



WARM
SPRINGS
NATURAL AREA
Stewardship
Plan

WARM SPRINGS NATURAL AREA



SOUTHERN NEVADA
WATER AUTHORITY

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people
process
place

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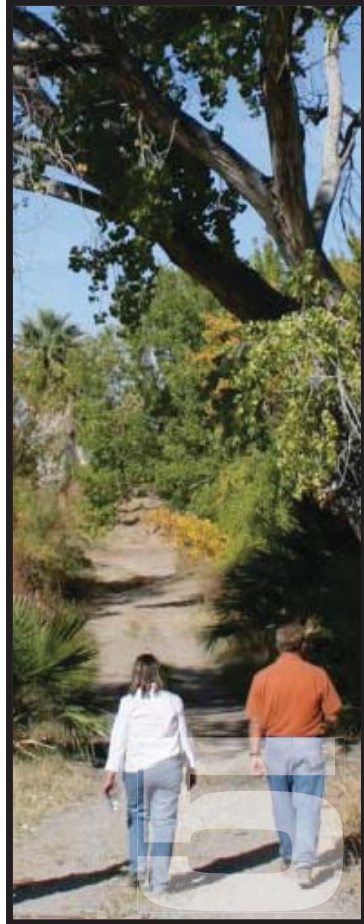
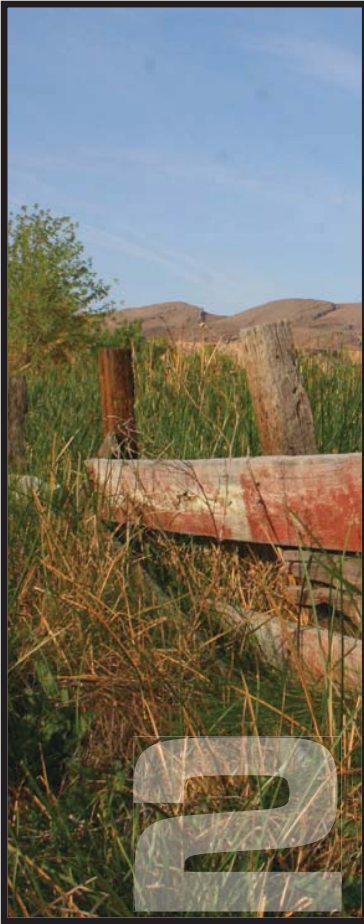
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ACKNOWLEDGEMENTS

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2011

Disclaimer

The following document is intended to be a guidance document for Warm Springs Natural Area as described under "Plan Purpose" on page 15 and is not intended to require implementation of any specific management action recommendation. Implementation of such actions is left to the discretion of the SNWA Board of Directors.

June 2011

SNWA BOARD OF DIRECTORS

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EXECUTIVE SUMMARY

Mission Statement

To manage the property as a natural area for the benefit of native species and for the recovery of the endangered Moapa Dace - consistent with the Southern Nevada Water Authority's commitments to the Southern Nevada Public Land Management Act funding of the property

EXECUTIVE SUMMARY

The Warm Springs Natural Area

Like a gemstone stashed away in the upper Moapa Valley, the Warm Springs Natural Area holds the secret to the headwaters of the Muddy River. Here, five major thermal spring complexes gush from the deep carbonate aquifer and converge in tributaries before flowing into the Muddy River and on to Lake Mead. Through time, the Warm Springs Natural Area has sustained many unique species that occur here and nowhere else in the world. This area has a long history of use by humankind. Native Americans, prehistoric peoples, outlaws, and early settlers were sustained by the abundant natural resources in the area. Howard Hughes considered the property worthy of his ownership. Showgirls came from Las Vegas to sun themselves under palm-thatched cabanas, and today the Warm Springs area attracts birders, naturalists, and wildlife enthusiasts.

When the property became available in 2005, the Southern Nevada Water Authority (SNWA) recognized the important conservation value and moved to acquire the 1,220-acre parcel formerly known as the “Warm Springs Ranch” – the largest tract of private property along the Muddy River. This unique environment is home to the Moapa dace – a small, endemic fish living on the Warm Springs Natural Area and Moapa Valley National Wildlife Refuge and nowhere else in the world. The Moapa dace is a key species to management of SNWA’s water

resources in the Muddy River and Coyote Spring Valley due to its ties to the deep carbonate aquifer and its limited distribution. The Secretary of the Department of the Interior approved Southern Nevada Public Land Management Act (SNPLMA) funding for acquisition of the Warm Springs Ranch. Upon acquisition in September of 2007, SNWA became the steward for managing this significant property to preserve its important ecological integrity. Once SNWA became the new landowner, it renamed the property the “Warm Springs Natural Area.”

Stewardship Plan

SNWA committed to join with stakeholders to develop a long-term stewardship plan for the property. The purpose of this document is to establish the framework and direction for management of the Warm Springs Natural Area. It is SNWA’s intention that the Stewardship Plan will lay a foundation for the property that will foster relations between SNWA and the property neighbors (the US Fish and Wildlife Service, Moapa Band of Paiutes, Coyote Springs Investment, LLC., Moapa Valley Water District, Clark County, Moapa Town Advisory Board, and others) while preserving the important ecological integrity of the property.

Management Direction

The Stewardship Plan is intended to establish a framework for appropriate land uses for the property that preserve the integrity of the natural resources and allow for management of water resources of the valley. This framework clarifies SNWA’s responsibilities and management direction as they pertain to conservation of the Warm Springs Natural Area and ensures consistency with SNWA’s commitments in the SNPLMA Nomination and the Muddy River Recovery Implementation Program. The Stewardship Plan establishes direction and clarifies SNWA’s intentions for property management.

SNPLMA OBJECTIVE

“The property will be acquired as a Parks, Trails, and Natural Area acquisition with the objective to develop a natural area. The natural area will provide controlled public access to enjoy the abundant natural resources, will include interpretation of the resources and Threatened and Endangered species located on the site, and will include measures to preserve and protect those resources. Natural Resources on the Property include, aquatic habitat for the Virgin River Roundtail Chub, the endemic Moapa Dace, the Southwestern Willow Flycatcher, and the Yellow-Billed Cuckoo. The property includes Nevada’s largest breeding population of Vermilion Flycatcher. Within this section of the Muddy River reside pockets of native Mesquite Bosque and Cottonwood-Willow riparian habitat.”
(SNPLMA Financial Assistance Agreement)

PLAN GOALS AND OBJECTIVES

Provide a clear statement for future management

Clarify SNWA’s intentions and direction for property management

Give neighbors, visitors, governmental and non-governmental organizations an understanding of SNWA’s management actions on and around the property

Ensure management actions consistent with the SNPLMA Nomination Package and Financial Assistance Agreement

Ensure management actions consistent with the Muddy River Recovery Implementation Program

Provide a basis for the development of staffing plans, budget needs, maintenance operations, and capital improvements

- 1.01** **SITE OVERVIEW**
- 1.02** **STAKEHOLDER PROCESS**
- 1.03** **COMMITMENTS FOR MANAGING THE PROPERTY**
- 1.04** **PURPOSE OF THE STEWARDSHIP PLAN**





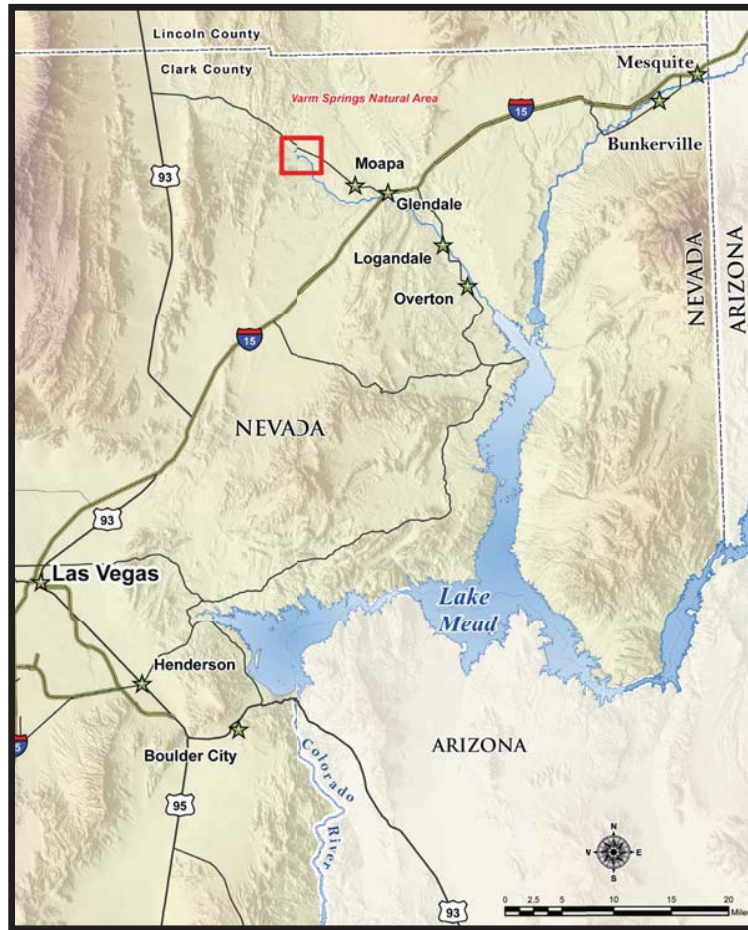
INTRODUCTION

WARM SPRINGS NATURAL AREA FACTS

- 1,220 acres of Mojave Desert riparian ecosystem
- 28 Sensitive Species
- Annual Rainfall 5.4 in.
- Elevation: 1,689 - 1,923 feet above mean sea level
- Five major spring complexes form the headwaters of the Muddy River
- Water emanates from 90° F thermal springs



1.01 SITE OVERVIEW

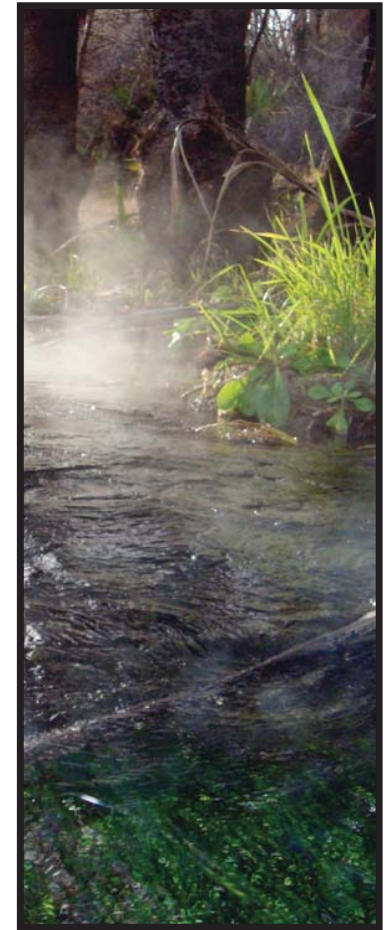


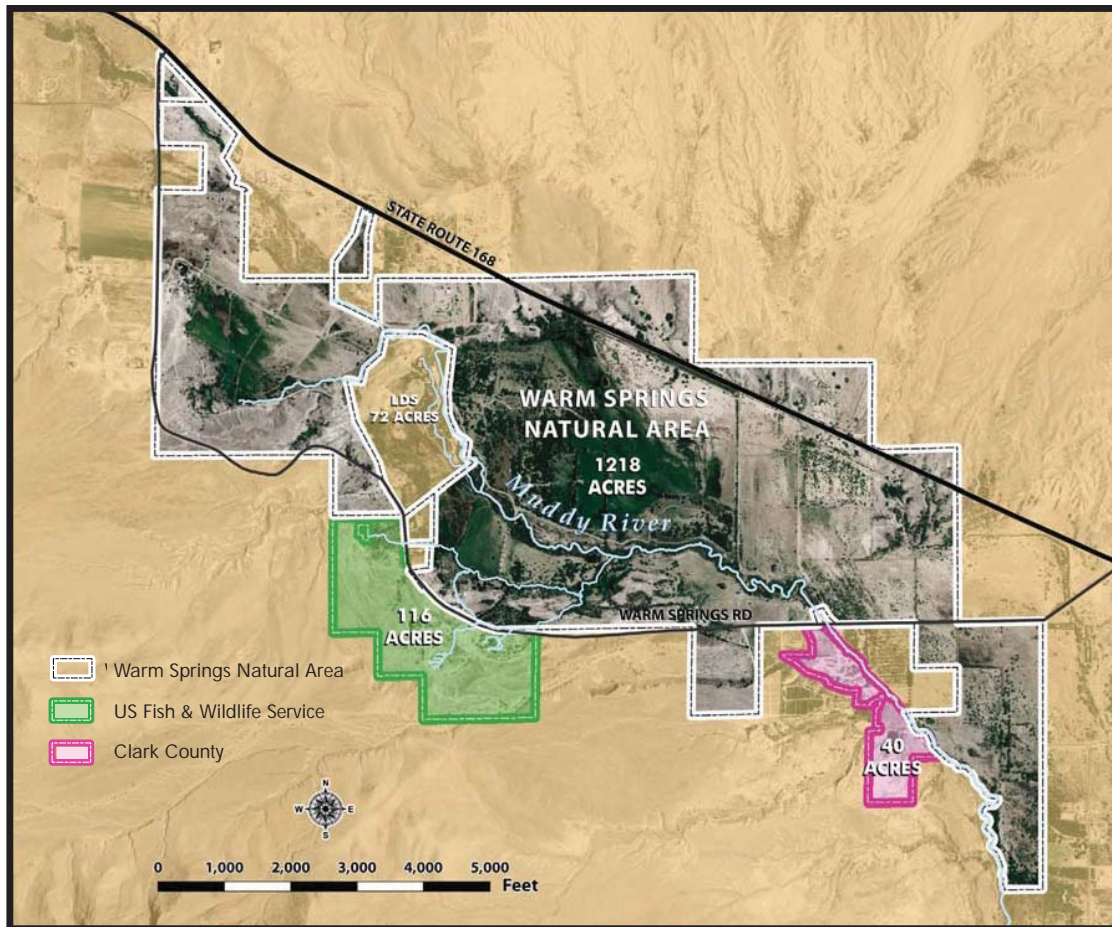
Moapa Valley

The Warm Springs Natural Area is located approximately seven miles northwest of the Town of Moapa and 60 miles northeast of Las Vegas, in Clark County, Nevada. The Natural Area is in upper Moapa Valley, a valley about 40 miles long running roughly northwest to southeast. The towns of Moapa, Glendale, Logandale and Overton are located in the Moapa Valley. Logandale is about 12 miles southeast of Moapa and Glendale. Overton is another five miles southeast of Logandale. Population numbers in the Moapa Valley from the 2000 US Census (which did not include the Town of Moapa) were 5,784. In the 2000 US Census, the Town of Moapa had a population of 928. The population of the Moapa Valley was estimated to be 7,200 in 2008 and 7,471 in 2009 which does not include the Moapa Indian Reservation. The Reservation's population was estimated to be 1,292 in 2009.

