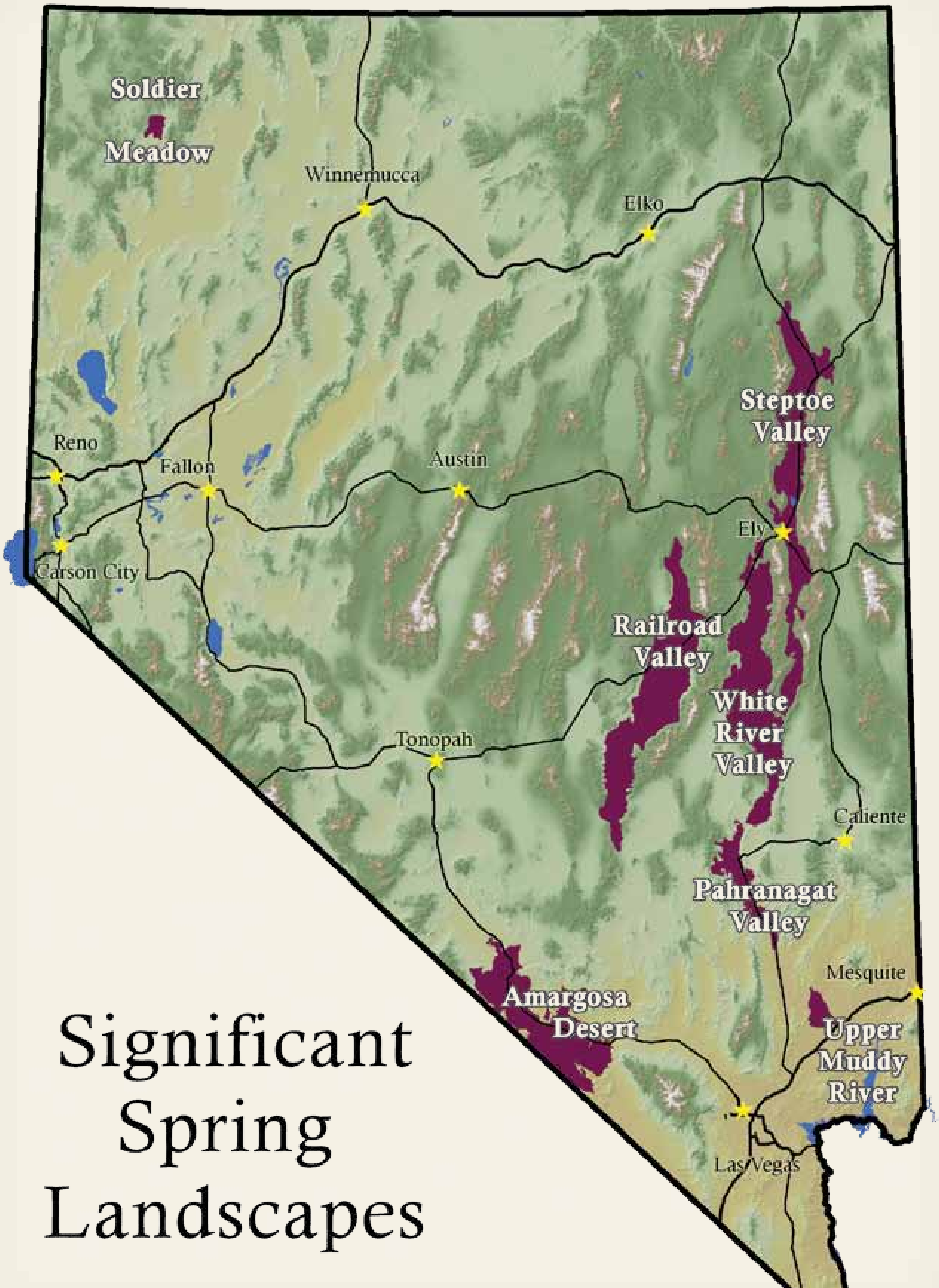
Natural Resources Conservation Service, Nevada Department of Wildlife, and private landowner, Mike Powell, are collaborating and cost-sharing restoration projects across approximately 1,000 acres of private land that contain a series of springs and wet meadow habitats.

Shoesole Resource Management Group – Working together to solve common problems and achieve common objectives © Shoesole Management Group

In northeastern Nevada, The Shoesole Resource Management Group is a community partnership that works collaboratively to 'maintain 160,000 acres of healthy rangeland, both public and private, while maintaining healthy, successful ranching operations using these lands' (Larry Hyslop, Elko Free Daily Press). The group has members from federal agencies, state agencies and academics, along with ranching friends, families, employees and concerned citizens. Although decisions 'are not usually unanimous… members agree to support the process' in order to achieve their goals of healthy rangelands and ranching operations.

Nevada's Biodiversity Depends Upon Conservation Partnerships

Significant Spring Landscapes



SIGNIFICANT SPRING LANDSCAPES

Steptoe Valley Wildlife Management Area. © Susan Abele

In deciding where to focus on-the-ground efforts, many criteria can influence a decision. To address conservation objectives for spring-dependent species and their habitats, one approach may be to direct resources into landscapes that capture a majority of biologically important species, although this does not preclude working elsewhere as opportunities arise.

In Nevada, seven landscapes capture almost 100 biologically important species dependent upon spring ecosystems. Some of these species are listed as endangered (E), threatened (T), or are a candidate (C) for listing under the Endangered Species Act (ESA). A majority of these species are unique to the location in which they occur (endemic) or do not have widespread distributions. Continuing to focus conservation and restoration actions in these landscapes will ensure persistence of these species and maximize conservation investments.

Amargosa Desert

Railroad Valley

White River Valley

Pahranagat Valley

Upper Muddy River

Steptoe Valley

Soldier Meadow

Amargosa Desert

Fairbanks Spring at Ash Meadows. © Cyndi Souza

Approximately 90 miles northwest of Las Vegas, in the Amargosa and Oasis valleys of southern Nye County, is a desert oasis harboring at least 20 plants and animals found nowhere else in the world, plus a number of other species of concern dependent upon spring ecosystems.

Within this landscape is the 23,000-acre Ash Meadows National Wildlife Refuge, managed by the U.S. Fish and Wildlife Service. Ash Meadows was named one of ten 'Waters to Watch' in 2010. This list, assembled by the nation's leading authorities on aquatic conservation, is a collection of rivers, streams, and shores that are important habitats for the many fish and wildlife species and people who call these areas home.

At Ash Meadows, restoration actions are planned that will restore hydrologic processes and create critically needed aquatic habitat for native species within the Fairbanks and Soda Springs spring brook outflow systems. These systems historically supported important populations of Ash Meadows pupfish, speckled dace, endemic aquatic invertebrates, and springsnails, and provide connectivity to Carson Slough downstream to enhance genetic exchange and increase habitat for the Ash Meadows pupfish.

Opportunities for Conservation

1. Maintain springs in Good condition at Ash Meadows National Wildlife Refuge and on private lands in the Amargosa Desert
2. Implement restoration projects to improve physical integrity from Fair to Good, where no other attributes are currently in Poor condition. Potential partnerships include U.S. Fish and Wildlife Service, Bureau of Land Management, and private landowners.
3. Work with U.S. Fish and Wildlife Service and private landowners to improve physical integrity and vegetation at springs in Poor condition
4. Control invasive aquatic species where they are known to occur at Ash Meadows National Wildlife Refuge and on private lands

SPECIES SUMMARY	Rare Species	Nevada Endemic	ESA
Invertebrates	13	11	1
Fish	5	5	4
Plants	8	3	3
Amphibians	1	1	-

Species

Ash Meadows pebblesnail, *Pyrgulopsis erythropoma**

Crystal Spring pyrg, *Pyrgulopsis crystalis**

Devils Hole warm spring riffle beetle, *Stenelmis calida calida**

Distal-gland pyrg, *Pyrgulopsis nanus**

elongate-gland pyrg, *Pyrgulopsis isolata**

Fairbanks pyrg, *Pyrgulopsis fairbanksensis**

median-gland Nevada pyrg, *Pyrgulopsis pisteri**

minute tryonia, *Tryonia ericae**

Oasis Valley pyrg, *Pyrgulopsis micrococcus*

Point of Rocks tryonia, *Tryonia elata**

sportinggoods tryonia, *Tryonia angulata**[E]

Ash Meadows Amargosa pupfish, *Cyprinodon nevadensis mionectes** [E]

Ash Meadows speckled dace, *Rhinichthys osculus nevadensis**[E]

Devils Hole pupfish, *Cyprinodon diabolis**[E]

Oasis Valley speckled dace, *Rhinichthys osculus ssp* 6*

Warm Springs Amargosa pupfish, *Cyprinodon nevadensis pectoralis**[E]

alkali mariposa lily, *Calochortus striatus*

Ash Meadows gumplant, *Grindelia fraxinopratensis*[T]

Ash Meadows lady's tresses, *Spiranthes infernalis**

Ash Meadows mousetails, *Ivesia kingii var. eremica**[T]

Death Valley blue-eyed grass, *Sisyrinchium funereum*

satintail, *Imperata brevifolia*

spring-loving centaury, *Centaurium namophilum**[T]

Tecopa birdbeak, *Cordylanthus tecopensis*

Amargosa toad, *Bufo nelsoni**

*Endemic, [E]ESA Endangered, [T]ESA Threatened, [C]ESA Candidate

Railroad Valley

Big Warm Spring © Janel Johnson

Spanning approximately 80 miles from north to south and up to 20 miles wide, Railroad Valley is home to ten aquatic species endemic to Nevada, six springsnails and four fish.

One fish species is native to the thermal spring systems of Railroad Valley, the Railroad Valley springfish. Historically, as the ancient Lake Railroad dried, the Railroad Valley springfish was isolated in six thermal springs distributed in two areas of the valley. It is currently listed as threatened under the Endangered Species Act and current stresses include alteration of spring systems and aquatic invasive species.

Tribal and state lands play a necessary role in the recovery of Railroad Valley springfish. The Duckwater Shoshone Tribe hosts Big Warm Spring, the largest of six historic habitats, which has been identified as integral in achieving desired population estimates for the threatened fish. In cooperation with the U.S. Fish and Wildlife Service, the tribe has implemented projects to restore the habitat of the Railroad Valley springfish at Big Warm Spring.

At Lockes Ranch, the U.S. Fish and Wildlife Service and Nevada Department of Wildlife identified habitat restoration of four spring channels to improve conditions for Railroad Valley springfish as a high priority. The project included removal of thousands of invasive Russian olive trees that choke spring systems and outcompete native vegetation. Restoration to native vegetation requires continued control of invasive plant species.

Opportunities for Conservation

1. Continue restoration efforts to improve vegetation condition at springs on the Duckwater Indian Reservation, where no other attributes are in Poor condition
2. On Tribal and state lands, improve physical integrity from Fair to Good at springs where no other attributes are in Poor condition
3. Prevent introductions of highly invasive aquatic species

SPECIES SUMMARY			
	Rare Species	Nevada Endemic	ESA
Invertebrates	6	6	-
Fish	4	4	1

Species

Big Warm Spring pyrg, *Pyrgulopsis papillata**

Duckwater pyrg, *Pyrgulopsis aloba**

Duckwater Warm Springs pyrg, *Pyrgulopsis villacampae**

grated tryonia, *Tryonia clathrata**

Lockes pyrg, *Pyrgulopsis lockensis**

southern Duckwater pyrg, *Pyrgulopsis anatina**

Duckwater Creek tui chub, *Gila bicolor* ssp. 3*

Hot Creek Valley tui chub, *Gila bicolor* ssp. 5*

Railroad Valley springfish, *Crenichthys nevadae**[T]

Railroad Valley tui chub, *Gila bicolor* ssp. 7*

*Endemic, [T]ESA Threatened

Hay Corral Spring at Lockes Ranch after restoration. © Janel Johnson

SPECIES SUMMARY			
	Rare Species	Nevada Endemic	ESA
Invertebrates	7	7	-
Fish	5	5	1

Species

Butterfield pyrg, *Pyrgulopsis lata**

Emigrant pyrg, *Pyrgulopsis gracilis**

Flag pyrg, *Pyrgulopsis breviloba**

grated tryonia, *Tryonia clathrata**

Hardy pyrg, *Pyrgulopsis marcida**

Pahranagat pebblesnail, *Pyrgulopsis merriami**

White River Valley pyrg, *Pyrgulopsis sathos**

Moorman White River springfish, *Crenichthys baileyi thermophilus**

Preston White River springfish, *Crenichthys baileyi albivallis**

White River sculpin, *Cottus sp.* 3*

White River speckled dace, *Rhinichthys osculus ssp.* 7*

White River spinedace, *Lepidomeda albivallis**[E]

*Endemic, [E]ESA Endangered

White River speckled dace

© Joseph R. Tomelleri

White River Valley

Hot Creek Springs and Marsh. © Janel Johnson

Spring systems important to fish and wildlife species in the White River Valley are dispersed across private lands and approximately 15,000 acres are managed by the State of Nevada at the Wayne E. Kirch Wildlife Management Area (WMA).

Kirch WMA plays a major role in conservation of four protected endemic species of fish that are found in Flag and Hot Creek Springs on the WMA. The Hot Creek Refugium was designated in 1966 as critical habitat for the protected Moorman White River springfish. In addition, the Hot Creek Springs and Marsh is designated as a National Natural Landmark because it is an outstanding representation of a spring and wetland area that supports a relict fish species, the White River springfish.

Opportunities for Conservation

1. Work with private landowners and Kirch WMA to maintain springs in Good condition
2. Work with private landowners to identify and implement restoration projects that improve physical integrity and vegetation condition at springs where no other attributes are in Poor condition
3. Reduce or eliminate aquatic invasive species on Kirch WMA

Pahranagat Valley

Ash Springs. © Susan Abele

Pahranagat, named by the Paiute Indians as 'a valley of shining waters', was historically fed by the White River and continues today to receive a large amount of water from large, thermal springs along the flood plain.

These springs are the source of spring and wetland habitat important to a variety of fish and wildlife species. In the valley, the Pahranagat National Wildlife Refuge and the Key Pittman Wildlife Management Area are hosts to thousands of migratory birds each year.

One of the large springs in the valley, Ash Springs, is partially managed by the Bureau of Land Management while the remaining portion of this area is privately owned. It is valuable for its ecological significance and recreation opportunities. Although recreation has been identified as a potential source of stress, it remains sustainable at high use areas such as Ash Springs, because it is regulated to minimize potential damaging effects to species of concern.

Opportunities for Conservation.

1. Implement restoration projects that improve physical integrity and vegetation condition of spring and wetland systems in Pahranagat Valley
2. Identify opportunities to reduce or eradicate aquatic invasive species in the springs of Pahranagat Valley
3. Increase opportunities for collaboration between Natural Resources Conservation Service, U.S. Fish and Wildlife Partners for Fish and Wildlife Program, and private landowners

SPECIES SUMMARY

	Rare Species	Nevada Endemic	ESA
Invertebrates	5	5	-
Fish	4	4	3
Plants	1	-	-
Amphibians	1	1	-

Species

Ash Springs riffle beetle, *Stenelmis larivers**

grated tryonia, *Tryonia clathrata**

Hubbs pyrg, *Pyrgulopsis hubbsi**

Pahranagat naucorid bug, *Pelocoris shoshone shoshone**

Pahranagat pebblesnail, *Pyrgulopsis merriami**

Hiko White River springfish, *Crenichthys baileyi grandis**[E]

Pahranagat roundtail chub, *Gila robusta jordani**[E]

Pahranagat speckled dace, *Rhinichthys osculus velife**

White River springfish, *Crenichthys baileyi baileyi**[E]

St. George blue-eyed grass, *Sisyrinchium radicatum*

Pahranagat Valley montane vole, *Microtus montanus fucosus**

*Endemic, [E]ESA Endangered

Pahranagat National Wildlife Refuge. © Susan Abele

SPECIES SUMMARY			
	Rare Species	Nevada Endemic	ESA
Invertebrates	5	5	-
Fish	3	3	1
Amphibians	1	-	-

Species

grated tryonia, *Tryonia clathrata**

Moapa pebblesnail, *Pyrgulopsis avernalis**

Moapa Valley pyrg, *Pyrgulopsis carinifera**

Pahranagat naucorid bug, *Pelocoris shoshone shoshone**

Warm Springs naucorid, *Usingerina moapensis**

Moapa dace, *Moapa coriacea**[E]

Moapa speckled dace, *Rhinichthys osculus moapae**

Moapa White River springfish, *Crenichthys baileyi moapae**

Arizona toad, *Bufo microscaphus*

*Endemic, [E]ESA Endangered

Springsnails seen through the stream viewing chamber at the Moapa Valley NWR. © Janel Johnson

Upper Muddy River

Ongoing vegetation restoration efforts at Moapa National Wildlife Refuge. © Susan Abele

The Muddy River is one of the Mojave Desert's important areas of biodiversity, providing habitat for many species of concern as well as a unique array of Mojave Desert aquatic and riparian habitats. The upper watershed of the Muddy River is located approximately 60 miles northeast of Las Vegas in Clark County, Nevada, and continues upstream of the Interstate 15 Bridge for approximately 14 miles. The Muddy River begins as a series of thermal springs in the upper valley and flows 26 miles before being submerged into Lake Mead. Prior to the construction of Hoover Dam, the Muddy River flowed into the Virgin River just upstream of the confluence of the Virgin and Colorado Rivers.

Conservation of the Muddy River species is a high priority for local, state and federal agencies. Many of the springs of the Upper Muddy River are on the Moapa Valley National Wildlife Refuge (U.S. Fish and Wildlife Service) and Warm Springs Natural Area (Southern Nevada Water Authority).

Opportunities for Conservation

1. Continue restoration efforts to improve vegetation condition at springs on the Moapa Valley NWR
2. With the U.S. Fish and Wildlife Service, implement restoration projects to improve physical integrity from Fair to Good, where no other attributes are currently in Poor condition
3. Work with the Southern Nevada Water Authority to improve physical integrity and vegetation at springs in Poor condition
4. Control invasive aquatic species where they are known to occur in the Upper Muddy River

The Warm Springs Natural Area contains nearly two dozen springs which form the headwaters of the Muddy River. The 1,218-acre property provides habitat for a number of fish, birds and other species of conservation concern. In 2007, the Southern Nevada Water Authority acquired the Warm Springs Natural Area to protect the headwaters of the Muddy River where the SNWA owns and leases water rights, to protect the habitat of the endangered Moapa dace, and to advance SNWA's goal of fostering responsible environmental stewardship.

The Moapa Valley National Wildlife Refuge (NWR) was established in 1979 to secure habitat for the endangered Moapa dace, a small fish found throughout the headwaters of the Muddy River system. Historically, springs and spring channels were modified to support raising nonnative fish for culinary development and as recreational pools for a hot spring resort. To support recovery of native species, the U.S. Fish and Wildlife Service has commenced springs restoration on the Refuge.

In addition to providing habitat for aquatic species, the Refuge also provides educational and recreational opportunites for connecting people with nature. A stream viewing chamber allows visitors to get an up-close view of fish and springsnails in their native habitat. Moapa Valley NWR is a participant in the Nature Champions Program that focuses on getting young people outdoors to support improved health and reduce childhood obesity. Doctors and other health care professionals from throughout the U.S. are participating in the program, with more than 70 from southern Nevada. Outdoor activities are prescribed to patients which gives them an opportunity to take a walk in nature while learning about native ecosystems.

Pederson Spring restoration at Moapa Valley NWR.
© Otis Bay

SPECIES SUMMARY			
	Rare Species	Nevada Endemic	ESA
Invertebrates	8	8	-
Fish	1	1	-
Plants	1	1	-

Species

flat-topped Steptoe pyrg, *Pyrgulopsis planulata**

Hardy pyrg, *Pyrgulopsis marcida**

Landyes pyrg, P*yrgulopsis landyei**

neritiform Steptoe Ranch pyrg, *Pyrgulopsis neritella**

northern Steptoe pyrg, *Pyrgulopsis serrata**

southern Steptoe pyrg, *Pyrgulopsis sulcata**

Steptoe hydrobe, *Eremopyrgus eganensis**

sub-globose Steptoe Ranch pyrg, *Pyrgulopsis orbiculata**

relict dace, *Relictus solitarius**

Monte Neva paintbrush, *Castilleja salsuginosa**

*Endemic

NDOW Fisheries Biologist, Chris Crookshanks, with an invasive crayfish. © Susan Abele

Steptoe Valley

Spring complexes in Steptoe Valley. © Susan Abele

Located in eastern Nevada, the Steptoe Valley watershed is the most heavily populated area within White Pine County. The valley hosts a diversity of landowners and most of the valley is in private ownership. In addition to its importance for maintaining agriculture livelihoods, ten species endemic to Nevada reside at springs scattered throughout the valley.

In 2002, the 1.2 million-acre Steptoe Valley Cooperative Weed Management Area (CWMA) was established under the umbrella of Eastern Nevada Landscape Coalition. Eastern Nevada CWMAs inventory lands for weed infestations, implement on-the-ground management of invasive species, and share information through annual meetings. The Steptoe Valley CWMA is comprised of local landowners and county, state, and federal land agency partners.

Opportunities for Conservation

1. Work with private landowners in Steptoe Valley to conserve or enhance spring systems
2. Continue to support efforts of Tri County Weed Control and Eastern Nevada Landscape Coalition to inventory and treat noxious weeds
3. Maintain springs in Good condition where no attributes are rated Fair or Poor
4. Improve vegetation from Fair to Good at springs where no other attributes are in Poor condition
5. Improve physical integrity from Fair to Good at springs where no other attributes are in Poor condition
6. Restore physical integrity and native vegetation at springs where both attributes are currently in Poor condition
7. Prevent introductions of highly invasive aquatic species where they are not currently present

Soldier Meadow

Soldier Meadow. © Brian Beffort

The Soldier Meadow hot spring outflows support a diverse array of species that depend on this desert aquatic ecosystem. There are cold water springs at Soldier Meadows as well that support different rare biota than the hot springs. The combination of hot and cold springs increases the animal and plant diversity of the site. The desert dace (*Eremichthys acros*), a rare desert fish, is found only in Soldier Meadow hot spring outflows north of Mud Meadow Reservoir. The desert dace is a monotypic genus (i.e., has only one species) that is federally listed as threatened. A rare plant, the basalt cinquefoil (*Potentilla basaltica*), also inhabits the hot springs area as well as four endemic springsnails.

Almost 20 years ago, The Nature Conservancy and the privately-owned Soldier Meadow Ranch negotiated a purchase of 1,820 acres of desert dace habitat and a conservation easement for 5,150 acres which included upland habitats important for antelope, sage grouse, deer, and raptors. Subsequently, the Conservancy transferred these lands, at cost, to the Bureau of Land Management for permanent protection in January 1993.