Headwaters of the Muddy River

Like a gemstone stashed away in the upper Moapa Valley, the Warm Springs Natural Area holds the secret to the headwaters of the Muddy River. Here, five major thermal spring complexes gush from the deep carbonate aquifer on three properties - the Moapa Valley National Wildlife Refuge, the Warm Springs Natural Area and the LDS Church property. They converge on the Warm Springs Natural Area in tributaries which flow into the Muddy River and on to Lake Mead.





Warm Springs Natural Area

The Warm Springs Natural Area is generally bordered by State Route 168 to the north, Warm Springs Road to the south and the Arrow Canyon Range to the west. The Moapa Valley National Wildlife Refuge and Clark County lands border the Natural Area to south. About 3.8 miles of the Muddy River flow through the Natural Area. The landscape is a mixture of desert, riparian, and fallowed agricultural fields. Here, seasonally flooded pastures are lined with mature Fremont cottonwoods. Goodding's willows and velvet ash trees occur throughout the property. Skirting the fields are numerous groves of established mesquite trees, in which the Vermilion flycatcher nests occur. The adjoining pastures have abundant insects such as large fleshy grasshoppers, which are a staple of the flycatcher's diet. The largest nesting population of Vermilion flycatchers in Nevada were observed here in 2000. The Warm Springs Natural Area has long been used by Native Americans, outlaws and early settlers. Today, the property continues to attract the attention of birders, naturalists, and wildlife enthusiasts.

PROPERTY PURPOSES

Protect the endangered Moapa dace and its habitat

Establish conservation projects that provide mitigation benefits for future water development

Manage the property as a natural area for the benefit of native species

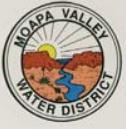
Restore and manage the area as an ecological reserve including implementation of recovery actions identified in the Muddy River Recovery Implementation Program

Create opportunities for low-impact public use

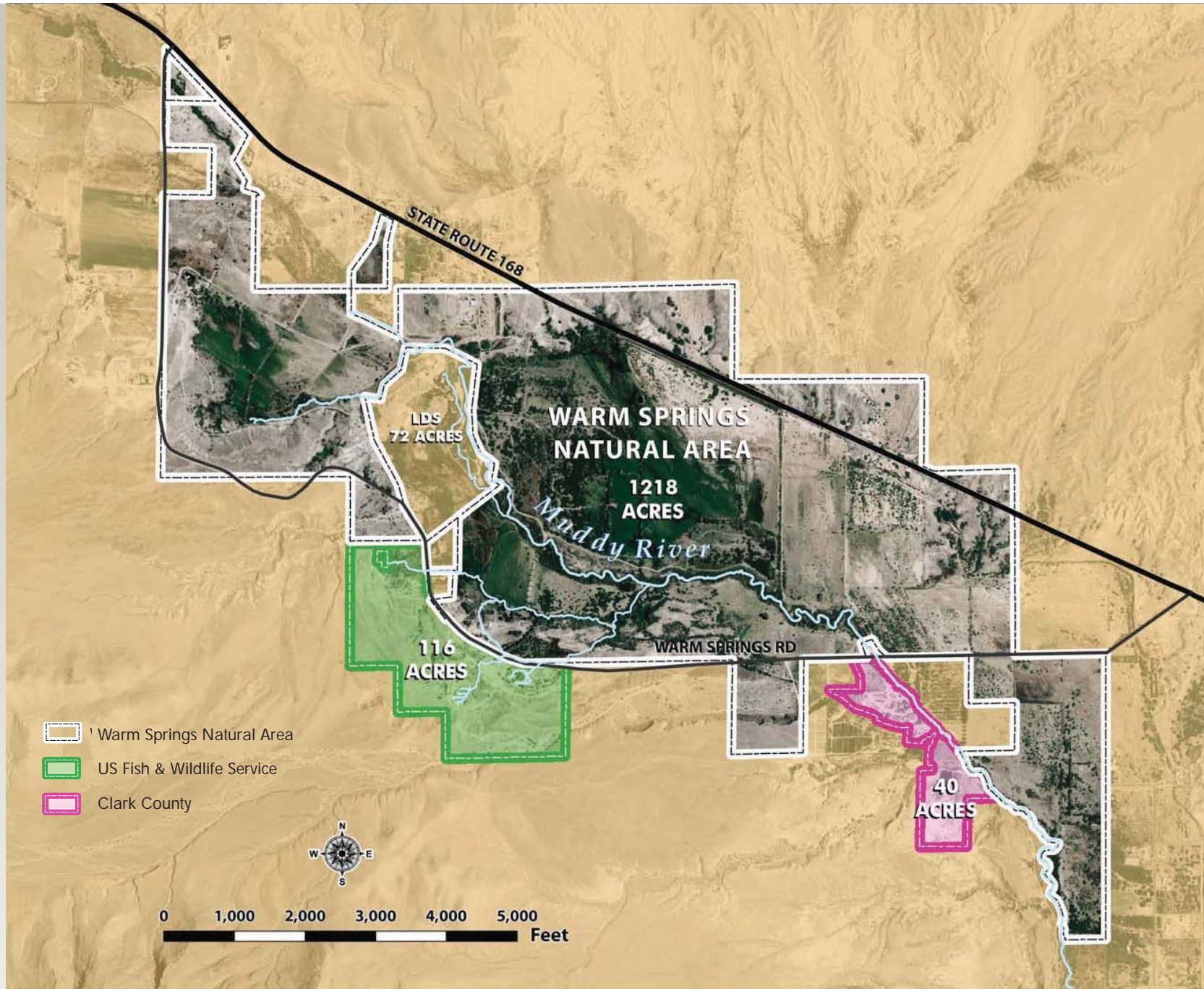
Develop public education opportunities which include ecological processes and endangered species recovery

Provide the opportunity for a program of national scientific research on aquatic and terrestrial systems in the Mojave Desert

MUDDY RIVER RECOVERY
IMPLEMENTATION
PROGRAM
EXECUTIVE COMMITTEE
AND STAKEHOLDERS



COYOTE SPRINGS LAND



1.02 STAKEHOLDER PROCESS

Muddy River Recovery Implementation Program

Development of the Muddy River Recovery Implementation Program (RIP) was identified in the 2006 Muddy River Memorandum of Agreement (MOA) and the Intra-Service Programmatic Biological Opinion for the Proposed MOA Regarding the Groundwater Withdrawal of 16,100 Acre-Feet per Year from the Regional Carbonate Aquifer in Coyote Spring Valley and California Wash Basins, and Establish Conservation Measures for the Moapa Dace, Clark County, Nevada.

The Executive Committee of the RIP is comprised of the signatories to the MOA which include SNWA, the US Fish and Wildlife Service, the Moapa Valley Water District, the Moapa Band of Paiutes, and Coyote Springs Investment, LLC. The RIP has a technical subcommittee, the Biological Advisory Committee. The Hydrologic Review Team was formed by the MOA and serves as a technical advisory committee to the RIP. Nevada Department of Wildlife was added as an ad hoc member to the Executive Committee.

The goal of the RIP is to implement a series of species recovery actions necessary to promote recovery and conservation of aquatic species in the Muddy River ecosystem, while at the same time, providing for mitigation and minimization of potential effects associated with the development and use of water supplies and other activities that may affect the aquatic ecosystem.

Stakeholder Process/Core Team

SNWA committed in its Southern Nevada Public Land Management Act (SNPLMA) Nomination package to the Secretary of the Department of Interior to enlist the involvement of specific stakeholders to develop the Stewardship Plan. To that end, the RIP Biological Advisory Committee agreed to join SNWA in the shared vision of developing a plan that satisfies the property stakeholders and directs management actions that benefit the natural resources on site and the water resource entities involved. The RIP Biological Advisory Committee identified a process to develop the Warm Springs Natural Area Stewardship Plan. The process entailed the Core Team developing the Stewardship Plan and other stakeholders providing review.

Core Team

The Core Team consists of representatives from SNWA, the US Fish and Wildlife Service, the Nevada Department of Wildlife and The Nature Conservancy. Individuals on the Core Team are named in the "Contributor" list on page 4. The Core Team met 2007 through 2010 and came together for workshops to discuss shared concepts and a vision for the Warm Springs Natural Area. The Core Team developed the Mission Statement - "To manage the property as a natural area for the benefit of native species and for the recovery of the endangered Moapa dace – consistent with the Southern Nevada Water Authority's commitments to the Southern Nevada Public Land Management Act funding of the property" - which establishes prioritization of management goals and serves to frame future decisions. Their recommendations have been reflected in this Stewardship Plan.

Core Team Members

- Southern Nevada Water Authority
- US Fish and Wildlife Service
- The Nature Conservancy
- Nevada Department of Wildlife



MUDDY RIVER RECOVERY IMPLEMENTATION PROGRAM

Executive Committee

- Southern Nevada Water Authority
- US Fish & Wildlife Service
- Moapa Valley Water District
- Coyote Springs Investment
- Moapa Band of Paiutes
- Nevada Dept. of Wildlife (ad hoc member)

Biological Advisory Committee

- US Fish & Wildlife Service
- Nevada Dept. of Wildlife
- US Geological Survey
- Bureau of Land Management
- Southern Nevada Water Authority
- Moapa Valley Water District
- Coyote Springs Investment
- Moapa Band of Paiutes
- The Nature Conservancy
- Clark County

Other Stakeholders

- Moapa Town Advisory Board
- Moapa Valley Town Advisory Board
- Property neighbors



INTRODUCTION

1.03 COMMITMENTS FOR MANAGING THE PROPERTY

SNWA Commitments

Commitments for the Warm Springs Natural Area were established prior to the acquisition of the property in the Southern Nevada Public Land Management Act (SNPLMA) Financial Assistance Agreement signed on May 16, 2007. In the Financial Assistance Agreement, SNWA agreed to:

Accomplish the **OBJECTIVE** as approved by the Secretary of the Department of the Interior
 Furnish qualified personnel for the coordination, oversight, and performance of the objective for the project
 Provide supervision for the project to include responsibility for all technical aspects, development, implementation, scheduling, safety, coordination, and other project needs
 Make certain necessary permits or environmental clearances are obtained
 Own and maintain in perpetuity any land, buildings, trails, facilities, or other features improved or constructed.

SNPLMA Nomination

As part of the 2005 SNPLMA Nomination to the Secretary of the Department of Interior, SNWA identified it would conduct a number of actions on the property. The Secretary of the Department of Interior approved SNPLMA funding for acquisition of the Warm Springs Natural Area on February 7, 2006. In the 2005 SNPLMA Nomination, SNWA pledged it would carry out:

Development of educational and recreational areas/trails emphasizing the natural resources for public use consistent with the Moapa Valley National Wildlife Refuge and other adjacent lands
 Invasive plant management
 Invasive fish and invertebrate management
 Bank and channel stabilization activities
 Construction and/or enhancement of wetlands
 Restoration and/or enhancement of riparian and upland habitat
 Spring pool restoration/enhancement



Property Purposes

Purposes for the Warm Springs Natural Area were established by SNPLMA directives and agreed to early on by the Core Team. Purposes include:

- Protect the endangered Moapa Dace and its habitat
- Establish conservation projects that provide mitigation benefits for future water development
- Manage the property as a natural area for the benefit of native species
- Restore and manage the area as an ecological reserve including implementation of recovery actions identified in the Muddy River Recovery Implementation Program
- Create opportunities for low-impact public use
- Develop public education opportunities which include ecological processes and endangered species recovery

Provide the opportunity for a program of national scientific research on aquatic and terrestrial systems in the Mojave Desert

SNPLMA OBJECTIVE

“The property will be acquired as a Parks, Trails, and Natural Area acquisition with the objective to develop a natural area. The natural area will provide controlled public access to enjoy the abundant natural resources, will include interpretation of the resources and Threatened and Endangered species located on the site, and will include measures to preserve and protect those resources. Natural Resources on the Property include, aquatic habitat for the Virgin River Roundtail Chub, the endemic Moapa Dace, the Southwestern Willow Flycatcher, and the Yellow-Billed Cuckoo. The property includes Nevada’s largest breeding population of Vermilion Flycatcher. Within this section of the Muddy River reside pockets of native Mesquite Bosque and Cottonwood-Willow riparian habitat.”
 (SNPLMA Financial Assistance Agreement)

1.04 PURPOSE OF THE STEWARDSHIP PLAN

Plan Purpose

The purpose of the Warm Springs Natural Area Stewardship Plan is to establish a long-term management direction for the Warm Springs Natural Area that will foster relations between SNWA and the property neighbors (the US Fish and Wildlife Service, Moapa Band of Paiutes, Coyote Springs Investment, LLC., Moapa Valley Water District, Clark County, Moapa Town Advisory Board, and others) while preserving the important ecological integrity of the property. The Stewardship Plan establishes a framework for appropriate land uses that preserves the integrity of the natural resources and is consistent with SNWA's management of the water resources. It clarifies SNWA's responsibilities and management direction as they pertain to the Warm Springs Natural Area and ensures consistency with SNWA's commitments in the SNPLMA Nomination and the Muddy River Recovery Implementation Program.

The development of the Stewardship Plan for the natural resources and facilities has involved soliciting stakeholder input, developing the mission statement to guide the process, and establishing the goals and objectives for the management of the property.

The purpose of the Stewardship Plan is also to identify public uses considered compatible with the intent of the SNPLMA application to "develop educational and recreational areas/trails emphasizing natural resources for public use consistent with the Moapa Valley National Wildlife Refuge, The Nature Conservancy, and other adjacent lands."

While the Stewardship Plan is intended to provide guidance for SNWA management and future land uses and activities on the Warm Springs Natural Area, it is important to note that the Stewardship Plan is a conceptual document to begin dialogue and is not intended to require implementation of any specific management action recommendations. Implementation of such actions is left to the discretion of the SNWA Board of Directors through the annual budgeting process and through specific contract approvals as needed.

If funding is approved for a specific program or program element or if requests are made for the Warm Springs Natural Area for a specific use, the Stewardship Plan is intended to provide important guidance on how that program or program element is to be implemented.