Opportunities for Conservation

1. Explore partnership between the Natural Resources Conservation Service, U.S. Fish and Wildlife Partners for Fish and Wildlife Program, and Soldier Meadow Ranch to identify future opportunities for conservation and restoration of native species and their habitats
2. Control populations of exotic sunfish that compete with native desert dace
3. Prevent expansion of aquatic invasive fish through the installation of fish barriers, where deemed appropriate
4. Support citizen science and volunteer stewardship efforts lead by Friends of Nevada Wilderness
5. Continue to manage for multiple uses (e.g., recreation and cattle grazing) by implementing management practices compatible with sustaining ecological integrity of Soldier Meadow

SPECIES SUMMARY

	Rare Species	Nevada Endemic	ESA
Invertebrates	4	4	1*
Fish	1	-	1
Plants	1	1	1*

*Candidate for listing under ESA

Species

elongate Mud Meadows pyrg, *Pyrgulopsis notidicola**[C]

northern Soldier Meadow pyrg, *Pyrgulopsis militaris**

southern Soldier Meadow pyrg, *Pyrgulopsis umbilicata**

squat Mud Meadows pyrg, *Pyrgulopsis limaria**

desert dace, *Eremichthys acros**[T]

Soldier Meadow cinquefoil, *Potentilla basaltica*[C]

Columbia spotted frog (Great Basin pop), *Rana luteiventris pop.* 3[C]

*Endemic, [T]ESA Threatened, [C]ESA Candidate

Wet meadows around springs provide important foraging habitat for wildlife species, including Greater Sage-Grouse. © Stephen Ting

NEXT STEPS FOR SPRINGS CONSERVATION IN NEVADA

Lost Canyon Spring at Red Rock Canyon © Susan Abele

The Springs Conservation Plan project was a unique opportunity to assess the current condition and future threats to almost 300 springs of biodiversity significance. The future outlook for much of the aquatic biodiversity in Nevada will be dependent upon preserving springs that are currently in good condition and restoring key ecological attributes where necessary.

Of the springs surveyed for this project, responsibility for management was mostly by the U.S. Fish and Wildlife Service (21%), Bureau of Land Management (11%), and private landowners (47%). While federal agencies typically have personnel and a budget to cover land management practices, including spring restoration activities, the resources for private landowners are more diverse. Because funding resources are scarce, cost sharing is encouraged or required for many assistance programs.

Financial Assistance – Various programs are available that provide funding for implementation of on-the-ground projects to protect or improve fish and wildlife habitat.

Easement Programs – Private landowners have additional options for protecting springs that include conservation easements. Conservation easements can be funded by government programs, non-governmental agencies and entities, or through a donation by a private landowner. Easement programs provide funding to private landowners where the landowner retains title to property, but transfers certain property rights to a land trust, government agency, or nonprofit conservation organization. The easement is a tool to protect significant fish and wildlife habitat.

Technical Assistance – In addition to financial resources necessary for the conservation and restoration of springs, data and technical expertise on restoration practices are integral in making decisions on where to focus efforts and increasing likelihood of success of a restoration project. Some programs have personnel who provide direct assistance with planning and implementation of conservation practices.

The following table highlights some resources available for springs conservation and restoration. This table is not intended to be a comprehensive list but rather a starting point for moving forward with on-the-ground action and implementation of the strategies identified in this plan. Other financial and technical resources available include local Conservation Districts, Cooperative Weed Management Area working groups, spring experts (e.g., Desert Research Institute staff, University professors, graduate students), and local nongovernmental organizations. These different groups have been and will continue to provide critical technical assistance in springs ecology and restoration. In addition, many of these groups have been instrumental in contributing labor for project completion through their active volunteer programs. Although every spring presents a unique challenge in its management and conservation, a common thread is that Nevada's biodiversity depends upon conservation partnerships.

Assistance Programs for Springs Conservation

Program Affiliation	Program	Financial Assistance	Easement Program	Technical Assistance	Portion of Total Cost
Ducks Unlimited	Various	+	+	+	Variable
Natural Resources Conservation Service	Environmental Quality Incentives Program (EQIP)	+		+	50-75%
	Wildlife Habitat Incentive Program (WHIP)	+		+	50-75%
	Farm and Ranch Lands Protection Program (FRPP)		+	+	50%
	Grassland Reserve Program		+	+	67%
	Wetlands Reserve Program (WRP)		+	+	75-100%
Nevada Department of Wildlife	Landowner Incentive Program (NLIP)	+	+	+	75%
Nevada Division of Environmental Protection	Clean Water Act Section 319 Grants	+			Variable
Nevada Division of State Lands	Question 1 Program		+		50%
Nevada Natural Heritage Program				+	
U.S. Fish and Wildlife Service	North American Wetlands Conservation Act	+	+		50%
	Partners for Fish and Wildlife Program	+		+	50%
	Tribal Wildlife Grant Program	+	+	+	75%

Ducks Unlimited
Western Regional Office
3074 Gold Canal Dr.
Rancho Cordova, CA 95670
(916) 852-2000

Natural Resources Conservation Service
1365 Corporate Blvd.
Reno, NV 89502
(775) 857-8500

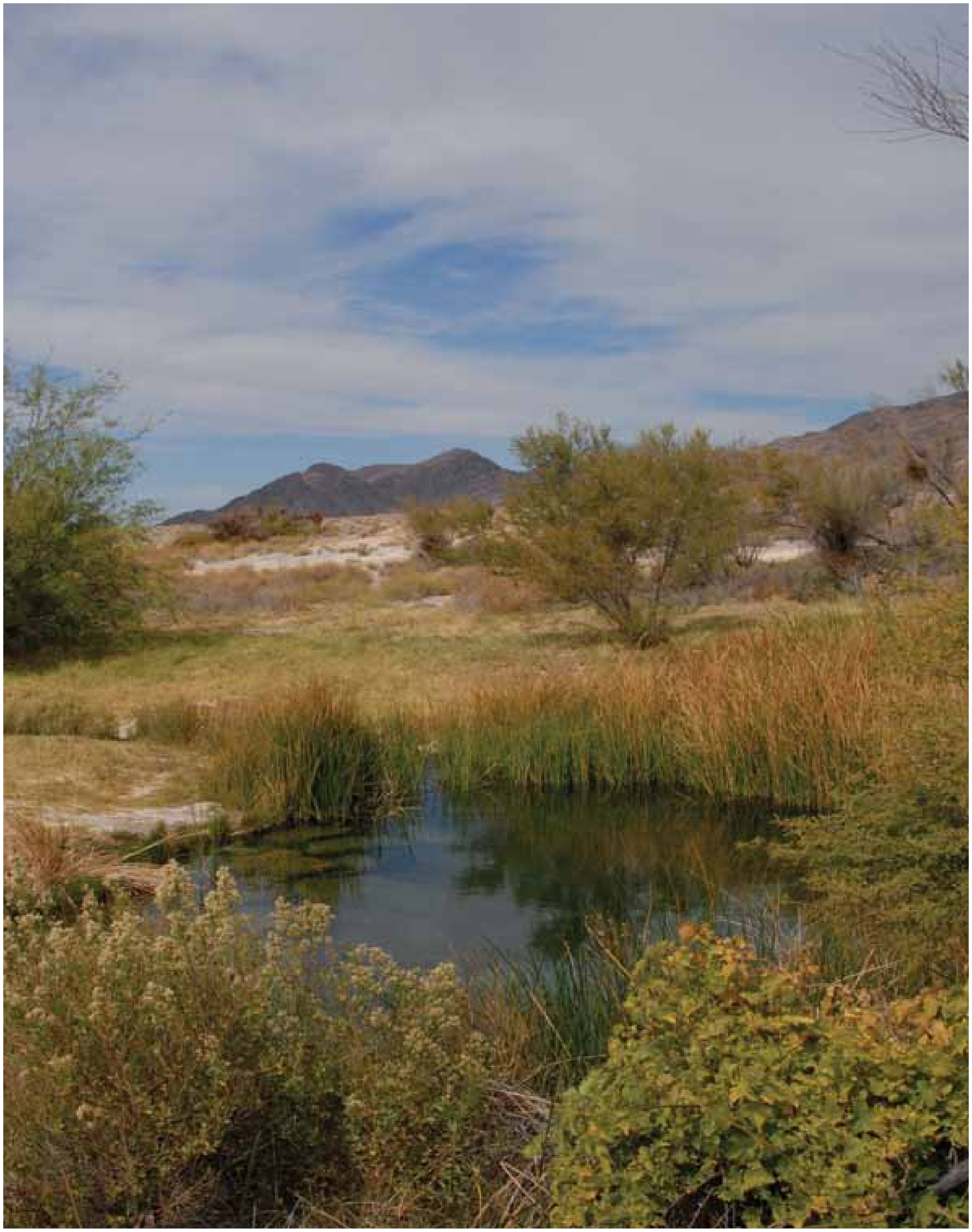
Nevada Department of Wildlife
60 Youth Center Rd.
Elko NV 89801
(775) 777-2392

Nevada Division of Environmental Protection
901 S. Stewart St., Suite 4001
Carson City, NV 89701
(775) 687-9550

Nevada Division of State Lands
901 S. Stewart St., Suite 5003
Carson City, NV 89701
(775) 684-2745

Nevada Natural Heritage Program
901 S. Stewart St., Suite 5002
Carson City, NV 89701
(775) 684-2900

U.S. Fish and Wildlife Service
1340 Financial Blvd., Suite 234
Reno, NV 89502
(775) 861-6300



ASH MEADOWS BIG SPRING

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Spring at Moapa National Wildlife Refuge

APPENDIX 1 Spring-dependent species of conservation concern in Nevada.

The following table includes spring-dependent species of conservation concern in Nevada (n = 158), which includes their NatureServe Global Conservation Status Ranks (G-rank). These ranks reflect an assessment of the condition of the species across its entire range. Nevada endemics – species found nowhere else in the world – are noted (Y).

NatureServe Global Conservation Status Rank definitions	
Rank	**Definition**
X	**Presumed Extinct** – not located despite intensive searches and virtually no likelihood of rediscovery
H	**Possibly Extinct** – missing; known from only historical occurrences but still some hope of rediscovery
1	**Critically Imperiled** – At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors
2	**Imperiled** – At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
3	**Vulnerable** – At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and wide-spread declines, or other factors.
4	**Apparently Secure** – Uncommon but not rare; some cause for long-term concern due to declines or other factors.
5	**Secure** – Common; widespread and abundant.
G	Refers to the **global** population of a species
T	Refers to the subspecific or variety **taxonomic** level.
Q	**Questionable taxonomy** – Taxonomic distinctiveness of this entity at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation priority.
NR	Taxon **Not Ranked**

Group	Scientific Name	Common Name	G-Rank	NV Endemic
Invertebrate Animal	*Ambrysus amargosus*	Ash Meadows naucorid	G1	Y
Invertebrate Animal	*Anodonta californiensis*	California floater	G3Q	
Invertebrate Animal	*Eremopyrgus eganensis*	Steptoe hydrobe	G1	Y
Invertebrate Animal	*Fluminicola dalli*	Pyramid Lake pebblesnail	G1	Y
Invertebrate Animal	*Fluminicola virginius*	Virginia Mountains pebblesnail	G1	Y
Invertebrate Animal	*Haliplus eremicus*	Warm Springs crawling water beetle	GNR	
Invertebrate Animal	*Juga interioris*	smooth juga	G1	
Invertebrate Animal	*Juga laurae*	Oasis juga	G1	
Invertebrate Animal	*Pelocoris shoshone amargosus*	Amargosa naucorid	G1G3T1	
Invertebrate Animal	*Pelocoris shoshone shoshone*	Pahranagat naucorid bug	G1G3T1	Y
Invertebrate Animal	*Pyrgulopsis aloba*	Duckwater pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis anatina*	southern Duckwater pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis anguina*	longitudinal gland pyrg	G1	
Invertebrate Animal	*Pyrgulopsis augustae*	elongate Cain Spring pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis aurata*	Pleasant Valley pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis avernalis*	Moapa pebblesnail	G1G2	Y
Invertebrate Animal	*Pyrgulopsis basiglans*	large gland Carico pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis bifurcata*	small gland Carico pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis breviloba*	Flag pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis bruesi*	Fly Ranch pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis bryantwalkeri*	Cortez Hills pebblesnail	G1	
Invertebrate Animal	*Pyrgulopsis carinata*	carinate Duckwater pyrg	GX	Y
Invertebrate Animal	*Pyrgulopsis carinifera*	Moapa Valley pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis coloradensis*	Blue Point pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis cruciglans*	transverse gland pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis crystalis*	Crystal Spring pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis deaconi*	Spring Mountains pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis dixensis*	Dixie Valley pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis erythropoma*	Ash Meadows pebblesnail	G1	Y
Invertebrate Animal	*Pyrgulopsis fairbanksensis*	Fairbanks pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis fausta*	Corn Creek pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis gracilis*	Emigrant pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis hovinghi*	Upper Thousand Spring pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis hubbsi*	Hubbs pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis humboldtensis*	Humboldt pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis imperialis*	Kings River pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis isolata*	elongate-gland pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis landyei*	Landyes pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis lata*	Butterfield pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis lentiglans*	Crittenden pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis leporina*	Elko pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis limaria*	squat Mud Meadows pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis lockensis*	Lockes pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis longiglans*	western Lahontan pyrg	G2G3	Y

Group	Scientific Name	Common Name	G-Rank	NV Endemic
Invertebrate Animal	*Pyrgulopsis marcida*	Hardy pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis merriami*	Pahranagat pebblesnail	G1	Y
Invertebrate Animal	*Pyrgulopsis micrococcus*	Oasis Valley pyrg	G3	
Invertebrate Animal	*Pyrgulopsis militaris*	northern Soldier Meadow pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis millenaria*	Twentyone Mile pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis montana*	Camp Valley pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis nanus*	Distal-gland pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis neritella*	neritiform Steptoe Ranch pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis nevadensis*	Pyramid Lake pebblesnail	GX	P
Invertebrate Animal	*Pyrgulopsis notidicola*	elongate Mud Meadows pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis orbiculata*	sub-globose Steptoe Ranch pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis papillata*	Big Warm Spring pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis peculiaris*	bifid duct pyrg	G2	
Invertebrate Animal	*Pyrgulopsis pellita*	Antelope Valley pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis pictilis*	ovate Cain Spring pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis pisteri*	median-gland Nevada pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis planulata*	flat-topped Steptoe pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis ruinosa*	Fish Lake Valley pyrg	GX	Y
Invertebrate Animal	*Pyrgulopsis sadai*	Sadas pyrg	G1G2	Y
Invertebrate Animal	*Pyrgulopsis sathos*	White River Valley pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis serrata*	northern Steptoe pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis sterilis*	sterile basin pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis sublata*	Lake Valley pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis sulcata*	southern Steptoe pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis turbatrix*	southeast Nevada pyrg	G2	
Invertebrate Animal	*Pyrgulopsis umbilicata*	southern Soldier Meadow pyrg	G1Q	Y
Invertebrate Animal	*Pyrgulopsis variegata*	northwest Bonneville pyrg	G2	
Invertebrate Animal	*Pyrgulopsis villacampae*	Duckwater Warm Springs pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis vinyardi*	Vinyards pyrg	G1	Y
Invertebrate Animal	*Pyrgulopsis wongi*	Wongs pyrg	G2	
Invertebrate Animal	*Stenelmis calida calida*	Devils Hole warm spring riffle beetle	GNRT1	Y
Invertebrate Animal	*Stenelmis lariversi*	Ash Springs riffle beetle	G1	Y
Invertebrate Animal	*Stenelmis occidentalis*	neararctic riffle beetle	G4	
Invertebrate Animal	*Tryonia angulata*	sportinggoods tryonia	G1	Y
Invertebrate Animal	*Tryonia clathrata*	grated tryonia	G2	Y
Invertebrate Animal	*Tryonia elata*	Point of Rocks tryonia	G1	Y
Invertebrate Animal	*Tryonia ericae*	minute tryonia	G1	Y
Invertebrate Animal	*Tryonia monitorae*	monitor tryonia	G1	Y
Invertebrate Animal	*Tryonia variegata*	Amargosa tryonia	G2	
Invertebrate Animal	*Usingerina moapensis*	Warm Springs naucorid	G1	Y
Vertebrate Animal	*Bufo boreas halophilus*	California toad	G4T4	
Vertebrate Animal	*Bufo microscaphus*	Arizona toad	G3G4	
Vertebrate Animal	*Bufo nelsoni*	Amargosa toad	G2	Y
Vertebrate Animal	*Cottus sp. 3*	White River sculpin	G1	Y

Group	Scientific Name	Common Name	G-Rank	NV Endemic
Vertebrate Animal	*Crenichthys baileyi albivallis*	Preston White River springfish	G2T1	Y
Vertebrate Animal	*Crenichthys baileyi baileyi*	White River springfish	G2T1	Y
Vertebrate Animal	*Crenichthys baileyi grandis*	Hiko White River springfish	G2T1	Y
Vertebrate Animal	*Crenichthys baileyi moapae*	Moapa White River springfish	G2T2	Y
Vertebrate Animal	*Crenichthys baileyi thermophilus*	Moorman White River springfish	G2T1	Y
Vertebrate Animal	*Crenichthys nevadae*	Railroad Valley springfish	G2	Y
Vertebrate Animal	*Cyprinodon diabolis*	Devils Hole pupfish	G1	Y
Vertebrate Animal	*Cyprinodon nevadensis mionectes*	Ash Meadows Amargosa pupfish	G2T2	Y
Vertebrate Animal	*Cyprinodon nevadensis pectoralis*	Warm Springs Amargosa pupfish	G2T1	Y
Vertebrate Animal	*Empetrichthys latos latos*	Pahrump poolfish	G1T1	Y
Vertebrate Animal	*Eremichthys acros*	desert dace	G1	Y
Vertebrate Animal	*Gila alvordensis*	Alvord chub	G2	
Vertebrate Animal	*Gila bicolor euchila*	Fish Creek Springs tui chub	G4T1Q	Y
Vertebrate Animal	*Gila bicolor eurysoma*	Sheldon tui chub	G4T1	
Vertebrate Animal	*Gila bicolor isolata*	Independence Valley tui chub	G4T1Q	Y
Vertebrate Animal	*Gila bicolor newarkensis*	Newark Valley tui chub	G4T1Q	Y
Vertebrate Animal	*Gila bicolor ssp. 10*	Charnock Springs tui chub	G4T1Q	Y
Vertebrate Animal	*Gila bicolor ssp. 11*	High Rock Spring tui chub	G4TX	Y
Vertebrate Animal	*Gila bicolor ssp. 3*	Duckwater Creek tui chub	G4T1	Y
Vertebrate Animal	*Gila bicolor ssp. 4*	Fish Lake Valley tui chub	G4T1Q	Y
Vertebrate Animal	*Gila bicolor ssp. 5*	Hot Creek Valley tui chub	G4T1Q	Y
Vertebrate Animal	*Gila bicolor ssp. 6*	Little Fish Lake Valley tui chub	G4T1	Y
Vertebrate Animal	*Gila bicolor ssp. 7*	Railroad Valley tui chub	G4T1Q	Y
Vertebrate Animal	*Gila bicolor ssp. 8*	Big Smoky Valley tui chub	G4T1	Y
Vertebrate Animal	*Gila bicolor ssp. 9*	Dixie Valley tui chub	G4T1Q	Y
Vertebrate Animal	*Gila bicolor vaccaceps*	Cow Head tui chub	G4T1	
Vertebrate Animal	*Gila robusta jordani*	Pahranagat roundtail chub	G3T1	Y
Vertebrate Animal	*Lepidomeda albivallis*	White River spinedace	G1	Y
Vertebrate Animal	*Lepidomeda mollispinis mollispinis*	Virgin River spinedace	G1G2T1	
Vertebrate Animal	*Lepidomeda mollispinis pratensis*	Big Spring spinedace	G1G2T1	Y
Vertebrate Animal	*Microtus montanus fucosus*	Pahranagat Valley montane vole	G5T2	Y
Vertebrate Animal	*Microtus montanus nevadensis*	Ash Meadows montane vole	G5TH	Y
Vertebrate Animal	*Moapa coriacea*	Moapa dace	G1	Y
Vertebrate Animal	*Rana luteiventris pop. 3*	Columbia spotted frog (Great Basin pop)	G4T2T3Q	
Vertebrate Animal	*Rana onca*	relict leopard frog	G1	
Vertebrate Animal	*Rana pipiens*	northern leopard frog	G5	
Vertebrate Animal	*Relictus solitarius*	relict dace	G2G3	Y
Vertebrate Animal	*Rhinichthys osculus lariversi*	Big Smoky Valley speckled dace	G5T1	Y
Vertebrate Animal	*Rhinichthys osculus lethoporus*	Independence Valley speckled dace	G5T1	Y
Vertebrate Animal	*Rhinichthys osculus moapae*	Moapa speckled dace	G5T1	Y
Vertebrate Animal	*Rhinichthys osculus nevadensis*	Ash Meadows speckled dace	G5T1	Y
Vertebrate Animal	*Rhinichthys osculus oligoporus*	Clover Valley speckled dace	G5T1	Y
Vertebrate Animal	*Rhinichthys osculus ssp. 11*	Meadow Valley speckled dace	G5T2	Y
Vertebrate Animal	*Rhinichthys osculus ssp. 5*	Monitor Valley speckled dace	G5T1	Y

Group	Scientific Name	Common Name	G-Rank	NV Endemic
Vertebrate Animal	*Rhinichthys osculus ssp. 6*	Oasis Valley speckled dace	G5T1	Y
Vertebrate Animal	*Rhinichthys osculus ssp. 7*	White River speckled dace	G5T2T3Q	Y
Vertebrate Animal	*Rhinichthys osculus velifer*	Pahranagat speckled dace	G5T1Q	Y
Vascular Plant	*Astragalus lentiginosus var. sesquimetralis*	Sodaville milkvetch	G5T1	
Vascular Plant	*Botrychium ascendens*	upswept moonwort	G2G3	
Vascular Plant	*Botrychium crenulatum*	dainty moonwort	G3	
Vascular Plant	*Calochortus striatus*	alkali mariposa lily	G2	
Vascular Plant	*Castilleja salsuginosa*	Monte Neva paintbrush	G1Q	Y
Vascular Plant	*Centaurium namophilum*	spring-loving centaury	G2Q	Y
Vascular Plant	*Cirsium virginense*	Virgin River thistle	G2	
Vascular Plant	*Cordylanthus tecopensis*	Tecopa birdbeak	G2	
Vascular Plant	*Eriogonum ampullaceum*	Mono buckwheat	G3	
Vascular Plant	*Eriogonum argophyllum*	Sulphur Springs buckwheat	G1	Y
Vascular Plant	*Eriogonum ovalifolium var. williamsiae*	Steamboat buckwheat	G5T1	Y
Vascular Plant	*Grindelia fraxinopratensis*	Ash Meadows gumplant	G2	
Vascular Plant	*Imperata brevifolia*	satintail	G2	
Vascular Plant	*Ivesia kingii var. eremica*	Ash Meadows mousetails	G3T1T2Q	Y
Vascular Plant	*Ivesia pityocharis*	Pine Nut Mountains mousetails	G2	Y
Vascular Plant	*Potentilla basaltica*	Soldier Meadow cinquefoil	G1	
Vascular Plant	*Sisyrinchium funereum*	Death Valley blue-eyed grass	G2G3	
Vascular Plant	*Sisyrinchium radicatum*	St. George blue-eyed grass	G2?Q	
Vascular Plant	*Spiranthes diluvialis*	Ute lady's tresses	G2	
Vascular Plant	*Spiranthes infernalis*	Ash Meadows lady's tresses	G1	Y
Nonvascular Plant	*Meesia triquetra*	three-ranked humpmoss	G5	
Fungus	*Dermatocarpon luridum*	stream stippleback lichen	G4G5	
Fungus	*Solorina spongiosa*	fringed chocolate chip lichen	G4G5	

Sidalcea oregana

Oregon checkermallow

APPENDIX 2 Plants documented during spring surveys in 2008-2009.