Plan Goals and Objectives

The following goals and objectives were developed by the Core Team:

Provide a clear statement for future management

Clarify SNWA's intentions and direction for property management

Give neighbors, visitors, governmental and non-governmental organizations an understanding of SNWA's management actions on and around the Warm Springs Natural Area

Ensure management actions consistent with the Southern Nevada Public Land Management Act Nomination Package and Financial Assistance Agreement

Ensure management actions consistent with the Muddy River Recovery Implementation Program

Provide a basis for the development of staffing plans, budget needs, maintenance operations, and capital improvements



PROPERTY PURPOSES

Protect the endangered Moapa dace and its habitat

Establish conservation projects that provide mitigation benefits for future water development

Manage the property as a natural area for the benefit of native species

Restore and manage the area as an ecological reserve including implementation of recovery actions identified in the Muddy River Recovery Implementation Program

Create opportunities for low-impact public use

Develop public education opportunities which include ecological processes and endangered species recovery

Provide the opportunity for a program of national scientific research on aquatic and terrestrial systems in the Mojave Desert

2.01 **SITE HISTORY**

2.02 **CULTURAL RESOURCES**

2.03 **HYDROLOGY AND WATER DEVELOPMENT**

2.04 **FACILITIES MANAGEMENT**

2



GROUNDING

2.01 SITE HISTORY

The known history of land use at WSNA begins with Native Americans during the Early Agricultural period (AD1-550). Though hunting and gathering certainly occurred during the Archaic period (5500 BC-AD 1), it was not until the early inhabitants began agriculture that land use took on new meaning. In the upper Muddy River, agriculture can trace its origins as far back as AD 20-220 from a radiocarbon dated corn cob. Cultivating maize, squash, and gourds was commonplace along the Muddy River and its tributaries during this period.

The Southern Paiutes continued to use and live around the WSNA when the Dominguez-Escalante Party charted the Spanish Trail.

The Spanish Trail passes about eight miles to the southeast (1776). The Coyote Spring Rockshelter on WSNA shows a period of use through the Early Historical (AD 1600-1830) and Settlement (1830-1900) periods where the shelter was possibly used by the Paiutes to escape Spanish slave raids that were common along the Spanish Trail.

Along with early American explorers, Mormon pioneers were among the first new arrivals to view the upper Muddy River area. Though the majority of settlements were established in the lower Muddy River drainage, the town of West Point (about five miles down river) was established in 1868 and persisted until the flood of 1870.

Around that time, the Muddy Springs band of Paiute Indians was led by Chief Rufus. Their home would have included Big Muddy Spring and the surrounding area of WSNA.

The first recorded settlement on the WSNA was by the Texas outlaw Alexander Dry. He built a stone cabin with an arrowweed thatched roof near a spring on WSNA in the late 1870s. He also ran a herd of cattle, the beginning of grazing and its cumulative impacts to the property.



Advent of maize farming in upper Muddy River (Basket maker II).
AD 100 - 300



Southern Paiutes - victims of Spanish slave trade.
1776-1850s



Mormon settlement along Muddy River.
1860s



Mormon settle West Point (closest settlement to Warm Springs).
1867



The Home Ranch established.
Early 1900s



Howard Hughes purchases Warm Springs Ranch. Ranching and agricultural practices continue.
1971

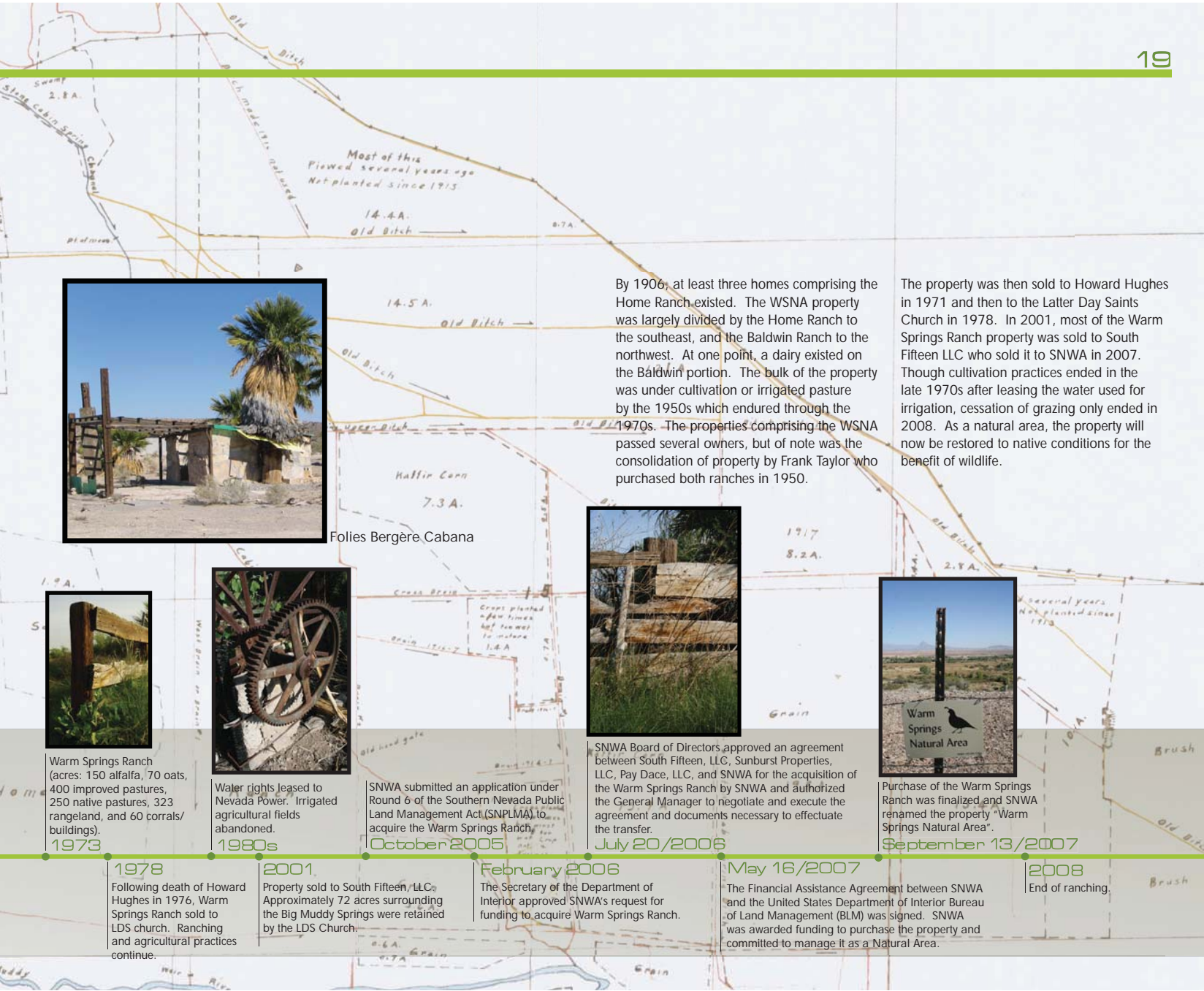
1776 Spanish priests Garcés, Dominguez, and Escalante encounter Southern Paiutes. Their route becomes the Old Spanish Trail.

1866 Chief Rufus of the Muddy Springs Band of Paiutes joins with other tribal chief and Mormon leaders to end hostilities.

1870 Town of West Point abandoned following a flood and occupied by Paiutes.

1906 Warm Springs schoolhouse along the Muddy River at WSNA.

1950 Francis Taylor acquired Baldwin and Home Ranches and other smaller parcels and he named the 1,200 acres the "Warm Springs Ranch." He built the "Big House" otherwise known as the Taylor Mansion aside Big Muddy Spring and began extensive pasture improvements.



Folies Bergère Cabana

By 1906, at least three homes comprising the Home Ranch existed. The WSNA property was largely divided by the Home Ranch to the southeast, and the Baldwin Ranch to the northwest. At one point, a dairy existed on the Baldwin portion. The bulk of the property was under cultivation or irrigated pasture by the 1950s which endured through the 1970s. The properties comprising the WSNA passed several owners, but of note was the consolidation of property by Frank Taylor who purchased both ranches in 1950.

The property was then sold to Howard Hughes in 1971 and then to the Latter Day Saints Church in 1978. In 2001, most of the Warm Springs Ranch property was sold to South Fifteen LLC who sold it to SNWA in 2007. Though cultivation practices ended in the late 1970s after leasing the water used for irrigation, cessation of grazing only ended in 2008. As a natural area, the property will now be restored to native conditions for the benefit of wildlife.



Warm Springs Ranch (acres: 150 alfalfa, 70 oats, 400 improved pastures, 250 native pastures, 323 rangeland, and 60 corrals/buildings).
1973



Water rights leased to Nevada Power. Irrigated agricultural fields abandoned.
1980s



SNWA Board of Directors approved an agreement between South Fifteen, LLC, Sunburst Properties, LLC, Pay Dace, LLC, and SNWA for the acquisition of the Warm Springs Ranch by SNWA and authorized the General Manager to negotiate and execute the agreement and documents necessary to effectuate the transfer.
July 20/2006



Purchase of the Warm Springs Ranch was finalized and SNWA renamed the property "Warm Springs Natural Area".
September 13/2007

SNWA submitted an application under Round 6 of the Southern Nevada Public Land Management Act (SNPLMA) to acquire the Warm Springs Ranch.
October 2005

1978
Following death of Howard Hughes in 1976, Warm Springs Ranch sold to LDS church. Ranching and agricultural practices continue.

2001
Property sold to South Fifteen, LLC. Approximately 72 acres surrounding the Big Muddy Springs were retained by the LDS Church.

February 2006
The Secretary of the Department of Interior approved SNWA's request for funding to acquire Warm Springs Ranch.

May 16/2007
The Financial Assistance Agreement between SNWA and the United States Department of Interior Bureau of Land Management (BLM) was signed. SNWA was awarded funding to purchase the property and committed to manage it as a Natural Area.

2008
End of ranching.



Environmental stewardship efforts are underway to recover the Moapa dace, restore habitat, and manage the property as a Natural Area.

HOME RANCH *et al*
NEAR
MOAPA NEVADA

T. 14 S. R. 65 E. M. D. B + M.

by
L. Tanner

Scale 400 Ft = One Inch
1918



2.02 CULTURAL RESOURCES

Imagine crossing Nevada's harsh desert on horseback or wagon in the heat of summer, with its miles and miles of barren soil and scrubby creosote. Then off in the distance you see a lush strip of green surrounding a flowing stream. Here, in what is today the Moapa Valley, tired settlers found water to quench their thirst, forage for their animals, shade from the heat, and warm pools to bathe tired feet. The area's flowing springs fed plants, animals, and people for thousands of years—both Native American and Euroamerican.

Rich cultural heritage is preserved in the numerous archaeological sites found throughout the Warm Springs Natural Area. The archaeological record tells us that Southern Paiute people and their ancestors lived in the Moapa Valley for thousands of years before the first American settlers arrived. The archaeological survey of the area identified prehistoric habitations, trails, artifact scatters and rock shelters located on the terraces above the floodplain. Archaeologists believe that pithouse villages, like those found elsewhere in the Southwestern United States, probably lie buried in the Valley's deep soils. Springs, fertile soils, lush vegetation, and plentiful wildlife created a unique desert oasis. The wild grasses and seeds that the first Euroamerican settlers fed to their livestock were the staple foods of the area's Southern Paiute occupants.

Before Native Americans began small-scale subsistence farming in the region 2,000 years ago, they collected and ate the plentiful edible foods. Thick stands of mesquite trees produced nutritious seed pods that were ground, made into cakes, and stored in caches. Grass seeds, wolf berries, cactus fruit, and Indian spinach (Prince's plume) are just a few of the numerous wild plants that the Native Americans collected to supplement their crops of corn, beans, and squash. Bighorn sheep and smaller animals such as quail, doves, rabbits, and mice were hunted with traps or bows and arrows. Occasionally, large family groups gathered to hunt jackrabbits by chasing them into large handmade nets that could be hundreds of yards in length. The Southern Paiute people and their ancestors developed cultural practices and traditions that enabled them to grow and prosper for thousands of years. Outlaws, like Alexander Dry, hid in the Warm Springs area and raised stolen cattle in the late 1800s.

The first Euroamericans to settle the region were members of the Church of Jesus Christ of the Latter Day Saints—the Mormons. Their descendants, including Ute Perkins and his large family, still occupy the Moapa Valley today. Historic corrals, irrigation canals, fences, and house foundations found throughout the WSNA are a reminder of the region's early ranching and farming families, like the Perkins, who struggled and fought to settle the American West. The Perkins family leased the Home Ranch, located in the WSNA for six years, between 1923 and 1929. The family raised cattle and hogs, cultivated hay and grain, and grew fruit trees on the ranch, and the only source of power was a water wheel until the 1930s. Although all of the buildings once occupied by the Perkins family on the Home Ranch burned in a 1987 fire, the oral histories, written stories, and photos provide abundant information about what early pioneer life was like in the area.



Moapa Paiute House



Las Vegas Paiute Encampment 1900



Water wheel



Warm Springs Ranch 1941 station wagon ("Woodie")



Cardy Lamb Springs

Baldwin Spring Complex

N. Fork Muddy

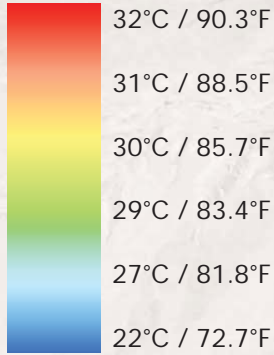
S. Fork Muddy

Big Muddy Springs Stream



Post Card

Stream Temperature



Temperature data courtesy of USGS and is an average of hourly temperature readings taken from 3/7/08 to 12/11/08. Temperatures between 17 sampling locations (not shown) are interpolated.

Jones Spring Complex

Apcar

Muddy River

Stream

Pederson Str

Refuge Str

Pederson Spring Complex

Plummer Spring Complex

2.03 HYDROLOGY AND WATER DEVELOPMENT

More than any other feature of the landscape, the hydrology of the Warm Springs area is key to the landscape. The unique hydrology is the reason Native Americans, ranchers, and people with recreational interests were drawn to the property and also the reason the property supports an endangered fish. The hydrology ties together a unique natural environment with the rich cultural, historic, and socioeconomic uses of the Warm Springs Natural Area. All are juxtaposed through time due to the thermal waters which emanate from more than twenty regional springs, numerous seeps and wetlands in the area. The springs then form warm-water tributaries, which become the headwaters of the Muddy River. The thermal spring water wells up at about 90°F from a deep carbonate aquifer. As the water flows downstream it cools and becomes less favorable to the existence of the endangered Moapa dace and the other thermophilic species.

Hydrology

There are five major spring complexes in the area. Two of these are on the Warm Springs Natural Area: Cardy Lamb and Baldwin Springs. The largest spring, producing over 4.8 million gallons per day, is Big Muddy Spring located on the LDS Recreation Area. The remaining springs - Pederson and Plummer Springs - are located on the Moapa Valley National Wildlife Refuge. Two lesser spring complexes of note, are Twin Springs on the Warm Springs Natural Area and Jones Springs on the Moapa Valley National Wildlife Refuge. A number of other unnamed springs and seeps also occur in the area (Beck et al. 2006).

The Warm Springs area is located near the southern end of the White River regional groundwater flow system and is believed to be the largest and one of the most southerly outflows from this groundwater system. The aquifers in this area are generally composed of Paleozoic carbonate rocks and Tertiary sedimentary rocks. Recharge in this system is primarily from precipitation in the high mountain ranges of eastern Nevada (Eakin 1966).