Plants documented at surveyed springs and their associated Natural Resources Conservation Service (NRCS) plant codes and Nevada 'noxious weed' status, as identified by the Nevada Department of Agriculture.

Categories were defined for assessing current condition of riparian vegetation at spring sites as follows:

Category 1: Invasives
Category 2: Non-natives (non-invasive) or upland species (native or not)
Category 3: Disturbance (mostly grazing or channel modification) tolerant native wetland species
Category 4: disturbance intolerant native wetland species

For the viability assessment, vegetation indicator ratings were quantified as follows:

Poor >10% Category 1, OR >50% Category 2, OR >50% bare ground;

Fair NOT Poor, Good or Very good;

Good <5% Category 1 AND <25% Category 2; Category 3 AND Category 4 >80% OR Category 4 <30%; bare ground <20%;

Very Good <1% Category 1 AND <10% Category 2 AND >75% Category 4 AND <5% bare ground.

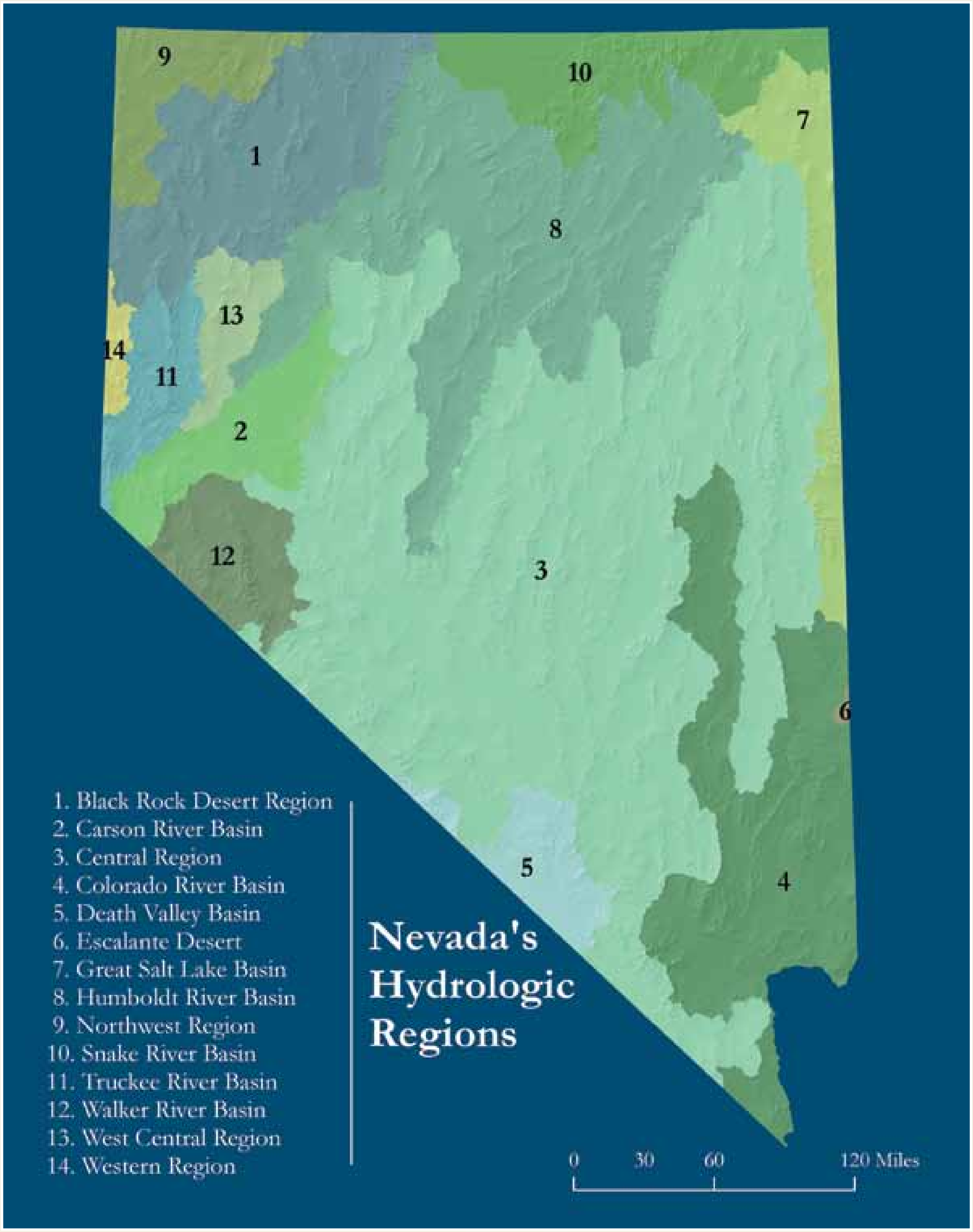
NRCS Code	Common Name	Scientific Name	Noxious	US Nativity	Category
ACMI2	common yarrow	*Achillea millefolium*		Native and Introduced to U.S.	3
ADCA	common maidenhair	*Adiantum capillus-veneris*		Native to U.S.	4
AGCR	crested wheatgrass	*Agropyron cristatum*		Introduced to U.S.	2
ANGL2	bushy bluestem	*Andropogon glomeratus*		Native to U.S.	4
ANCA10	yerba mansa	*Anemopsis californica*		Native to U.S.	3
APCA	Indianhemp	*Apocynum cannabinum*		Native to U.S.	3
AQFO	western columbine	*Aquilegia formosa*		Native to U.S.	3
ARAN7	silverweed cinquefoil	*Argentina anserina*		Native to U.S.	3
ARDO3	Douglas' sagewort	*Artemisia douglasiana*		Native to U.S.	3
ARTRT	basin big sagebrush	*Artemisia tridentata ssp. tridentata*		Native to U.S.	2
ASCLE	milkweed	*Asclepias*		Native to U.S.	3
ATRIP	saltbush	*Atriplex*		Native to U.S.	2
BAEM	Emory's baccharis	*Baccharis emoryi*		Native to U.S.	3
BEER	cutleaf waterparsnip	*Berula erecta*		Native to U.S.	4
BICE	nodding beggartick	*Bidens cernua*		Native to U.S.	4
BRIN2	smooth brome	*Bromus inermis*		Native and Introduced to U.S.	2
BRTE	cheatgrass	*Bromus tectorum*		Introduced to U.S.	1
CANU4	nodding plumeless thistle	*Carduus nutans*	Y	Introduced to U.S.	1
CAREX	sedge	*Carex*		Native to U.S.	3
CANE2	Nebraska sedge	*Carex nebrascensis*		Native to U.S.	4
CAPR5	clustered field sedge	*Carex praegracilis*		Native to U.S.	4
CASTI2	Indian paintbrush	*Castilleja*		Native to U.S.	2
CERE6		*Centaurea repens*	Y	Introduced to U.S.	1

NRCS Code	Common Name	Scientific Name	Noxious	US Nativity	Category
CENTA2	centaury	*Centaurium*		Native to U.S.	3
CEEX	desert centaury	*Centaurium exaltatum*		Native to U.S.	3
CEDE4	coon's tail	*Ceratophyllum demersum*		Native to U.S.	3
CEOR9	California redbud	*Cercis orbiculata*		Native to U.S.	3
CHAL7	lambsquarters	*Chenopodium album*		Native and Introduced to U.S.	2
CHVI8	yellow rabbitbrush	*Chrysothamnus viscidiflorus*		Native to U.S.	2
CIRSI	thistle	*Cirsium*		Native and Introduced	3
CIAR4	Canada thistle	*Cirsium arvense*	Y	Introduced to U.S.	1
CIMO	Mojave thistle	*Cirsium mohavense*		Native to U.S.	3
CISC2	meadow thistle	*Cirsium scariosum*		Native to U.S.	3
CIVU	bull thistle	*Cirsium vulgare*		Introduced to U.S.	1
CLCA2	California sawgrass	*Cladium californicum*		Native to U.S.	3
COUM	bastard toadflax	*Comandra umbellata*		Native to U.S.	2
CREPI	hawksbeard	*Crepis*		Native to U.S.	2
CRSE11	dove weed	*Croton setigerus*		Native to U.S.	2
CRYPT	cryptantha	*Cryptantha*		Native to U.S.	2
CYDA	Bermudagrass	*Cynodon dactylon*		Introduced to U.S.	1
CYPER	flatsedge	*Cyperus*		Native and Introduced	4
CYLA2	smooth flatsedge	*Cyperus laevigatus*		Native to U.S.	3
DAGL	orchardgrass	*Dactylis glomerata*		Introduced to U.S.	2
DEPI	western tansymustard	*Descurainia pinnata*		Native to U.S.	2
DISP	saltgrass	*Distichlis spicata*		Native to U.S.	3
DODEC	shootingstar	*Dodecatheon*		Native to U.S.	3
ELAN	Russian olive	*Elaeagnus angustifolia*		Introduced to U.S.	1
ELEOC	spikerush	*Eleocharis*		Native and Introduced	3
ELPA4	Parish's spikerush	*Eleocharis parishii*		Native to U.S.	3
ELRO2	beaked spikerush	*Eleocharis rostellata*		Native to U.S.	3
ELYMU	wildrye	*Elymus*		Native to U.S.	3
ELSA		*Elymus salinus*		Native to U.S.	4
EPCI	fringed willowherb	*Epilobium ciliatum*		Native to U.S.	3
EPGI	stream orchid	*Epipactis gigantea*		Native to U.S.	4
EQUIS	horsetail	*Equisetum*		Native to U.S.	3
ERNA10	rubber rabbitbrush	*Ericameria nauseosa*		Native to U.S.	2
ERIGE2	fleabane	*Erigeron*		Native to U.S.	2
ERCI6	redstem stork's bill	*Erodium cicutarium*		Introduced to U.S.	2
FITH	hot springs fimbry	*Fimbristylis thermalis*		Native to U.S.	4
Frase	green gentian	*Frasera*		Native to U.S.	2
FRVE2	velvet ash	*Fraxinus velutina*		Native to U.S.	4
GABI	twinleaf bedstraw	*Galium bifolium*		Native to U.S.	3
GARRY	silktassel	*Garrya*		Native to U.S.	2
GEUM	avens	*Geum*		Native to U.S.	3
GNPA	western marsh cudweed	*Gnaphalium palustre*		Native to U.S.	3
HELIA	helianthella	*Helianthella*		Native to U.S.	3