The US Geological Survey, irrigation districts, the US Bureau of Reclamation, the State of Nevada, SNWA and others have collected water levels and stream gage data throughout the system as far back as 1913. Six continuous-record stream gaging stations and 11 partial-record stations in the area are cooperatively maintained by SNWA and the USGS (Beck et al. 2006).

History of Water Development

From European settlement in the late 1800s to about the 1950s, water use in the area consisted of a few ranches that derived their water from individual springs or wells. In the 1950s, the ranches eventually merged into one large ranch with an intricate system of irrigation ditches.

Water Companies

In 1954, the Moapa Valley Water Company and the Overton Water District entered into a joint agreement to divert water from the Warm Springs area to residences, businesses, and dairy establishments to the south. For this purpose, water was developed from the Baldwin Springs complex. In 1960, a pump

house was also built on Jones Spring and the landowner, Francis Taylor, donated water rights and one acre of land to the Moapa Valley Water Company. Frederick Apcar soon bought the surrounding 45 acres for his own private recreational use, concreted one of the springs and built a large swimming pool on the site. A new pump house was constructed on the Jones Spring in 2004 by the Moapa Valley Water District (Beck et al. 2006).

Recreational Facilities

Other recreational facilities were built to take advantage of the 90°F water for swimming. At the Pederson Springs, the 7-12 Warm Springs Resort was built in the 1950s. This resort had two swimming pools, one of which was built directly over a spring and the other was fed with piped spring water. The Desert Oasis Warm Springs Resort had a swimming pool, ponds, spa and water slide all fed by the Plummer Springs. Other recreational swimming facilities included a large spring fed pond and swimming pool on the LDS property fed by Big Muddy Springs. In the early 1980s the LDS Church constructed a very large swimming pool at the Cardy Lamb Springs (Beck et al. 2006).

Power Plant









In the mid-1960s, the Reid Gardner coal-fired power plant was constructed about three miles downstream of the Warm Springs area. Initially, water for the plant was obtained from the Muddy River near the plant and from several wells in the Warm Springs area on the Lewis Property. By the early 1970s, Nevada Power (now NV Energy) constructed a diversion dam and a pumping station on the Muddy River just above Warm Springs Road.

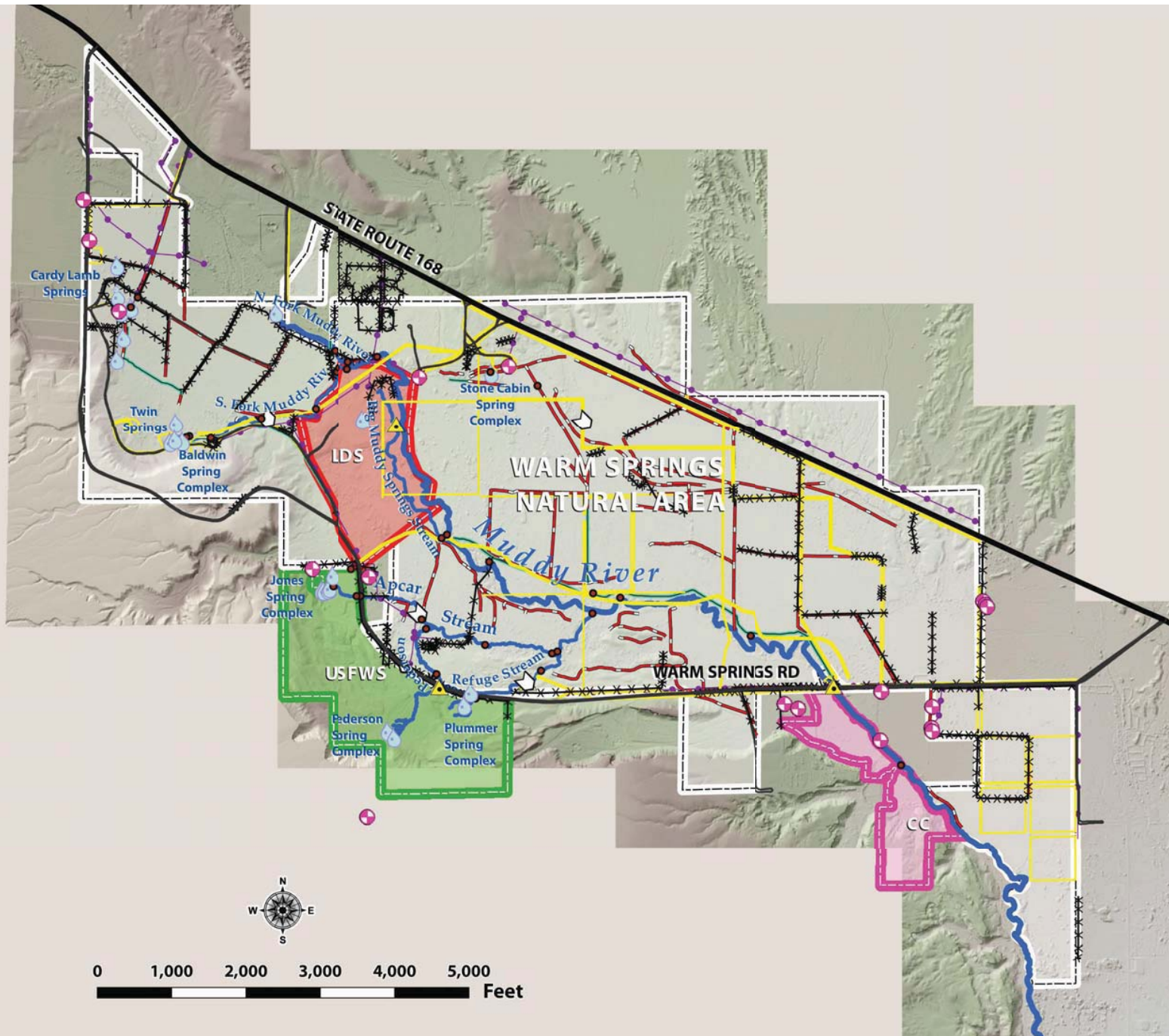
Water is pumped from the river and piped to power plant. In the 1980s, the power plant was expanded and Nevada Power purchased water rights from the LDS Church and other private landowners in the Warm Springs area. Currently, NV Energy seasonally operates about 12 alluvial wells in the Warm Springs area and the surface water diversion on the river. Generally, the surface water is used in the winter months and the wells are pumped in the summer months (Beck et al. 2006).

Moapa Valley National Wildlife Refuge In 1979, the Moapa Valley National Wildlife Refuge was created from most of the 7-12 Warm Springs Resort and a small portion of the Desert Oasis Warm Springs Resort. By the late 1990s most of the swimming pools and other recreational infrastructure from the old 7-12 Warm Springs Resort had been removed and restored for the Moapa dace. The Desert Oasis Warm Springs Resort operated until 1994 when a fire closed the resort. After the fire, the resort remained closed until it was purchased by Del Webb and turned over to the Moapa Valley National Wildlife Refuge. In 2001, the US Fish and Wildlife Service (USFWS) expanded the Wildlife Refuge by purchasing 45 acres of land around Jones Spring (Apcar unit). The USFWS removed the swimming pool that Frederick Apcar had installed and begun restoring the stream below the pump house (Beck et al. 2006). In 2007, USFWS removed all the palm trees from the Apcar unit and restored the stream channel in Spring 2009.



FACILITIES
INFRASTRUCTURE
LEGEND

-  Flume
-  Gage
-  Spring
-  Well
-  Easement
-  Pipe
-  Overhead Electrical
-  Concrete Ditch
-  Irrigation Pipe
-  Rivers and Streams
-  Roads
-  Fences
-  Warm Springs Natural Area
-  LDS Recreational Area
-  US Fish and Wildlife Service
-  Clark County



2.04 FACILITIES MANAGEMENT



Water diversions



Irrigation ditches



Historic structures



Municipal water source/
water treatment plant



Historic recreation



County road



Existing fencing



Non-historic structures

Acquisition of the Warm Springs Natural Area by SNWA in 2007 included not only property assets but also a requirement to accommodate entities with easements on the property. Easements for water and power conveyance traverse the property servicing Moapa Valley Water District, NV Energy, and Overton Power Company. Gaging stations to monitor stream flows exist on several stream reaches and have monitoring requirements by federal and state agencies. County roads and State Highway 168 overlay a portion of the property. Because the property was previously used mainly for agriculture, irrigation ditches and fencing are ubiquitous features found throughout the Natural Area. To improve the aesthetics and decrease habitat segregation, much of the fencing and ditch works will be removed. Any features of historic significance will be preserved.

EXISTING PROPERTY USES

RIGHTS-OF-WAY

Moapa Valley Water District

- Baldwin Spring box
- Baldwin Spring treatment plant
- Baldwin Spring pipeline
- Jones Spring pipeline

NV Energy

- LDS East (Stone Cabin Spring) Well
- LDS Central (Willow Spring) Well
- LDS West Well
- Pipelines

Overton Power Lines

Roads

- Clark County roads
- State Highway 168

WATER RIGHTS/MONITORING

Water Monitoring Activities

- Iverson Flume (USGS)
- South Fork Flume (NV Energy)
- Apcar Flume (NDWR)
- Cardy Lamb Spring (NV Energy)

Water Rights

- Twin Springs
- Cardy Lamb Spring
- Irrigation Company Water



Fence maintenance



Pipeline easements



Overhead easements



Easement maintenance



Historic agriculture

- 3.01 BIODIVERSITY**
- 3.02 SENSITIVE SPECIES OF WSNA**
- 3.03 ECOLOGICAL SYSTEMS ON WSNA**
- 3.04 MUDDY RIVER AQUATIC ASSEMBLAGE**
- 3.05 WARM SPRINGS AQUATIC ASSEMBLAGE**
- 3.06 DECIDUOUS RIPARIAN WOODLAND**
- 3.07 RIPARIAN SHRUBLAND**
- 3.08 RIPARIAN MARSH/MEADOW**
- 3.09 MESQUITE BOSQUE**
- 3.10 OTHER ECOLOGICAL GROUPS**



Vermilion flycatcher

3.01 BIODIVERSITY

The upper Muddy River is considered one of the Mojave's most important areas of biodiversity and regionally important ecological but threatened riparian landscapes (Provencher et al. 2005). Not only does the Warm Springs Natural Area encompass the majority of Muddy River tributaries it is also the largest single tract of land in the upper Muddy River set aside for the benefit of native species in perpetuity.

The prominence of water in an otherwise barren Mojave landscape provides an oasis for regional wildlife. A high bird diversity is attributed to an abundance of riparian and floodplain trees and shrubs. Contributions to plant diversity come from the Mojave vegetation that occur on the toe slopes of the Arrow Canyon Range from the west and the plant species occupying the floodplain where they are supported by a high water table. Several marshes and wet meadows add to the diversity of plants and animals. The thermal springs and tributaries host an abundance of aquatic species, many of which are endemic. The WSNA provides a haven for the abundant wildlife that resides permanently or seasonally and provides a significant level of protection for imperiled species.



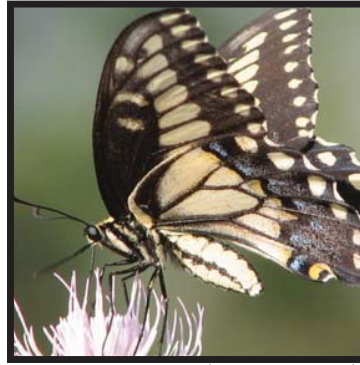
Common buckeye on sunflower
(*Junonia coenia* on *Helianthus annuus*)



Cryptantha (*Cryptantha* sp.)



Tarantula (*Aphonopelma* spp.)



Old World swallowtail (*Papilio machaon*)



Beavertail cactus (*Opuntia basilaris*)



Coyote (*Canis latrans*)



Desertsnow (*Linanthus demissus*)



Pacific tree frog (*Pseudacris regilla*)



Damselfly (*Enallagma* sp.)



Lobe-leaved Phacelia (*Phacelia crenulata*)



Merriam's kangaroo rat
(*Dipodomys merriami*)



Great horned owl (*Bubo virginianus*)



Desert banded gecko (*Coleonyx variegatus*)



Spinyhair blazingstar (*Mentzelia tricuspis*)



Bighorn sheep (*Ovis canadensis*)



Turkey vulture (*Cathartes aura*)



Master blister beetle (*Lytta magister*)



Brittlebush (*Encelia farinosa*)



California kingsnake
(*Lampropeltis getula californiae*)



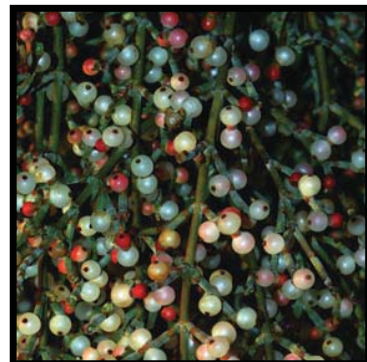
California palm (*Washingtonia filifera*)
seeds



Desert horned lizard
(*Phrynosoma platyrhinos*)



Screwbean mesquite (*Prosopis pubescens*)
pods



Mesquite mistletoe
(*Phoradendron californicum*) fruit



Honey mesquite (*Prosopis glandulosa*)
flowers



Desert Tortoise (*Gopherus agassizii*)



Catclaw acacia (*Acacia gregii*) seed pods

BIOLOGICAL RESOURCES AND MANAGEMENT

3.02 SENSITIVE SPECIES OF WSNA

Endemic Species

All organisms, their niches, and their interactions with each other comprise biological resources. Because of the plentiful spring water with its unique thermal properties, the Warm Springs Natural Area (WSNA) harbors an abundance of endemic species that occur nowhere else on earth. Of all the endemic species that occur on WSNA, the *Moapa dace* (*Moapa coriacea*) is the most imperiled and is federally protected as an endangered species. For this reason, the priority of management attention is focused on its protection and recovery. The *Moapa dace*'s recovery is largely dependent upon restoring stream habitat and the removal of introduced, competitive fish species.

Thermal properties of the WSNA springs and tributaries are key to the existence of the endemic and rare species.

Ecological Isolate

The WSNA is considered an ecological isolate (or island) within the dry Mojave Desert, providing quality riparian and mesquite woodlands that attract an abundance of wildlife, especially birds. The endangered Southwestern willow flycatcher (*Empidonax traillii extimus*) has been documented as nesting on the property. Protecting the nesting habitat is an important management objective to help ensure long-term population viability for this endangered species. Plant communities and their floristic composition, structure, and condition all contribute to habitat quality and preferential use by wildlife. Soil disturbance and the introduction of invasive weeds have created a threat to habitat quality and increase the risk of catastrophic wildfires.

Species Conservation

In addition to species protected under the federal Endangered Species Act (ESA), numerous other species are considered at-risk because of their local endemism or limited distribution. A critical management component on the WSNA is not only identifying threatened and/or endangered species, but also managing at-risk or rare plants and animals. It is important to monitor at-risk species in order to assess population stability. It requires less effort to protect a species from becoming endangered than recovering one once it has become such.

There are several bird species on the WSNA identified under the Partners in Flight Species Conservation Priority list. These species will be provided appropriate conservation consideration.

Some species such as the Vermilion flycatcher (*Pyrocephalus rubinus*) and Phainopepla (*Phainopepla nitens*) are signature species at the WSNA. Due to abundant and predictable population levels, they are important for recreational viewing by the birding community. Protecting at-risk and other important species is primarily a function of protecting and enhancing their respective habitats. Much of their habitat requirements overlap where multiple species are benefited from the same management practices.

Because of the oasis effect, provided by lush riparian vegetation in an otherwise harsh Mojave Desert ecosystem, WSNA supports a large and diverse population of bats. At least 15 species of bats have been documented using various habitats of the Warm Springs Natural Area. Fields, mesquite woodlands, riparian habitats, marshes, and open water offer large insect populations and foraging opportunities for bats.



Sensitive Species

28 SENSITIVE SPECIES

There are 28 at-risk or rare species including some endangered or threatened species residing on the property. The 1996 Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem identifies current status, threats and recovery needs for the Moapa dace and seven other rare, aquatic species (three fish, two snails and two insects).

Other species are included from the Clark County Multiple Species Habitat Conservation Plan (2000), the Nevada Natural Heritage Program at-risk tracking list and/or watch list, and rare aquatic species at WSNA identified in a survey report by Albrecht et al. (2008).

28 Sensitive Species on WSNA				
Common Name	Scientific Name	USFWS	NNHP State Status	Footnotes
Fish				
1 Moapa White River springfish	<i>Crenichthys baileyi moapae</i>		critically imperiled in state	4,6,8
2 Virgin River chub	<i>Gila seminuda</i> (Muddy River Population)		globally - critically imperiled	4,5,6,8
3 Moapa dace	<i>Moapa coriacea</i>	Endangered	critically imperiled in state	1,4,5,6,8
4 Moapa speckled dace	<i>Rhinichthys osculus moapae</i>		critically imperiled in state	4,5,6,8
Invertebrates				
5 Western naucorid	<i>Ambrysus mormon</i>			7
6 Warm Springs crawling water beetle	<i>Haliplus eremicus</i>		not ranked	4
7 MacNeill sooty wing skipper	<i>Hesperopsis graciellae</i>		critically imperiled in state	4,5,6
8 Moapa naucorid	<i>Limnocois moapensis</i>		critically imperiled in state	4,7,8
9 Moapa riffle beetle	<i>Microcyloepus moapus</i>		critically imperiled in state	4,5,7
10 Pahrnagat naucorid	<i>Pelocoris biimpressus shoshone</i>			4,7
11 Moapa pebblesnail	<i>Pyrgulopsis avernalis</i>	petitioned for listing	imperiled in state due to rarity	4,7,8
12 Moapa Valley pyrg	<i>Pyrgulopsis carinifera</i>	petitioned for listing	critically imperiled in state	4,7
13 Moapa skater	<i>Rhagovelia becki</i>			7
14 Moapa Warm Springs riffle beetle	<i>Stenelmis moapa</i>		critically imperiled in state	4,5,7,8
15 Grated tryonia	<i>Tryonia clathrata</i>	petitioned for listing	imperiled in state due to rarity	4,7,8
Birds				
16 Western yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	Candidate	globally - vulnerable to decline	3,4,5,6
17 Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Endangered	critically imperiled in state	1,4,5,6
18 Phainopepla	<i>Phainopepla nitens</i>		imperiled in state due to rarity	4,5,6
19 Vermillion flycatcher	<i>Pyrocephalus rubinus</i>			6
20 Summer tanager	<i>Piranga rubra</i>			6
Bats				
21 Townsend's big-eared bat	<i>Corynorhinus townsendii</i>		imperiled in state due to rarity	4,5,6
22 Spotted bat	<i>Euderma maculatum</i>		imperiled in state due to rarity	4,5,6
23 Western red bat	<i>Lasiurus blossevillii</i>		critically imperiled in state	4,5
24 Western yellow bat	<i>Lasiurus xanthinus</i>		critically imperiled in state	4
25 California leaf-nosed bat	<i>Macrotus californicus</i>		imperiled in state due to rarity	4,5,6
26 Fringed myotis	<i>Myotis thysanodes</i>		imperiled in state due to rarity	4,5,6
27 Big free-tailed bat	<i>Nyctinomops macrotis</i>		imperiled in state due to rarity	4,5,6
Reptiles				
28 Desert tortoise	<i>Gopherus agassizii</i>	Threatened	vulnerable to decline	2,4,5,6

FOOTNOTES:

1 Listed as Endangered under the Endangered Species Act

2 Listed as Threatened under the Endangered Species Act

3 Candidate species under the Endangered Species Act

4 State of Nevada Department of Conservation & Natural Resources. 2009

5 Bureau of Land Management - Nevada Special Status Species

6 Clark County Multiple Species Habitat Conservation Plan (MSHCP). 2000

7 Muddy River Headwaters Macroinvertebrate Report - Albrecht et al. 2008

8 U.S. Department of the Interior Fish and Wildlife Service. 1996. Recovery plan for the rare aquatic species of the Muddy River ecosystem

BIOLOGICAL RESOURCES AND MANAGEMENT

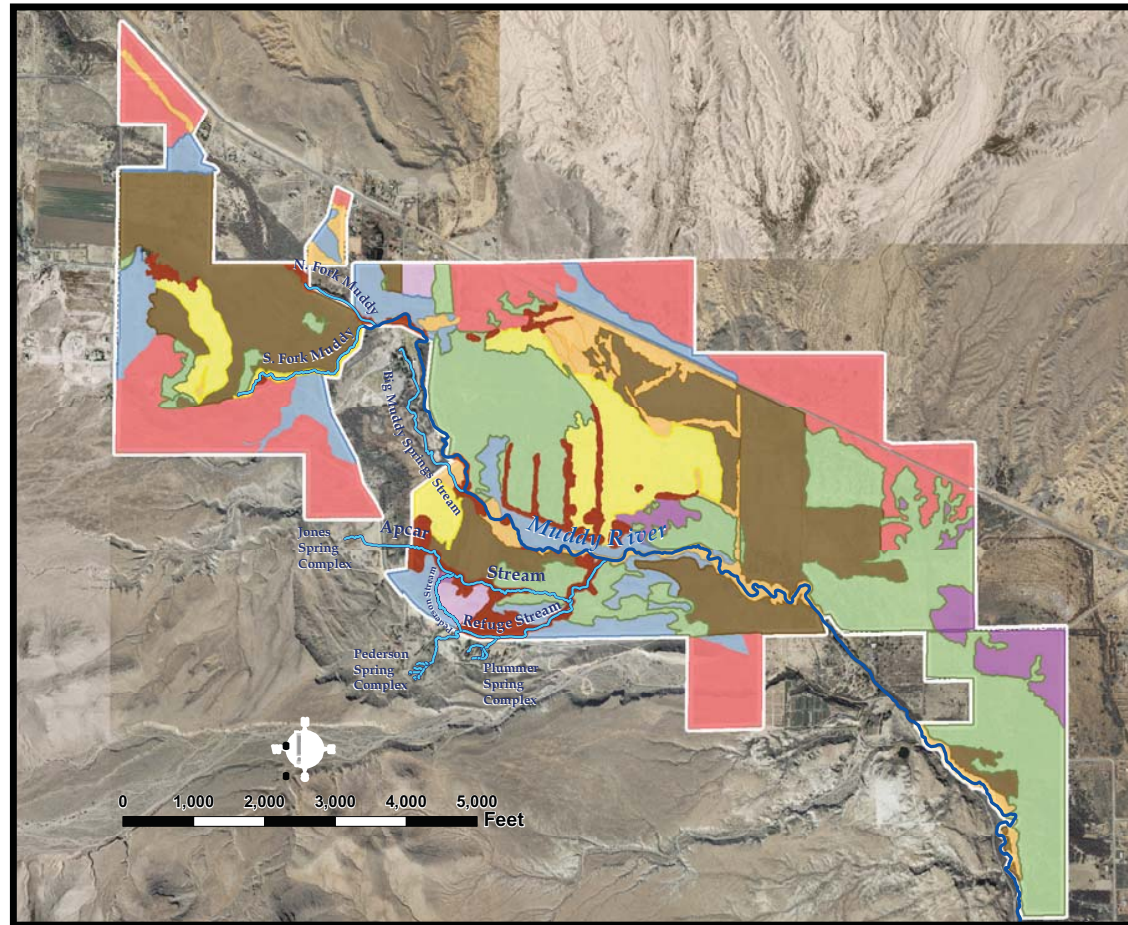
3.03 ECOLOGICAL SYSTEMS OF THE WSNA

ECOLOGICAL ASSEMBLAGES

-  Muddy River Aquatic Assemblage
-  Warm Springs Aquatic Assemblage
-  Riparian Woodlands
-  Riparian Shrubland
-  Riparian Marsh/Meadow
-  Mesquite Bosques

OTHER ECOLOGICAL GROUPS

-  Creosote Bush Shrubland
-  Saltbush Shrubland
-  Alkali Meadow
-  Abandoned Agricultural Fields
-  Other



Six ecological systems were identified by Provencher and Andress (2004) as occurring in the upper Muddy River. Each system forms an ecologically functional assemblage that contains habitat features and a suite of organisms. All six assemblages are known to occur on the Warm Springs Natural Area and help characterize the existing ecological units that require management in order to protect wildlife, many of which are endemic or regionally rare. The Warm Springs Aquatic Assemblage and the Muddy River Aquatic Assemblage are of particular interest due to the endangered *Moapa dace* (*Moapa coriacea*) as well as several endemic invertebrates.

The other assemblages provide habitat for a variety of wildlife but especially for rare birds such as the Southwestern willow flycatcher (*Empidonax traillii extimus*), Yellow-billed cuckoo (*Coccyzus americanus occidentalis*), Vermilion flycatcher (*Pyrocephalus rubinus*), Summer tanager (*Piranga rubra*), and Phainopepla (*Phainopepla nitans*). Each assemblage and its associated species that merits management consideration is discussed per assemblage. This approach emphasizes the need to manage functional systems and habitats in order to sustain and/or enhance identified recovery species. While the same species may occupy multiple ecological assemblages, each species is discussed in the assemblage where it reaches maximum prevalence.

3.04 MUDDY RIVER AQUATIC ASSEMBLAGE

The Muddy River Aquatic Assemblage encompasses the Muddy River. It is characterized by shrubby vegetation composed primarily of tamarisk and honey mesquite growing along a highly incised streambank. Water temperatures range between 80°-90° F on the WSNA. Exotic fishes such as tilapia, mollies, and mosquito fish are ubiquitous. While many aquatic animal species occur throughout the aquatic assemblages, a few reach maximum prevalence within this assemblage. Two native fishes and two aquatic invertebrates of concern primarily occur in this assemblage.

SPECIES FOR MANAGEMENT CONSIDERATION

- Virgin River chub
Gila seminuda - Muddy River Population*
- Moapa speckled dace
*Rhinichthys osculus moapae**
- Warm Springs crawling water beetle
Haliplus eremicus
- Moapa skater
Rhagovelia becki

* Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (USFWS 1996)

Virgin River chub (*Gila seminuda*)

The Muddy River population of Virgin River chub has a high potential for being listed as an endangered species. It has been declining throughout the Muddy River since the 1960s. Chub decline has been attributed to changes in water and substrate quality, channelization, introduced fishes, and parasites. Since its extirpation in the Warm Springs area in about 1997, this species has not been able to recolonize these streams due to a diversion dam near Warm Springs Road. The Virgin River chub averages 8-10 inches in length. It prefers deep streams with swift water. Dietary preferences of larval and juvenile chub consist primarily of aquatic insects. Adult chub feed on both insects and algae. Management of Virgin River chub on WSNA requires reestablishing connectivity with the core population that occur downstream, eliminating introduced fishes, and restoring floodplain vegetation.



Virgin River chub
(*Gila seminuda*)

Moapa speckled dace (*Rhinichthys osculus moapae*)

Moapa speckled dace populations are known to fluctuate greatly. The Moapa speckled dace averages three inches in length and typically lives for three years. The speckled dace is a close relative of the Moapa dace and has similar habitat requirements but prefers the cooler water temperatures below the Warm Springs area. Because of this thermal barrier, the two species are non-competitive. Larval speckled dace are primarily plankton feeders, while the adults feed primarily on both aquatic insects and algae. Speckled dace prefer the lower horizon of shallow, cobble riffles. They likely face similar threats from deterioration in water quality, introduction of non-native fish, and parasites. The source population of speckled dace resides downstream of WSNA below a fish barrier. Restoring a population on the WSNA will require reestablishing connectivity.



Moapa speckled dace
(*Rhinichthys osculus moapae*)

Aquatic invertebrates

The only published collection of the Moapa skater (*Rhagovelia becki*) was by Polhemus (1973) who described the species and by Huillet (1998). Several surveys since have not recorded the species (Albrecht et al. 2008, Stevens Ecological Consulting 2004, Sada and Herbst 1999), but *R. choneutes* was commonly observed in the Warm Springs area, suggesting either local extirpation or misidentification of *R. becki* (Sada and Herbst 1999). The Warm Springs crawling water beetle (*Haliplus eremicus*) was collected originally on the LDS Recreational Property as well as from Arizona (Wells 1989) and subsequently from the Muddy River on the LDS property (Huillet 1998). Current collection records include California and Utah within its range (R. Baumann, personal communication, April 2009).



Warm Springs crawling water beetle
(*Haliplus eremicus*)



Surveys for Virgin River chub are currently conducted in the Muddy River in Spring and Fall.

BIOLOGICAL RESOURCES AND MANAGEMENT

3.05 WARM SPRINGS AQUATIC ASSEMBLAGE

The Warm Springs Aquatic Assemblage is considered irreplaceable and the most important assemblage in the upper Muddy River ecoregional portfolio (Provencher and Andress 2004). This assemblage includes the thermal springs and tributaries which constitute the headwaters of the Muddy River. The endangered Moapa dace (*Moapa coriacea*) and the Moapa White River springfish (*Crenichthys baileyi moapae*) are native thermophiles dependent upon the warm springs and streams for survival. The Moapa pebblesnail (*Pyrgulopsis avernalis*) is an endemic snail species found in the headwaters of the upper Muddy River. Additionally, three thermophilic aquatic insects are endemic to the Muddy River headwaters, namely, the Moapa naucorid (*Limnocois moapensis*), Moapa riffle beetle (*Microcyloepus moapus*), and Moapa Warm Springs riffle beetle (*Stenelmis moapa*) (Parker et al. 1997). All seven species are identified by the Nevada Natural Heritage Program as at-risk. Other rare species within this assemblage that occur on the WSNA and other locations in Nevada include the Western naucorid (*Ambrysus mormon*), Pahranaagat naucorid (*Pelocoris biimpressus shoshone*) (Parker et al. 1997), and Moapa Valley pyrg (*Pyrgulopsis carinifera*) (Albrecht et al. 2008). The latter two species are also listed as "at-risk" by the Nevada Natural Heritage Program.