NRCS Code	Common Name	Scientific Name	Noxious	US Nativity	Category
HEAN3	common sunflower	*Helianthus annuus*		Native to U.S.	3
HENU	Nuttall's sunflower	*Helianthus nuttallii*		Native to U.S.	3
HECU3	salt heliotrope	*Heliotropium curassavicum*		Native to U.S.	3
HIERA	hawkweed	*Hieracium*		Native to U.S.	2
HIVU2	common mare's-tail	*Hippuris vulgaris*		Native to U.S.	4
HOBR2	meadow barley	*Hordeum brachyantherum*		Native to U.S.	3
HOJU	foxtail barley	*Hordeum jubatum*		Native to U.S.	3
HYSC5	Scouler's St. Johnswort	*Hypericum scouleri*		Native to U.S.	2
IRMI	Rocky Mountain iris	*Iris missouriensis*		Native to U.S.	3
IVAX	povertyweed	*Iva axillaris*		Native to U.S.	2
JUNCU	rush	*Juncus*		Native to U.S.	4
JUBA		*Juncus balticus*		Native to U.S.	3
JUBU	toad rush	*Juncus bufonius*		Native to U.S.	4
JUEN	swordleaf rush	*Juncus ensifolius*		Native to U.S.	4
JUENB		*Juncus ensifolius var. brunnescens*		Native to U.S.	4
KOSC		*Kochia scoparia*		Introduced to U.S.	1
LASE	prickly lettuce	*Lactuca serriola*		Introduced to U.S.	1
LAMIU	deadnettle	*Lamium*		Native to U.S.	3
LAREC		*Lappula redowskii var. cupulata*		Native to U.S.	2
LEMNA	duckweed	*Lemna*		Native to U.S.	4
LETR	star duckweed	*Lemna trisulca*		Native to U.S.	4
LELA2	broadleaved pepperweed	*Lepidium latifolium*	Y	Introduced to U.S.	1
LECI4	basin wildrye	*Leymus cinereus*		Native to U.S.	2
LILE3	Lewis flax	*Linum lewisii*		Native to U.S.	2
LOCA2	cardinalflower	*Lobelia cardinalis*		Native to U.S.	4
LOPE	perennial ryegrass	*Lolium perenne*		Introduced to U.S.	2
LURE2	creeping primrose-willow	*Ludwigia repens*		Native to U.S.	2
LUAR3	silvery lupine	*Lupinus argenteus*		Native to U.S.	2
LYCA4	California loosestrife	*Lythrum californicum*		Native to U.S.	3
MACHA	tansyaster	*Machaeranthera*		Native to U.S.	2
MACA2	hoary tansyaster	*Machaeranthera canescens*		Native to U.S.	2
MAFR3	Fremont's mahonia	*Mahonia fremontii*		Native to U.S.	2
MAVU	horehound	*Marrubium vulgare*		Introduced to U.S.	2
MELU	black medick	*Medicago lupulina*		Introduced to U.S.	2
MESA	alfalfa	*Medicago sativa*		Introduced to U.S.	1
MEOF	yellow sweetclover	*Melilotus officinalis*		Introduced to U.S.	1
MENTH	mint	*Mentha*		Introduced to U.S.	2
MEAR4	wild mint	*Mentha arvensis*		Native to U.S.	3
MESP3	spearmint	*Mentha spicata*		Introduced to U.S.	2
MIGU	seep monkeyflower	*Mimulus guttatus*		Native to U.S.	4
MUAS	scratchgrass	*Muhlenbergia asperifolia*		Native to U.S.	3
NAOF	watercress	*Nasturtium officinale*		Introduced to U.S.	2
OENOT	evening-primrose	*Oenothera*		Native to U.S.	2
ORCU	toothed owl's-clover	*Orthocarpus cuspidatus*		Native to U.S.	2

NRCS Code	Common Name	Scientific Name	Noxious	US Nativity	Category
OXAC4	copperweed	*Oxytenia acerosa*		Native to U.S.	2
PAPA8	marsh grass of Parnassus	*Parnassia palustris*		Native to U.S.	4
PADI6	knotgrass	*Paspalum distichum*		Native to U.S.	3
PHAR3	reed canarygrass	*Phalaris arundinacea*		Native to U.S.	3
PHPR3	timothy	*Phleum pratense*		Introduced to U.S.	2
PHAU7	common reed	*Phragmites australis*		Native to U.S.	3
PLANT	plantain	*Plantago*		Native and Introduced	2
PLMA2	common plantain	*Plantago major*		Native to U.S.	3
PLATA2	fringed orchid	*Platanthera*		Native to U.S.	4
PLOD	sweetscent	*Pluchea odorata*		Native to U.S.	3
PLSE	arrowweed	*Pluchea sericea*		Native to U.S.	3
POA	bluegrass	*Poa*		Native and Introduced	3
POPR	Kentucky bluegrass	*Poa pratensis*		Native and Introduced	2
POSE	Sandberg bluegrass	*Poa secunda*		Native to U.S.	2
POLEM	Jacob's-ladder	*Polemonium*		Native to U.S.	4
POFO	towering Jacob's-ladder	*Polemonium foliosissimum*		Native to U.S.	4
POOC2	western polemonium	*Polemonium occidentale*		Native to U.S.	4
POLYG4	knotweed	*Polygonum*		Native and Introduced to U.S.	2
POMO5	annual rabbitsfoot grass	*Polypogon monspeliensis*		Introduced to U.S.	1
POPUL	cottonwood	*Populus*		Native to U.S.	4
POBAT	black cottonwood	*Populus balsamifera ssp. trichocarpa*		Native to U.S.	4
PODE3	Eastern Cottonwood	*Populus deltoides*		Native to U.S.	2
POFR2	Fremont cottonwood	*Populus fremontii*		Native to U.S.	4
POTAM	pondweed	*Potamogeton*		Native to U.S.	4
POAR7	tall cinquefoil	*Potentilla arguta*		Native to U.S.	3
POGR9	slender cinquefoil	*Potentilla gracilis*		Native to U.S.	3
PRIMU	primrose	*Primula*		Native to U.S.	4
PRGL2	honey mesquite	*Prosopis glandulosa*		Native to U.S.	4
PRPU	screwbean mesquite	*Prosopis pubescens*		Native to U.S.	4
PSST7	cottonbatting plant	*Pseudognaphalium stramineum*		Native to U.S.	3
PUST	Stansbury cliffrose	*Purshia stansburiana*		Native to U.S.	2
RANUN	buttercup	*Ranunculus*		Native and Introduced	3
RAAQ	white water crowfoot	*Ranunculus aquatilis*		Native to U.S.	4
RACY	alkali buttercup	*Ranunculus cymbalaria*		Native to U.S.	3
RHTR	skunkbush sumac	*Rhus trilobata*		Native to U.S.	2
RIBES	currant	*Ribes*		Native to U.S.	3
ROPS	black locust	*Robinia pseudoacacia*		Native to U.S.	2
ROSA5	rose	*Rosa*		Native to U.S.	2
RUMEX	dock	*Rumex*		Introduced to U.S.	2
SALIX	willow	*Salix*		Native to U.S.	4
SAEX	narrowleaf willow	*Salix exigua*		Native to U.S.	4
SALA3	red willow	*Salix laevigata*		Native to U.S.	4
SAMOL	brookweed	*Samolus*		Native to U.S.	4

NRCS Code	Common Name	Scientific Name	Noxious	US Nativity	Category
SAVE4	greasewood	*Sarcobatus vermiculatus*		Native to U.S.	2
SCTA2	softstem bulrush	*Schoenoplectus tabernaemontani*		Native to U.S.	4
SCNI	black bogrush	*Schoenus nigricans*		Native to U.S.	4
SCAM2		*Scirpus americanus*		Native to U.S.	4
SCMI2	panicled bulrush	*Scirpus microcarpus*		Native to U.S.	4
SCTA80		*Scirpus tabernaemontani*		Native to U.S.	4
SESE2	tall ragwort	*Senecio serra*		Native to U.S.	2
SESES	tall ragwort	*Senecio serra var. serra*		Native to U.S.	2
SHAR	silver buffaloberry	*Shepherdia argentea*		Native to U.S.	3
SIOR	Oregon checkerbloom	*Sidalcea oregana*		Native to U.S.	4
SIAL2	tall tumblemustard	*Sisymbrium altissimum*		Introduced to U.S.	1
SISYR	blue-eyed grass	*Sisyrinchium*		Native to U.S.	4
SIHA2	Nevada blue-eyed grass	*Sisyrinchium halophilum*		Native to U.S.	4
SIUM	waterparsnip	*Sium*		Native to U.S.	4
SOLAN	nightshade	*Solanum*		Native to U.S.	3
SOLID	goldenrod	*Solidago*		Native to U.S.	3
SOSP3	Nevada goldenrod	*Solidago spectabilis*		Native to U.S.	3
SOVE6	threenerve goldenrod	*Solidago velutina*		Native to U.S.	3
SONCH	sowthistle	*Sonchus*		Introduced to U.S.	1
SOAR2	field sowthistle	*Sonchus arvensis*	Y	Introduced to U.S.	1
SOAS	spiny sowthistle	*Sonchus asper*		Introduced to U.S.	1
SPAI	alkali sacaton	*Sporobolus airoides*		Native to U.S.	3
SUMO	Mojave seablite	*Suaeda moquinii*		Native to U.S.	3
TAMAR2	tamarisk	*Tamarix*		Introduced to U.S.	1
TARA	saltcedar	*Tamarix ramosissima*	Y	Introduced to U.S.	1
TAOF	common dandelion	*Taraxacum officinale*		Native and Introduced to U.S.	2
THERM	goldenbanner	*Thermopsis*		Native to U.S.	3
TRDU	yellow salsify	*Tragopogon dubius*		Introduced to U.S.	2
TRFR2	strawberry clover	*Trifolium fragiferum*		Introduced to U.S.	2
TRPR2	red clover	*Trifolium pratense*		Introduced to U.S.	2
TRRE3	white clover	*Trifolium repens*		Introduced to U.S.	2
TRWO	cows clover	*Trifolium wormskioldii*		Native to U.S.	3
TRIGL	arrowgrass	*Triglochin*		Native to U.S.	4
TRMA20	seaside arrowgrass	*Triglochin maritima*		Native to U.S.	4
TRMA4		*Triglochin maritimum*		Native to U.S.	4
TYDO	southern cattail	*Typha domingensis*		Native to U.S.	3
TYLA	broadleaf cattail	*Typha latifolia*		Native to U.S.	3
URDI	stinging nettle	*Urtica dioica*		Native and Introduced to U.S.	3
VEAN2	water speedwell	*Veronica anagallis-aquatica*		Native to U.S.	3
VIAR2	canyon grape	*Vitis arizonica*		Native to U.S.	3
WAFI	California fan palm	*Washingtonia filifera*		Native to U.S.	2
ZIGAD	deathcamas	*Zigadenus*		Native to U.S.	3



NEVADA'S HYDROLOGIC REGIONS

APPENDIX 3

Current condition of key ecological attributes for springs surveyed in 2008-2009.