The overall condition of the Warm Springs Aquatic Assemblage is considered "poor" due to water withdrawals, entrenchment, and exotic species (Provencher et al. 2005). Past and ongoing stream restoration has improved conditions, but until the Moapa dace population has rebounded, restoration efforts will continue. On the WSNA, stream reaches and spring heads have been identified and prioritized by the Biological Advisory Committee for restoration. The Lower Pederson has been rechanneled, and the system is currently being improved for dace habitat by installing drift stations and augmenting natural revegetation. Of the nine upper Muddy Valley stream segments identified for restoration by Provencher et al. (2005), four reside almost exclusively on the WSNA, and one other is shared with the Moapa Valley National Wildlife Refuge. The remaining reach segments would not be considered part of the Warm Springs Aquatic Assemblage but rather the Muddy River Aquatic Assemblage.

SPECIES FOR MANAGEMENT CONSIDERATION

Endemics

Moapa dace (*Moapa coriacea*)*
Moapa White River springfish (*Crenichthys baileyi moapae*)*
Moapa naucorid (*Limnocois moapensis*)*
Moapa riffle beetle (*Microcyloepus moapus*)
Moapa pebblesnail (*Pyrgulopsis avernalis*)*
Moapa Warm Springs riffle beetle (*Stenelmis moapa*)*

Rare Non-Endemics

Grated tryonia (*Tryonia clathrata*)*
Moapa Valley pyrg (*Pyrgulopsis carinifera*)
Western naucorid (*Ambrysus mormon*)
Pahranaagat naucorid (*Pelocoris biimpressus shoshone*)

* Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (USFWS 1996)

Moapa dace population surveys are conducted each February and August.

MOAPA DACE

Moapa dace (*Moapa coriacea*)

Of all the endemic species that occur on the WSNA, the Moapa dace is the most imperiled and is federally protected as an endangered species. For this reason, the highest priority management attention on the WSNA is focused on its protection and recovery. The recovery of the Moapa dace is largely dependent on restoring stream habitat quality and the removal of introduced fish species that compete with and predate upon the dace.

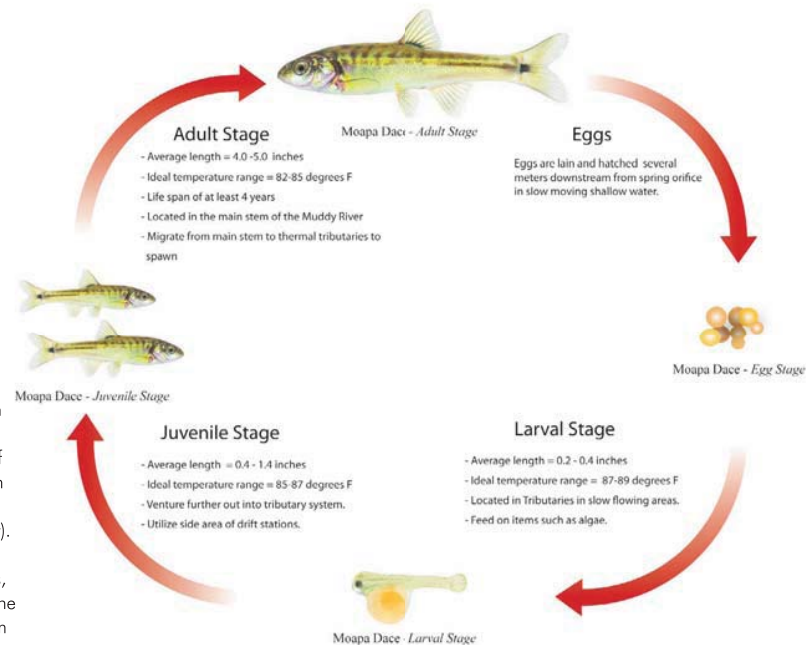


Life History

In 1967, the Moapa dace was listed as an endangered species under the Endangered Species Preservation Act of 1966. This fish only occurs in the warm springs, tributaries, and upper main stem of the Muddy River. Several critical springs for the dace occur on the neighboring Moapa Valley National Wildlife Refuge which feed the Refuge, Pederson, and the Apcar Streams. Those streams flow through the WSNA and provide important habitat for the dace. The WSNA also has an important spring that feeds the Refuge Stream and provides dace spawning habitat. Currently the Refuge Stream and springheads support the largest dace population, followed by the Pederson Stream. The Apcar Stream also has the potential to significantly contribute to dace recovery following the completion of restoration activities.

Adult Moapa dace are approximately four inches in length. A key identification characteristic is a large black spot near the end of the tail (Hubbs and Miller 1948). Fish typically live for four years, but can live up to approximately eight years in the main stem of the Muddy River. The Moapa dace is a warm water fish, and habitat type preferences vary with each life stage (larval, juvenile and adult). Larval Moapa dace begin their life in the warmer, slow-moving thermal spring outflows, and will venture out further and deeper into the water column of the tributaries and main stem of the river as they get larger. Adult Moapa dace return to the spring outflows from the river to reproduce. Reproduction takes place year round, but peak reproduction occurs in the spring when food sources, such as insects and plant material, are most readily available. All three habitat types (thermal springs, thermal tributaries, and the main stem river) are essential for Moapa dace reproduction and survival (Scoppettone et al. 1992).

Life Cycle of the Moapa Dace



RECOVERY GOALS FOR DELISTING

Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (USFWS 1996)

- 6,000 adult Moapa dace present in 5 spring systems
- Restore 75% of historic habitat in 5 spring systems
- Eliminate adverse effects of non-native fish and parasites
- Protect habitat in 3 of the 5 spring systems through agreements, easements, or acquisition

STEPS TO ACHIEVE RECOVERY

Install fish barriers
 Eradicate/control non-native species
 Install drift stations
 Restore/protect spring/stream flow dynamics
 Restore riparian vegetation
 Restore spring/stream connectivity

OTHER RARE AQUATIC SPECIES

Moapa White River springfish (*Crenichthys baileyi moapae*)

As the most abundant native fish on WSNA and the entire upper Muddy River, the Moapa White River springfish is the least threatened. The springfish is able to tolerate high water temperatures and low dissolved oxygen making the thermal springs and streams on WSNA ideal habitat. The upper Muddy River is the source population for those downstream. The Moapa White River springfish is commonly 1.5-2.0 inches in length and typically lives three years. Springfish reproduce year-round, with peak reproduction occurring in the spring when food sources, such as algae and aquatic insects are most readily available. Protecting existing thermal and flow qualities of the upper Muddy River springs and reaches, and controlling introduced fishes is important for this species.



Moapa White River springfish
(*Crenichthys baileyi moapae*)

Aquatic Invertebrates

Several aquatic invertebrates identified for management consideration are known to reach their maximum prevalence in the Warm Springs Aquatic Assemblage. The Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (1996) recognizes two snails and two insects as species of concern. They are all endemic to the Muddy River and known to occur on WSNA. The Clark County Multiple Species Habitat Conservation Plan (2000) identifies one additional snail and two additional aquatic insects as high priority species for evaluation. An aquatic invertebrate survey performed on WSNA by Albrecht et al. (2008) identified three additional rare insect species. The Nevada Natural Heritage Program adds another aquatic insect purported as occurring on WSNA on their watch list.



Moapa Warm Springs riffle beetle
(*Stenelmis moapa*)

The Amargosa naucorid (*Pelocoris shoshone amargosus*) may have mistakenly been thought as occurring in the Muddy River due to referenced use of the common name "Amargosa naucorid." Parker et al. (1997) lists *P. shoshone* as occurring in thermal springs of the upper Muddy River, but no mention is made of the subspecies. The Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem (USFWS 1996) identifies *Pelocoris shoshone shoshone* as a species of concern on their recovery list but applies the common name as Amargosa naucorid. Huillet (1998) did not sample *Pelocoris shoshone* but listed *Pelocoris biimpressus shoshone* indicating taxonomic confusion among literature citing *Pelocoris* in the Muddy River.



Pahranaugat naucorid
(*Pelocoris biimpressus shoshone*)

Pelocoris biimpressus shoshone was also encountered by Sada and Herbst (1999). Albrecht et al. (2008) listed a sampled naucorid as *Pelocoris biimpressus* (?shoshone) suggesting uncertainty as to the identification at the subspecies level. It is apparent that all variations are the same species – hereafter referred to as the Pahranaugat naucorid (*Pelocoris biimpressus shoshone*).



Moapa naucorid (*Limnocoris moapensis*)

Aquatic Invertebrate Recovery

The general belief is that restoring stream habitat for Moapa dace will be beneficial for all aquatic invertebrates. Competition theory suggests niche separation will occur across the breadth of existing niches. Single species management can easily favor one group of species over another. Due to the diversity of rare aquatic species in the upper Muddy River, aquatic invertebrate sampling will be implemented for all stream restoration

projects. Restoration projects will also give due consideration to habitat heterogeneity in design and implementation.

Stream restoration efforts require provisions for the full suite of endemic and rare aquatic macroinvertebrates at WSNA. Because the different species prefer different flow velocities, water depths, substrates, vegetation, coarse particulate organic matter, and bank structure, it is imperative to maintain a diversity of aquatic habitat

parameters throughout the stream reaches. Sada and Herbst (1999) recommend maximizing habitat diversity to benefit the entire community.

Focusing restoration work solely on fishes may negatively impact aquatic invertebrates. Community stability, resistance, and resilience are positively related to species diversity.

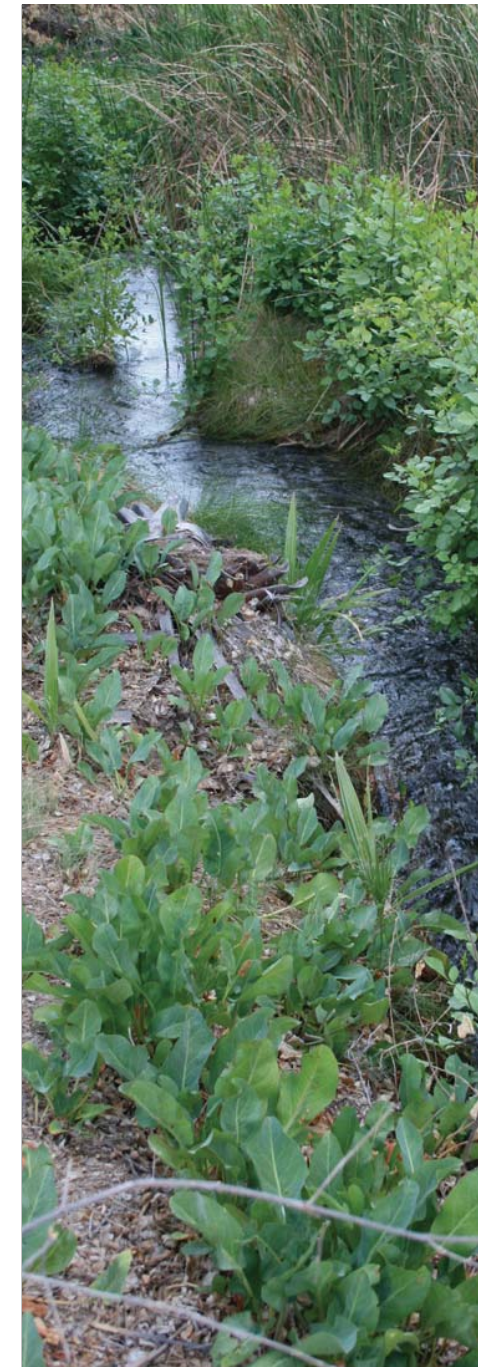


Moapa pebblesnail (*Pyrgulopsis avernalis*)

Aquatic Invertebrates - Percent Occurrence per 11 Reaches from Muddy River Headwaters to NV Energy Diversion	% Reach Occurrence
Grated tryonia (<i>Tryonia clathrata</i>)	100%
Moapa Warm Springs riffle beetle (<i>Stenelmis moapa</i>)	91%
Moapa riffle beetle (<i>Microcyloepus moapus</i>)	91%
Western naucorid (<i>Ambrysus mormon</i>)	82%
Moapa pebblesnail (<i>Pyrgulopsis avernalis</i>)	73%
Moapa naucorid (<i>Limnocoris moapensis</i>)	73%
Moapa Valley pyrg (<i>Pyrgulopsis carinifera</i>)	73%
Pahranagat naucorid (<i>Pelocoris biimpressus shoshone</i>)	27%

Albrecht et al. 2008

The occurrence of rare aquatic invertebrates throughout the headwaters of the Muddy River within the Warm Springs Aquatic Assemblage indicates broad distribution with the exception of the Pahranagat naucorid which was only sampled in 3 of 11 headwater reaches (Albrecht et al. 2008). It was located in the Apcar, South Fork, and middle main stem reaches. Previous sampling by Sada & Herbst (1999) did not encounter it in the South Fork but did locate it in the Plummer and Pederson streams. They noted a habitat preference for slow backwater with fine substrates and sparse vegetation. Huillet (1998) mentioned the naucorid as commonly collected. The distribution of this species appears greater than what was sampled by Albrecht et al. (2008) and is likely an artifact of sample methodology.



BIOLOGICAL RESOURCES AND MANAGEMENT

3.06 DECIDUOUS RIPARIAN WOODLAND

SPECIES FOR MANAGEMENT CONSIDERATION

- Southwestern willow flycatcher
Empidonax traillii extimus
- Western yellow-billed cuckoo
Coccyzus americanus occidentalis
- Summer tanager
Piranga rubra
- Townsend's big-eared bat
Corynorhinus townsendii
- Western red bat
Lasiurus blossevillii
- Western yellow bat
Lasiurus xanthinus
- Fringed myotis
Myotis thysanodes

The Deciduous Riparian Woodland along the Muddy River and its tributaries on WSNA have an abundance of velvet ash (*Fraxinus velutina*), Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), and California fan palm (*Washingtonia filifera*). The deciduous trees are especially important as nesting habitat for birds and as shade cover for native fish. The fan palms, while not desirable when they are impacting stream flow dynamics, do provide roosting habitat for the yellow bat and food for a variety of birds. Riparian woodlands have expanded along many irrigation ditches thereby extending the distribution of quality bird habitat. In many riparian areas, the trees alternate with or are replaced by the Riparian Shrubland Assemblage, forming an ecotone.