Current condition of key ecological attributes for springs surveyed in 2008-2009 for the Springs Conservation Plan, organized by hydrologic region. Requests for details on Field Note records can be submitted to the Nevada Natural Heritage Program. Key ecological attributes were rated: **Very Good**, **Good**, **Fair**, or **Poor**. Manager/ownership of the surveyed springs included: Private (47%), U.S. Fish and Wildlife Service (FWS, 21%), Bureau of Land Management (BLM, 11%), U.S. Forest Service (USFS, 5%), State of Nevada (5%), Tribal (5%), BLM/Private (4%), National Park Service (1%), The Nature Conservancy (1%), Southern Nevada Water Authority (SNWA, 1%), Department of Energy (DOE, less than 1%), and BLM/Tribal (less than 1%).

* denotes a spring currently in good condition

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
AS09-69	Good	Very Good	Very Good	Fair	FWS	Black Rock Desert
AS09-76	Poor	Poor	Very Good	Fair	BLM	Black Rock Desert
AS08-002	Good	Good	Good	Fair	Private	Central
AS08-003	Good	Very Good	Good	Fair	USFS	Central
AS08-013	Fair	Very Good	Very Good	Fair	Private	Central
AS08-014	Fair	Very Good	Very Good	Good	Private	Central
AS08-016	Fair	Very Good	Very Good	Fair	Private	Central
AS08-017	Very Good	Very Good	Very Good	Fair	USFS	Central
AS08-019	Fair	Very Good	Very Good	Fair	Private	Central
AS08-020	Fair	Very Good	Very Good	Fair	Private	Central
AS08-021	Fair	Very Good	Very Good	Fair	Private	Central
AS08-022	Fair	Very Good	Very Good	Fair	Private	Central
AS08-023	Very Good	Very Good	Very Good	Fair	Private	Central
* AS08-028	Good	Very Good	Very Good	Good	BLM/Private	Central
AS08-029	Fair	Very Good	Very Good	Good	BLM/Private	Central
AS08-030	Fair	Very Good	Very Good	Good	Private	Central
AS08-031	Fair	Very Good	Good	Good	Private	Central
AS08-032	Fair	Very Good	Very Good	Good	Private	Central
AS08-033	Fair	Very Good	Very Good	Good	Private	Central
AS08-034	Fair	Very Good	Very Good	Good	Private	Central
AS08-035	Fair	Very Good	Very Good	Good	Private	Central
* AS08-036	Very Good	Very Good	Very Good	Good	Private	Central
* AS08-037	Very Good	Very Good	Very Good	Good	Private	Central
* AS08-038	Very Good	Very Good	Very Good	Good	Private	Central
* AS08-039	Very Good	Very Good	Very Good	Good	Private	Central
AS08-040	Good	Very Good	Very Good	Good	Private	Central
AS08-041	Fair	Very Good	Very Good	Fair	Private	Central
AS08-042	Fair	Very Good	Very Good	Good	Private	Central
AS08-043	Good	Very Good	Very Good	Fair	Private	Central
* AS08-044	Very Good	Very Good	Very Good	Good	Private	Central

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
* AS08-045	Very Good	Very Good	Very Good	Good	Private	Central
* AS08-046	Very Good	Very Good	Very Good	Good	Private	Central
AS08-122	Fair	Very Good	Very Good	Good	FWS	Central
AS08-123	Very Good	Very Good	Very Good	Poor	FWS	Central
* AS08-124	Very Good	Very Good	Very Good	Good	FWS	Central
AS08-125	Fair	Very Good	Very Good	Poor	Private	Central
* AS08-126	Good	Very Good	Very Good	Good	Private	Central
* AS08-127	Good	Very Good	Very Good	Good	Private	Central
AS08-128	Fair	Very Good	Very Good	Poor	Private	Central
AS08-129	Fair	Very Good	Very Good	Poor	Private	Central
AS08-134	Fair	Very Good	Very Good	Good	BLM	Central
AS08-146	Fair	Very Good	Very Good	Fair	Private	Central
AS08-147	Fair	Very Good	Very Good	Good	Private	Central
AS08-148	Fair	Very Good	Very Good	Fair	Private	Central
AS08-149	Fair	Very Good	Very Good	Fair	Private	Central
AS08-150	Fair	Very Good	Very Good	Good	Private	Central
AS08-151	Fair	Very Good	Very Good	Good	Private	Central
AS08-152	Fair	Very Good	Very Good	Good	Private	Central
AS08-153	Fair	Very Good	Very Good	Good	Private	Central
AS08-154	Fair	Very Good	Very Good	Good	Private	Central
AS08-155	Fair	Very Good	Very Good	Good	Private	Central
AS08-156	Fair	Very Good	Very Good	Poor	Private	Central
AS08-157	Fair	Very Good	Very Good	Poor	Private	Central
AS08-158	Poor	Very Good	Very Good	Fair	Private	Central
AS08-159	Poor	Very Good	Very Good	Poor	Private	Central
AS08-160	Very Good	Very Good	Very Good	Fair	BLM/Private	Central
AS08-161	Good	Very Good	Very Good	Fair	BLM/Private	Central
AS08-162	Fair	Good	Very Good	Fair	BLM	Central
AS08-163	Fair	Good	Very Good	Fair	BLM	Central
AS08-164	Fair	Good	Very Good	Fair	BLM	Central
AS08-165	Fair	Good	Very Good	Fair	BLM	Central
AS08-166	Fair	Good	Very Good	Fair	BLM	Central
AS08-167	Fair	Good	Very Good	Fair	BLM	Central
AS08-168	Fair	Very Good	Very Good	Poor	Private	Central
AS08-169	Fair	Very Good	Very Good	Poor	Private	Central
EM08-11	Very Good	Fair	Very Good	Poor	DOE	Central
* AS09-01	Good	Very Good	Very Good	Good	Private	Central
AS09-02	Fair	Very Good	Very Good	Good	Private	Central
AS09-03	Fair	Very Good	Very Good	Good	Private	Central
AS09-06	Fair	Very Good	Very Good	Good	USFS	Central
* AS09-07	Good	Very Good	Very Good	Good	USFS	Central
AS09-08	Fair	Very Good	Very Good	Good	USFS	Central
* AS09-09	Very Good	Very Good	Very Good	Good	USFS	Central
AS09-20	Fair	Very Good	Very Good	Fair	Private	Central

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
AS09-22	Poor	Good	Very Good	Poor	BLM	Central
AS09-26	Poor	Very Good	Very Good	Poor	BLM	Central
AS09-27	Fair	Very Good	Very Good	Good	BLM	Central
* AS09-28	Good	Very Good	Very Good	Good	BLM	Central
AS09-29	Fair	Very Good	Very Good	Good	BLM	Central
* AS09-30	Good	Very Good	Very Good	Good	BLM	Central
AS09-31	Fair	Very Good	Very Good	Good	BLM	Central
AS09-33	Fair	Very Good	Very Good	Good	Private	Central
AS09-34	Fair	Very Good	Very Good	Good	Private	Central
AS09-35	Fair	Very Good	Very Good	Good	Private	Central
DWS09-2	Good	Very Good	Fair	Poor	Tribal	Central
DWS09-3	Fair	Very Good	Good	Good	Tribal	Central
DWS09-4	Good	Very Good	Fair	Fair	Tribal	Central
AS09-46	Poor	Very Good	Very Good	Fair	Tribal	Central
DWS09-5	Fair	Very Good	Very Good	Fair	Tribal	Central
AS09-48	Fair	Very Good	Very Good	Fair	Tribal	Central
DWS09-6	Fair	Very Good	Fair	Fair	Tribal	Central
AS09-50	Fair	Good	Very Good	Good	State of NV	Central
AS09-51	Fair	Very Good	Fair	Good	State of NV	Central
AS09-52	Poor	Very Good	Fair	Good	State of NV	Central
AS09-53	Fair	Very Good	Very Good	Good	State of NV	Central
AS09-54	Fair	Very Good	Very Good	Good	State of NV	Central
* AS09-55	Good	Very Good	Very Good	Good	Private	Central
* AS09-56	Good	Very Good	Very Good	Good	Private	Central
* AS09-58	Good	Good	Very Good	Good	Private	Central
AS09-78	Fair	Very Good	Very Good	Fair	Private	Central
AS09-79	Fair	Very Good	Fair	Poor	Private	Central
AS09-80	Poor	Very Good	Very Good	Poor	Private	Central
AS08-008	Fair	Very Good	Poor	Fair	NPS	Colorado River Basin
* AS08-005	Very Good	Very Good	Very Good	Good	BLM	Colorado River Basin
AS08-006	Fair	Very Good	Very Good	Fair	BLM	Colorado River Basin
* EM08-08	Good	Very Good	Very Good	Very Good	BLM	Colorado River Basin
AS08-004	Very Good	Very Good	Very Good	Fair	USFS	Colorado River Basin
AS08-010	Good	Very Good	Poor	Good	NPS	Colorado River Basin
* AS08-011	Very Good	Very Good	Very Good	Good	NPS	Colorado River Basin
* AS08-012	Good	Good	Very Good	Good	NPS	Colorado River Basin
AS08-050	Poor	Good	Fair	Poor	SNWA	Colorado River Basin

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
AS08-051	Poor	Good	Fair	Fair	SNWA	Colorado River Basin
AS08-052	Fair	Good	Fair	Fair	FWS	Colorado River Basin
AS08-053	Fair	Good	Fair	Fair	FWS	Colorado River Basin
AS08-054	Fair	Good	Fair	Fair	FWS	Colorado River Basin
AS08-055	Fair	Good	Fair	Fair	FWS	Colorado River Basin
AS08-056	Fair	Good	Fair	Fair	FWS	Colorado River Basin
AS08-057	Fair	Good	Fair	Fair	FWS	Colorado River Basin
AS08-058	Fair	Good	Fair	Fair	FWS	Colorado River Basin
AS08-059	Good	Good	Fair	Good	FWS	Colorado River Basin
AS08-060	Good	Good	Fair	Good	FWS	Colorado River Basin
AS08-061	Good	Good	Fair	Good	FWS	Colorado River Basin
AS08-062	Fair	Good	Fair	Good	FWS	Colorado River Basin
AS08-063	Fair	Good	Fair	Good	FWS	Colorado River Basin
AS08-064	Fair	Good	Fair	Good	FWS	Colorado River Basin
AS08-065	Fair	Good	Fair	Good	FWS	Colorado River Basin
AS08-066	Fair	Good	Fair	Good	FWS	Colorado River Basin
AS08-067	Fair	Good	Fair	Good	FWS	Colorado River Basin
AS08-069	Fair	Very Good	Fair	Fair	BLM	Colorado River Basin
AS08-074	Poor	Very Good	Poor	Fair	Private	Colorado River Basin
AS08-075	Fair	Very Good	Poor	Poor	Private	Colorado River Basin
AS08-076	Fair	Very Good	Very Good	Good	State of NV	Colorado River Basin
AS08-077	Poor	Very Good	Very Good	Fair	Private	Colorado River Basin
AS08-078	Poor	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-079	Poor	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-080	Poor	Very Good	Very Good	Poor	Private	Colorado River Basin

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
AS08-081	Poor	Very Good	Very Good	Fair	Private	Colorado River Basin
AS08-082	Fair	Very Good	Very Good	Fair	Private	Colorado River Basin
AS08-083	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-084	Good	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-085	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-086	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-087	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
* AS08-088	Very Good	Very Good	Good	Good	Private	Colorado River Basin
* AS08-089	Very Good	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-090	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-091	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-092	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-093	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
* AS08-094	Very Good	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-095	Fair	Very Good	Fair	Good	Private	Colorado River Basin
AS08-096	Fair	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-097	Fair	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-098	Fair	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-099	Good	Very Good	Fair	Good	State of NV	Colorado River Basin
AS08-100	Good	Very Good	Fair	Good	State of NV	Colorado River Basin
AS08-101	Good	Very Good	Fair	Good	State of NV	Colorado River Basin
AS08-102	Good	Very Good	Fair	Good	State of NV	Colorado River Basin
* AS08-103	Good	Very Good	Very Good	Good	State of NV	Colorado River Basin
AS08-104	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
AS08-105	Fair	Very Good	Very Good	Fair	Private	Colorado River Basin

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
AS08-106	Fair	Very Good	Very Good	Fair	Private	Colorado River Basin
AS08-107	Fair	Very Good	Very Good	Fair	Private	Colorado River Basin
AS08-108	Fair	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-109	Good	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-110	Fair	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-111	Fair	Very Good	Very Good	Poor	Private	Colorado River Basin
AS08-112	Fair	Very Good	Very Good	Fair	Private	Colorado River Basin
AS08-113	Good	Very Good	Very Good	Fair	Private	Colorado River Basin
AS08-114	Good	Very Good	Very Good	Fair	Private	Colorado River Basin
AS08-115	Very Good	Very Good	Very Good	Fair	Private	Colorado River Basin
* EM08-10.5	Good	Very Good	Good	Good	FWS	Colorado River Basin
AS09-11	Very Good	Good	Very Good	Poor	FWS	Colorado River Basin
AS09-59	Poor	Very Good	Poor	Poor	Private	Colorado River Basin
AS09-60	Poor	Good	Poor	Poor	Private	Colorado River Basin
AS09-61	Good	Very Good	Fair	Good	State of NV	Colorado River Basin
AS09-62	Good	Very Good	Fair	Fair	State of NV	Colorado River Basin
AS09-63	Fair	Good	Very Good	Poor	State of NV	Colorado River Basin
AS09-64	Fair	Very Good	Very Good	Good	Private	Colorado River Basin
AS09-65	Poor	Very Good	Very Good	Fair	BLM/Private	Colorado River Basin
AS09-66	Poor	Very Good	Very Good	Fair	BLM/Private	Colorado River Basin
AS09-67	Fair	Very Good	Very Good	Fair	BLM/Private	Colorado River Basin
AS09-68	Fair	Very Good	Very Good	Fair	BLM/Private	Colorado River Basin
DWS08-001	Poor	Poor	Very Good	Good	Private	Death Valley Basin
DWS08-002	Good	Fair	Very Good	Fair	Private	Death Valley Basin
* DWS08-003	Very Good	Very Good	Very Good	Very Good	FWS	Death Valley Basin
* DWS08-004	Very Good	Very Good	Very Good	Good	FWS	Death Valley Basin
* DWS08-005	Very Good	Very Good	Very Good	Very Good	FWS	Death Valley Basin
DWS08-006	Good	Good	Very Good	Fair	FWS	Death Valley Basin

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
DWS08-007	Very Good	Very Good	Poor	Good	FWS	Death Valley Basin
DWS08-008	Good	Very Good	Poor	Good	FWS	Death Valley Basin
DWS08-009	Good	Very Good	Poor	Good	FWS	Death Valley Basin
DWS08-010	Good	Very Good	Poor	Very Good	FWS	Death Valley Basin
DWS08-011	Good	Very Good	Fair	Good	FWS	Death Valley Basin
DWS08-012	Good	Very Good	Very Good	Fair	FWS	Death Valley Basin
DWS08-013	Good	Very Good	Fair	Fair	FWS	Death Valley Basin
DWS08-014	Good	Very Good	Fair	Fair	FWS	Death Valley Basin
DWS08-015	Very Good	Very Good	Very Good	Fair	Private	Death Valley Basin
* DWS08-016	Very Good	Very Good	Very Good	Good	Private	Death Valley Basin
* DWS08-017	Good	Good	Very Good	Good	Private	Death Valley Basin
* DWS08-018	Good	Very Good	Very Good	Good	Private	Death Valley Basin
* DWS08-019	Good	Very Good	Very Good	Good	Private	Death Valley Basin
DWS08-020	Fair	Very Good	Very Good	Good	BLM	Death Valley Basin
DWS08-021	Poor	Good	Fair		FWS	Death Valley Basin
DWS08-022	Very Good	Very Good	Fair	Good	FWS	Death Valley Basin
* DWS08-023	Very Good	Very Good	Very Good	Good	FWS	Death Valley Basin
* DWS08-024	Very Good	Very Good	Very Good	Very Good	FWS	Death Valley Basin
* DWS08-025	Good	Very Good	Very Good	Good	FWS	Death Valley Basin
DWS08-026	Fair	Fair	Very Good	Very Good	FWS	Death Valley Basin
DWS08-028	Good	Very Good	Fair	Good	FWS	Death Valley Basin
* DWS08-029	Very Good	Very Good	Very Good	Good	FWS	Death Valley Basin
* DWS08-030	Very Good	Very Good	Good	Good	FWS	Death Valley Basin
* DWS08-033	Good	Very Good	Very Good	Good	FWS	Death Valley Basin
* DWS08-035	Good	Very Good	Very Good	Good	FWS	Death Valley Basin
* DWS08-036	Very Good	Very Good	Very Good	Good	FWS	Death Valley Basin
* DWS08-031	Very Good	Very Good	Very Good	Good	FWS	Death Valley Basin
* DWS08-032	Very Good	Very Good	Very Good	Good	FWS	Death Valley Basin
* DWS08-034	Good	Very Good	Very Good	Good	FWS	Death Valley Basin
DWS08-037	Poor	Poor	Very Good	Very Good	FWS	Death Valley Basin
* DWS08-038	Good	Very Good	Very Good	Good	FWS	Death Valley Basin
DWS08-039	Good	Very Good	Poor		FWS	Death Valley Basin
DWS08-040	Poor	Fair	Very Good	Good	FWS	Death Valley Basin
DWS08-041	Fair	Good	Very Good	Good	FWS	Death Valley Basin
DWS08-042	Good	Very Good	Fair	Good	FWS	Death Valley Basin
EM08-01	Fair	Very Good	Poor	Very Good	TNC	Death Valley Basin
EM08-02	Fair	Very Good	Poor	Very Good	TNC	Death Valley Basin
EM08-03	Poor	Very Good	Poor	Poor	Private	Death Valley Basin
EM08-04	Fair	Very Good	Very Good	Fair	BLM	Death Valley Basin
AS08-001	Fair	Very Good	Very Good	Fair	Private	Death Valley Basin
AS09-81	Fair	Very Good	Very Good	Fair	Private	Great Salt Lake Basin
AS09-82	Good	Very Good	Very Good	Fair	Private	Great Salt Lake Basin

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
AS08-117	Good	Good	Very Good	Poor	Private	Humboldt River Basin
AS08-118	Good	Very Good	Very Good	Fair	Private	Humboldt River Basin
AS08-119	Good	Very Good	Very Good	Poor	Private	Humboldt River Basin
AS08-120	Poor	Good	Very Good	Poor	Private	Humboldt River Basin
AS08-171	Poor	Very Good	Very Good	Fair	USFS	Humboldt River Basin
AS08-172	Poor	Very Good	Very Good	Fair	USFS	Humboldt River Basin
AS08-173	Poor	Very Good	Very Good	Fair	USFS	Humboldt River Basin
AS08-174	Poor	Very Good	Very Good	Fair	USFS	Humboldt River Basin
AS08-175	Good	Very Good	Very Good	Fair	Private	Humboldt River Basin
AS08-176	Very Good	Very Good	Very Good	Fair	Private	Humboldt River Basin
AS08-177	Very Good	Very Good	Very Good	Fair	Private	Humboldt River Basin
AS09-12	Fair	Very Good	Very Good	Good	BLM	Humboldt River Basin
AS09-13	Fair	Very Good	Very Good	Poor	BLM	Humboldt River Basin
AS09-14	Fair	Very Good	Very Good	Fair	Private	Humboldt River Basin
AS09-15	Poor	Very Good	Very Good	Good	BLM	Humboldt River Basin
AS09-16	Fair	Good	Very Good	Good	BLM	Humboldt River Basin
AS09-17	Fair	Very Good	Very Good	Good	BLM	Humboldt River Basin
* AS09-18	Very Good	Very Good	Very Good	Good	BLM	Humboldt River Basin
* AS09-19	Very Good	Very Good	Very Good	Good	BLM	Humboldt River Basin
AS09-70	Very Good	Very Good	Very Good	Fair	FWS	Northwest
AS09-71	Very Good	Very Good	Very Good	Fair	FWS	Northwest
AS09-72	Very Good	Very Good	Very Good	Fair	FWS	Northwest
AS09-75	Poor	Very Good	Very Good	Poor	BLM	Northwest
AS09-23	Good	Very Good	Very Good	Fair	Private	Snake River Basin
AS09-24	Good	Very Good	Very Good	Fair	Private	Snake River Basin
AS09-25	Very Good	Very Good	Very Good	Fair	Private	Snake River Basin
EM08-12	Poor	Very Good	Very Good	Poor	Tribal	Truckee River Basin
EM08-13	Poor	Very Good	Very Good	Poor	Tribal	Truckee River Basin

Field Note #	Degree of physical alteration	Surface discharge	Nonnative aquatic species	Vegetation	Manager/ Ownership	Hydro Region Name
EM08-14	Poor	Very Good	Very Good	Poor	Tribal	Truckee River Basin
EM08-15	Good	Very Good	Very Good	Poor	Tribal	Truckee River Basin
EM08-16	Good	Very Good	Very Good	Poor	Tribal	Truckee River Basin
EM08-16.5	Good	Very Good	Very Good	Poor	Tribal	Truckee River Basin
EM09-08	Fair	Very Good	Very Good	Fair	BLM	Truckee River Basin
EM09-09	Good	Very Good	Very Good	Poor	BLM/Private	Truckee River Basin
EM09-10	Good	Very Good	Very Good	Poor	BLM/Private	Truckee River Basin
* EM09-11	Good	Very Good	Very Good	Good	BLM/Tribal	Truckee River Basin
EM09-12	Fair	Very Good	Very Good	Fair	BLM	Truckee River Basin
EM08-17	Poor	Very Good	Very Good	Poor	Private	Walker River Basin
EM08-18	Fair	Very Good	Very Good	Fair	Private	Walker River Basin
AS09-05	Fair	Very Good	Very Good	Fair	Private	Walker River Basin
EM09-20	Fair	Very Good	Very Good	Good	Private	Walker River Basin
EM09-21	Fair	Very Good	Very Good	Fair	Private	Walker River Basin
EM09-22	Fair	Very Good	Very Good	Fair	Private	Walker River Basin
EM09-23	Fair	Very Good	Very Good	Fair	Private	Walker River Basin
* EM09-24	Good	Very Good	Very Good	Good	Private	Walker River Basin
EM09-25	Fair	Very Good	Very Good	n/a	Private	Walker River Basin
EM09-26	Fair	Very Good	Very Good	n/a	Private	Walker River Basin
EM09-03	Good	Very Good	Very Good	Poor	USFS	Western
EM09-04	Good	Very Good	Very Good	Poor	USFS	Western
EM09-05	Fair	Very Good	Very Good	Poor	USFS	Western
EM09-06	Poor	Poor	Very Good	Fair	Private	Western
* EM09-07	Good	Very Good	Very Good	Good	USFS	Western

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