Management of riparian woodland entails protecting existing quality habitat from fire, exotic plant invasion, and age-related decadence, as well as restoring riparian woodland along denuded stream reaches. Velvet ash and Goodding's willow are particularly valuable riparian woodland species. Where recruitment of these species is not occurring naturally, site augmentation with propagated plants or transplants is recommended. The desired condition for this assemblage is a heterogeneous composition of age classes and tree densities throughout the riparian corridors.

Fremont cottonwood provides the largest structural component in this assemblage and is an important habitat species. It readily pioneers disturbed riparian areas and will likely not require significant restoration attention. In established groves along irrigation ditches, the trees continue to persist because their roots have reached groundwater, but recruitment of new trees is limited because of discontinued irrigation. In such areas, managed restoration may be desirable.

Because the California fan palm has invasive characteristics, develops undesirable fuel loads, and can negatively impact stream flow dynamics, it will not be purposefully planted as a component in riparian woodland restoration. In many woodland areas, the palms will be controlled in favor of more desirable native trees. Where fuel loads are not an issue, palms may be left intact. Where palm trees are removed, native tree species will be restored.



Velvet ash woodland

RIPARIAN SPECIES

Southwestern willow flycatcher (*Empidonax traillii extimus*)

The southwestern willow flycatcher is a small, insect-eating bird that has been protected as an endangered species by the US Fish and Wildlife Service since 1995. There are estimated to be only 900 - 1,000 breeding pairs of the southwestern willow flycatcher. Southwestern willow flycatchers breed in sites that have very dense tree cover usually close to water and over saturated soil.

Resident southwestern willow flycatchers were noted on the Warm Springs Natural Area in 2004, 2005, 2007, 2008, 2009, and 2010. In 2008, nine southwestern willow flycatchers were located on WSNA north of the Apar Stream (Braden et al. 2009). In 2009, four birds were found in dense patches of trees north of the Muddy River (Klinger & Conrad 2010). Of the four birds detected, two were a pair that fledged three young (McLeod et al. 2010).



Southwestern willow flycatcher
(*Empidonax traillii extimus*)

Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

The Western yellow-billed cuckoo is a medium-sized, slender and inconspicuous bird that forages in dense, leafy trees and eats large insects such as grasshoppers and caterpillars. The Nevada Department of Wildlife has identified cuckoos in a few areas around the state in small numbers. These birds are nomadic and numbers fluctuate greatly from year to year. A significant portion of the cuckoos found in Nevada in the early 2000s were at the Warm Springs Natural Area but more recent surveys have only detected one bird each year from 2003 to 2006, zero in 2007, and three in 2008. Two detections were made in 2009 (Bruce Lund, personal communication, 2009). These birds have been observed in the large woodland north of the main stem of the Muddy River (Braden et al. 2009), but cuckoos can be found throughout the WSNA in appropriate habitats.



Western yellow-billed cuckoo
(*Coccyzus americanus occidentalis*)

Summer tanager (*Piranga rubra*)

The summer tanager, a Clark County Multiple Species Habitat Conservation Plan Covered Species, is a medium-sized bird with a stout bill. Males are a brilliant red color and females are a buffy orange color. Males have small crests. Summer tanagers feed on bees and wasps that they catch in the air. They are confirmed breeders on the Warm Springs Natural Area according to Great Basin Bird Observatory (Appendix 4). Management for the summer tanager is similar to management for the southwestern willow flycatcher and includes preservation and establishment of dense riparian vegetation.



Summer tanager (*Piranga rubra*)

Western yellow bat (*Lasiurus xanthinus*)

The Western yellow bat has been recorded roosting in the palm trees (*Washingtonia filifera*) of the Warm Springs Natural Area. This is the only population of yellow bats that has been located in Nevada, and this population is disjunct and more northerly than other populations of yellow bats (O'Farrell et al. 2004).

RIPARIAN WOODLAND BAT SPECIES

- Western yellow bat
Lasiurus xanthinus
- Townsend's big-eared bat
Corynorhinus townsendii
- Western red bat
Lasiurus blossevillii
- Fringed myotis
Myotis thysanodes



Western yellow bat
(*Lasiurus xanthinus*)



BIOLOGICAL RESOURCES AND MANAGEMENT

3.07 RIPARIAN SHRUBLAND



The Riparian Shrubland at WSNA occurs along sections of the South Fork and Muddy River as well as along some irrigation ditches. Shrubs including Emory's baccharis (*Baccharis emoryi*), arrowweed (*Pluchea sericea*), coyote willow (*Salix exigua*) and other riparian non-obligates such as quailbush (*Atriplex lentiformis*) commonly occur in this assemblage. This riparian shrubland provides valuable habitat for birds, small mammals, and terrestrial invertebrates.

SPECIES FOR MANAGEMENT CONSIDERATION

- MacNeill sooty wing skipper
Hesperopsis graciellae

MacNeill sooty wing skipper
(*Hesperopsis graciellae*)

Quailbush is a known host plant for the MacNeill sooty wing skipper. Larvae of this butterfly feed on the leaves whereas the adults forage for nectar on flowering plants. Quailbush occurs abundantly at WSNA and is not in danger of diminishing.

The MacNeill sooty wing skipper is considered common to abundant in Moapa Valley having been collected from Bowman Reservoir and Hidden Valley (Austin & Austin 1980). Hidden Valley is approximately five miles south of the WSNA and no fragmented host plant populations occur between recorded collections and the WSNA property. Adults have been recorded nectaring on tamarisk, salt heliotrope (*Heliotropium curassavicum*), and alfalfa (*Medicago sativa*) (Austin & Austin 1980). However, Nelson (2009) did not record the MacNeill sooty-wing skipper at the WSNA during limited sampling in April and July 2009.



MacNeill sooty wing skipper
(*Hesperopsis graciellae*)



Quailbush
(*Atriplex lentiformis*)



3.08 RIPARIAN MARSH/MEADOW

Marshes and seeps provide essential habitat for amphibians, birds, invertebrates, and small mammals. Because wetland habitat is so productive, it provides the food base to support higher trophic species such as predators. Due to its rarity and resource-rich quality within an otherwise resource-scarce Mojave desert ecosystem, riparian marshes and seeps attract and harbor an abundance of wildlife.

SPECIES FOR MANAGEMENT CONSIDERATION

- Relict leopard frog *Lithobates onca*

Marshland on the Warm Springs Natural Area is primarily derived from spring outflow that may be either partially ponded or terminates in wet meadows. The amount of water varies seasonally with the greatest standing water most abundant during the winter months when the groundwater is particularly close to the surface. In some areas, riparian meadow vegetation can be found where surface water is entirely absent. Vegetation in such areas is supported by the high water table in the winter months. Riparian meadows form an important feeding ground for many of the bird species found on the natural area. Mowing in combination with periodic prescribed fire is useful to maintain the health and productivity of riparian meadows. The few marshes found on the Natural Area are largely overgrown with cattails and would benefit from the management practices that expose surface water for waterfowl and other wildlife.

Introduction of the Relict leopard frog

The relict leopard frog (*Lithobates onca*) historically occurred in springs near the Colorado, Virgin, and Muddy Rivers including the springs at the headwaters of the Warm Springs Natural Area (Bradford et al. 2004). By 1950, this frog was believed to be extinct. However, in 1991 relict leopard frogs were rediscovered in several springs near Littlefield Arizona, near Lake Mead, and below Hoover dam. Conservation efforts include monitoring existing populations, enhancing spring habitats, captive rearing, and translocating frogs into historic and new locations.

Because Warm Springs Area is within the historic range of the relict leopard frog, frogs were relocated to adjacent lands owned by Clark County in 2010. Releasing relict leopard frogs on the Warm Springs Natural Area may be part of recovery efforts for this species.



Marsh



Cattails



Relict leopard frog (*Lithobates onca*)



Yerba mansa

BIOLOGICAL RESOURCES AND MANAGEMENT

3.09 MESQUITE BOSQUE



Both honey mesquite (*Prosopis glandulosa*) and screwbean mesquite (*Prosopis pubescens*) comprise the mesquite woodland community type. Of the two, screwbean mesquite is regionally least common and perhaps therefore the most ecologically significant. On the WSNA screwbean mesquite forms a dense (near monotypic) woodland in some areas and provides important nesting and shelter habitat for many species of wildlife. The screwbean mesquite woodland at WSNA is the largest contiguous stand in Nevada. Both mesquite species host the parasitic mesquite mistletoe (*Phoradendron californicum*) which is an important food item for the Phainopepla. Aerial photographs of WSNA taken in 1950 reveal an absence of mesquite in the floodplain due to cultivated crops. Much of the land currently occupied by mesquite was still farmed as late as 1985. The abundance of mesquite at the present time reflects a discontinuation of farming and change to cattle grazing as the primary land use on the property since the late 1980s. While mature stands of mesquite provide positive habitat attributes, the total replacement of native grasslands by mesquite is not desirable. Ideally, a mosaic of mesquite woodland across the landscape representing different age-classes and densities is the preferred ecological state. At present, the woodland understory is dominated by non-native grasses and forbs, remnants of former pasture species. A long-term goal of restoring native understory species will only enhance the value of this vegetation type.

Phainopepla
(*Phainopepla nitans*)

The phainopepla is a medium-sized bird. Males are a silky black color and females are gray. Both sexes have crests. Phainopeplas feed on both berries and flying insects. The phainopepla is closely tied to the availability of the berries of mistletoe (*Phoradendron* spp.) which is a parasitic plant that grows on mesquite trees (*Prosopis* spp.). The phainopepla eats the mistletoe berries, digests them, and defecates the remaining sticky seeds on the branches of mesquite trees. The seeds sprout and the mistletoe becomes established on new mesquite trees. Management for phainopepla includes maintaining mesquite stands that are parasitized by mistletoe.



Phainopepla
(*Phainopepla nitans*)

Vermilion flycatcher
(*Pyrocephalus rubinus*)

The Vermilion flycatcher is a small flycatcher found in the southwestern United States southward to Argentina. This species inhabits desert riparian areas but primarily nests in the screwbean woodland on the WSNA. The Warm Springs Natural Area is home to the largest breeding population of Vermilion flycatchers in Nevada. Males are a bright red color and females are gray with a peach belly. Vermilion flycatchers feed mostly on flying insects, such as bees and dragonflies that they catch on the wing. They often forage over water or meadows. Management for the Vermilion flycatcher includes keeping riparian and mesquite woodlands relatively open because they avoid densely wooded areas. These birds also occur in the riparian-agricultural interface especially near lightly cultivated or abandoned fields near open water.



Vermilion flycatcher
(*Pyrocephalus rubinus*)

Spotted bat
(*Euderma maculatum*)

The spotted bat is a large bat with extremely large ears and three large white spots on its back. This state-protected species is known to roost on cliffs and to forage in mesquite bosques in the Warm Springs Natural Area (O'Farrell et al. 2004 and Williams et al. 2006). The spotted bat eats a variety of insects but primarily feeds on moths. This species is rare and patchy in occurrence in a variety of habitats throughout the western United States. The spotted bat has one young per year in June or July. Little else is known about this elusive species. Management for the spotted bat includes protecting cliff roosting areas and maintaining insect and moth diversity by maintaining open mesquite bosque habitat.

SPECIES FOR MANAGEMENT CONSIDERATION

- Phainopepla
Phainopepla nitans
- Vermilion flycatcher
Pyrocephalus rubinus
- Spotted bat
Euderma maculatum

Honey mesquite pods



3.10 OTHER ECOLOGICAL GROUPS

Several plant communities exist on WSNA that do not fall within TNC's six ecological "assemblages" (Provencher et al. 2005) but still harbor rare and or protected animal species. Additional plant communities include the creosote bush shrubland, saltbush shrubland, and alkali meadows.

Creosote bush shrubland

Characteristic of the Mojave Desert, this shrubland provides habitat for the threatened desert tortoise and at least two species of bats, the California leaf-nosed bat and the big free-tailed bat. Creosote bush shrubland occupies the upland areas of WSNA above the floodplain. It is also the dominant vegetation type that surrounds WSNA. Much of the plant diversity documented on the WSNA occurs in this community. The Creosote bush shrubland at the WSNA has not been heavily impacted by past agricultural practices. This area is in good condition with expansive distribution outside the WSNA boundary. Management action will likely be limited to controlling some of the common non-native weeds that increase the risk and spread of wildfire such as red brome (*Bromus rubens*) and Sahara mustard (*Brassica tournefortii*).



Creosote bush shrubland

Saltbush shrubland

This vegetation community is found in more saline soils of the floodplain in the upper Muddy River. In the most saline soils where a high water table exists, iodinebush (*Allenrolfea occidentalis*) can be a dominant species. Other areas on the WSNA are dominated by quailbush (*Atriplex lentiformis*) and Mojave seablite (*Suaeda moquinii*). This community often forms a gradient with alkali meadows.



Saltbush shrubland

Alkali meadow

Saltgrass (*Distichlis spicata*) is the most prevalent species found within this plant community followed by alkali sacaton (*Sporobolus airoides*). Because of the past extensive cultivation at WSNA, remnant stands of alkali meadows are considered extremely important. Much of this community type has been replaced by Bermuda grass (*Cynodon dactylon*). These meadows also serve as foraging grounds for wildlife, especially where they border mesquite woodland.



Alkali meadow

SPECIES FOR MANAGEMENT CONSIDERATION

(Creosote bush shrubland)

- Desert tortoise
Gopherus agassizii
- California leaf-nosed bat
Macrotus californicus
- Big free-tailed bat
Nyctinomops macrotis



- 4.01** SPECIAL MANAGEMENT
- 4.02** FIRE MANAGEMENT
- 4.03** INVASIVE MANAGEMENT
- 4.04** CULTURAL RESOURCE MANAGEMENT







SPECIAL MANAGEMENT

4.01 SPECIAL MANAGEMENT

Stewardship Plan

SNWA committed to join with stakeholders to develop a long-term plan for the property. The purpose of this document is to establish long-term management direction for the Warm Springs Natural Area. It is SNWA's intention that the Stewardship Plan will establish a framework for appropriate land uses for the property that preserve the integrity of natural resources and lay a foundation for the property that will foster stakeholder relationships. The Stewardship Plan is intended to clarify SNWA's responsibilities and management direction as they pertain to conservation on the Warm Springs Natural Area and ensure consistency with the SNWA's commitments in the SNPLMA Nomination and the Muddy River Recovery Implementation Program.

While the Stewardship Plan is intended to provide guidance for SNWA management and future land uses and activities on the Warm Springs Natural Area, it is important to note that the Stewardship Plan is a conceptual document to begin dialogue and is not intended to require implementation of any specific management action recommendations. Implementation of such actions is left to the discretion of the SNWA Board of Directors through the annual budgeting process and through specific contract approvals as needed.

Management Priorities

The prioritization process was formulated by the Core Team and experts in various fields. The Mission Statement developed by the Core Team establishes management priorities and serves to frame future decisions.

The following are management priorities for the property:

- Manage the property for the benefit and recovery of the Moapa dace. This includes restoring and protecting the thermal springs and their outflows.
- Manage the property for the benefit of federally-protected, state-protected, sensitive, and thermal endemic species.
- Manage the property as a Natural Area – which means encouraging native species and their ecological assemblages and removing invasive species.
- Reduce fuel loads and establish fire breaks on the Natural Area to protect neighbors and property.
- Carry out SNPLMA commitments for the property for controlled public access of the Natural Area.

Goals and Objectives

Goals and objectives guide implementation of future management actions toward activities that produce the desired outcome of a well-balanced Natural Area. The Core Team identified the following goals and objectives to direct future management for the Warm Springs Natural Area:

- Protect listed, sensitive, and thermal endemic species and their habitat when conducting management activities;
- Reduce fuels on site, focusing first on the portion of the property adjacent to neighbors and then property-wide fuels reduction to insure safety;
- Preserve cultural and historic resources on the property;
- Utilize local, native species when restoring the Natural Area;
- Reduce invasive species on site, where possible;
- Encourage public appreciation of the natural systems through education;
- Provide the opportunity for scientific research programs of the Warm Springs ecological system; and
- Consider the Warm Springs Natural Area as a component of the Muddy River ecosystem (migratory flyway, headwaters of the Muddy River, etc.) when implementing management decisions.

MANAGEMENT PRIORITIES

Manage the property for the benefit and recovery of the Moapa dace. This includes restoring and protecting the thermal springs and their outflows.

Manage the property for the benefit of protected species: federal, state, sensitive and thermal endemic species.

Manage the property as a Natural Area – which means promoting native species and their habitats and controlling invasive species.

Reduce fuel loads and establish fire breaks on the Natural Area to protect neighbors and property.

Carry out SNPLMA commitments for controlled public access of the Natural Area.

Illegal Dumping

Illegal dumping of trash has occurred at certain locations of the WSNA for many years. Lawn and garden refuse and household items are a few of the commonly encountered items once disposed of on the property. The most serious known dump site is an area adjacent to BLM land that has always been accessible just off Highway 168 on a gravel road. To prevent further dumping, it is necessary to adequately fence off open access areas and to properly sign the property. Existing trash will need to be removed and disposed of properly at an authorized landfill.



Beaver Management

Although beaver dams and ponds are well known for their important role in flood control and in the establishment of wetlands, meadows, and riverine forests, beaver dams and ponds can be detrimental to Moapa dace habitat. Dams cause the swift-flowing water to slow, pond, and cool, which reduces the length of stream with the warm water temperatures needed by the dace. This ultimately reduces the amount of adequate dace habitat. Non-native dace competitors and predators such as mollies and tilapia thrive in the slow moving water behind beaver dams. Due to the imperiled status of the Moapa dace, beavers and their dams should be removed from streams containing Moapa dace. Beaver and dam removal will improve habitat for the dace by increasing water temperatures, increasing appropriate swift water habitat, and will reduce habitat for non-native fish.



Grazing

The current ecological condition of WSNA (ranging from poor to good) is primarily due to the cumulative effect of crop cultivation and extensive grazing. While grazing pastured or grassland systems can have the visual effect of a pleasing pastoral scene, its persistent practice has more subtle but lasting negative effects on natural systems. Cattle preferentially forage on certain species, thereby encouraging the expansion of less preferred plants. On WSNA, alkali goldenbush (*Isocoma acradenia*) and honey mesquite (*Prosopis glandulosa*) have greatly increased due to grazing.

Grazing for the sake of livestock production is no longer a justifiable activity under managing the property as a natural area. The use of animals to accomplish certain management objectives may be considered in the event that other alternatives are not available or are less satisfactory.



Using grazing for the purpose of fuels reduction or biological weed control is worthy of consideration given other factors of habitat quality are preserved. Currently, preference for fuels reduction is being given to mechanical mowing and prescribed fire. For the purpose of weed control in biologically sensitive areas where chemical control is not appropriate, confined, intensive grazing may produce desirable outcomes.

Vegetation manipulation by grazing should only be considered in localized situations. Grazing can have the unwanted outcome of introducing or spreading noxious weeds. Overgrazing can negatively affect plant community composition. Serious problems persist from past grazing, impacting stream bank stability, water quality, and hydrological function, which has negatively altered Moapa dace habitat.



SPECIAL MANAGEMENT

4.02 FIRE MANAGEMENT

Fire History

Warm Springs Natural Area has experienced many wildfires over the past half century. Large wildfires have occurred approximately every ten years. A large wildfire occurred in 1987 consuming several homes and barns at the old Home Ranch. Another catastrophic fire occurred in 1994 impacting property and Moapa dace habitat on the Moapa Valley National Wildlife Refuge. In 2004, a wildfire followed the palms up the North Fork and destroyed a home. In 2008 a lightning strike ignited a palm tree on the northern side of the property starting a 2.5 acre wildfire that was quickly quelled thanks to water trucks working nearby. A fire in 2010 burned 601 acres, destroying a residence, staffing quarters and the "Big House" on the LDS Church Recreational Area.

Fire can have positive effects on natural ecosystems. Many ecosystems require fire to maintain plant community health and productivity which can support a more abundant and diverse wildlife component. While wildfire can be beneficial, the threat of wildfire to private property has been and continues to be a relevant concern for property owners in the Warm Springs area. The impact of wildfire to the endangered Moapa dace is also of concern. Burning vegetation along streams can raise the water temperature. Ash deposition in streams can raise the pH and lower the dissolved oxygen.

The loss of desirable riparian and mesquite woodland due to wildfire can also have significant impacts on sensitive bird species. Wildfire results in the expansion of introduced weeds which in turn can increase frequency and extent of future wildfires. Much of WSNA is densely vegetated and entails a certain degree of risk for wildfire. Steps to reduce wildfire risk to property and habitat will be implemented as part of a fuels reduction program and outlined in a wildfire management plan.



Pre-suppression

Pre-suppression means taking preventative action to reduce the likelihood or extent of accidental or natural wildfires. Pre-suppression activities include surveying WSNA and prioritizing areas that would benefit from fuel reduction, fire breaks, and vegetative manipulation. Weed management is a related activity that contributes to the reduction of fine fuels. A survey of fuels around priority wildlife areas, structures, and neighboring properties will be required on a regular basis. Fuel loads may be reduced using a variety of methods including mechanical, chemical, and biological treatments. Because fuel biomass will continually accrue from one growing season to the next, fuels reduction will need to be an ongoing program requiring vigilant monitoring.

Palm trees contribute to the most serious build up of fuels at the WSNA. Dry palm fronds are highly flammable and are easily ignited by lightning strikes. Because so much biomass accumulates in the palm tree skirts, palm fires are intense and can carry in the tree canopies regardless of understory vegetation. Fire risk from palm trees can be partially remedied by regularly trimming palm skirts or complete removal of enough trees to disrupt fuel continuity. Given the thousands of palm trees on the property, palm frond trimming is not feasible for property wide application.

Grass contributes to the establishment of a fine fuel load through which fire can rapidly advance. There are several areas where perennial grasslands are extensive. Because these grasses are generally valuable habitat components, maintaining roads to function as fire breaks should be employed. Additional roads can be created to act as fire breaks against grassland fire. Periodic prescribed burns in grasslands can help minimize the buildup of fine fuels. Prescribed burning can also improve the overall quality of grass dominated systems.

Prescribed fire

Prescribed fire can be a valuable management tool and is a viable option for WSNA. Use of prescribed fire is however contingent upon the development of a site specific prescribed fire plan with a full complement of appropriate response personnel and equipment. Following prescribed burns, areas that lack the capacity to rejuvenate as native plant communities should be reseeded with native species. Encouraging native plant revegetation will help exclude the establishment of exotic weeds which can exacerbate future fire problems.

Fire Breaks

Fire breaks can provide an effective safeguard against fire advance if their width is sufficient to prevent a breach. The appropriate width of a fire break is dependant upon adjacent fuel types. Higher, denser vegetation such as trees require wider fire breaks. Regardless of fire break design, high winds can carry embers far beyond any fire break. Fire breaks require regular maintenance to preserve their effectiveness. Fire break lines will need to be monitored regularly and treated as appropriate. Mechanical or chemical treatments can be effective though mechanical treatments can subsequently promote the growth of weedy species.

Besides defensive perimeters around neighboring property owners, fire breaks within the property are necessary to reduce the spread and severity of fire. Palm trees skirts form a near continuous fuel source for fire to travel riparian corridors. The heat generated from flame engulfed palm trees contributes to the rapid spread of fire into neighboring vegetation. Sections of palm trees along the waterways may be removed to eliminate a contiguous line of fuel load.

Palm Management

Fond memories of swimming amid the palms as a child at Warm Springs pervade the memory of many local citizens. The public has a strong emotional link to the past and palm trees appeal to people's sense of place. There is considerable debate regarding the palm trees' origin and the role California palms play in the riparian ecosystem. Palms on WSNA will be managed individually, depending upon an identified impact to hydrological function, stream ecology, or as a fire risk. Palms having no direct impact may be left for wildlife. The first management solution for palms considered as a fire risk may be to trim the palm skirt, otherwise they may be removed.



Fire Response

The Clark County Fire Department has fire suppression responsibilities outside incorporated areas within Clark County and therefore has command responsibility. The closest Clark County Fire Department station is the Moapa Volunteer Fire Department Station 72 located in Moapa. Federal agencies responded to the fire in July 2010, due to the proximity of WSNA to the Moapa Valley National Wildlife Refuge.



Post-fire Rehabilitation

Depending upon the severity and extent of habitat damage following a wildfire, natural recovery, augmented recovery, or intensive rehabilitation should be evaluated for treatment consideration. Post-fire weed control is usually necessary to prevent the spread of invasives. Post-fire monitoring using photo-points and vegetation analysis should be encouraged. Unlike federal agencies which have access to emergency fire funds to help rehabilitation efforts, WSNA rehabilitation will be contingent upon budgeted funding availability. For that reason, pre-suppression will be emphasized; however, a post-fire analysis can be conducted to develop a response plan that will document restoration needs and costs. Post-fire rehabilitation plans will be coordinated with the Biological Advisory Committee and the USFWS.



SPECIAL MANAGEMENT

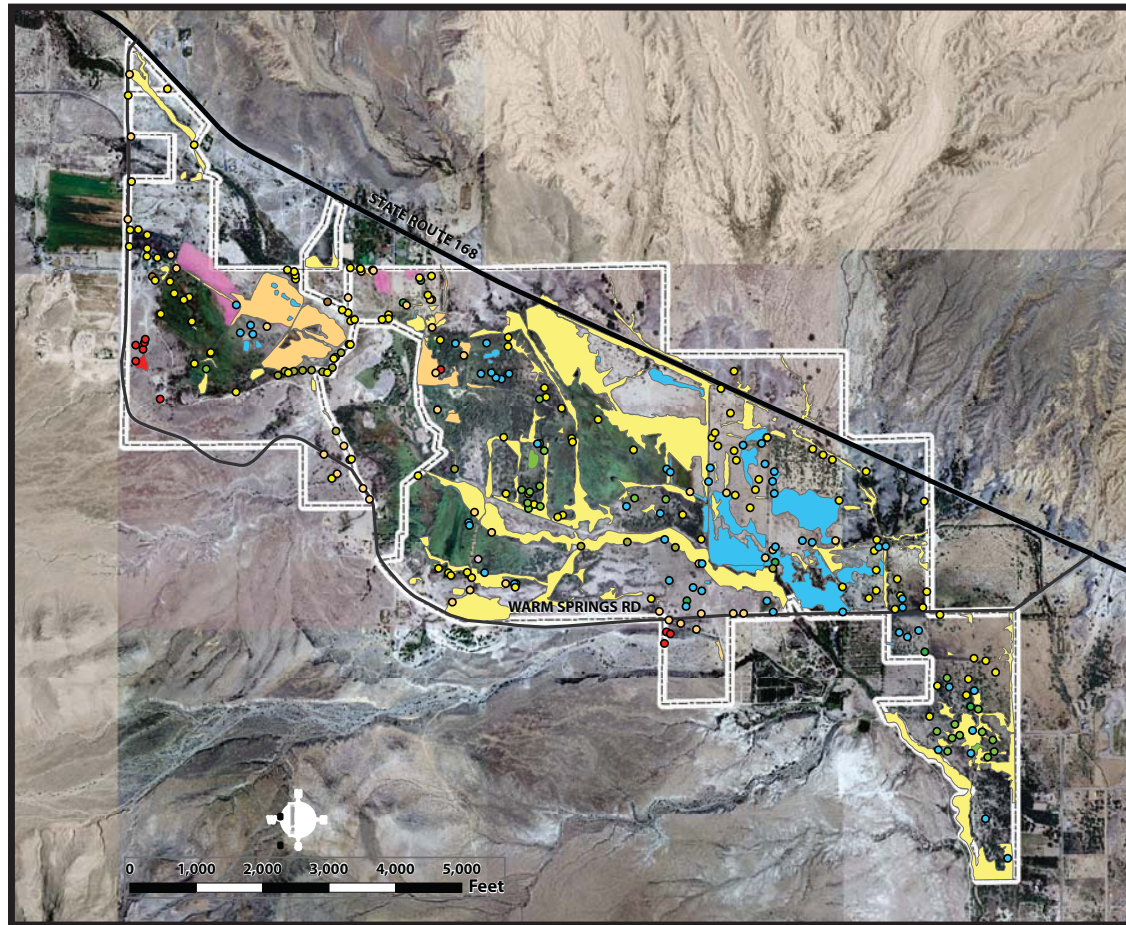
4.03 INVASIVE MANAGEMENT

2008 Weed Survey

- Malta Starthistle
- Perennial Pepperweed
- Russian Knapweed
- Sahara Mustard
- Saltcedar
- Morning Glory

- Hoary Cress
- Malta Starthistle
- Perennial Pepperweed
- Russian Knapweed
- Sahara Mustard
- Saltcedar
- Common Reed
- Giant Reed
- Morning Glory

- Warm Springs Natural Area



A 2008 weed survey at the WSNA identified seven noxious and two nuisance weed species (Tri-County Weed Control 2008). Three additional noxious weeds and five additional nuisance weeds were identified by WSNA staff. Prioritization of weed species, based on negative habitat effects, invasiveness, and risk for additional impacts at the WSNA, identified both noxious and nuisance weed species as targets for control.

Weed Management

Any undesired plant in a given location can be classified as a weed; however, not all weeds are equal. Some weeds are labeled “noxious” and require abatement action according to Nevada State law. In Nevada, noxious weeds are broken into one of three categories (A, B, or C). Category A noxious weeds require active control of all populations. Control of Category B noxious weeds is centered on reducing the risk of further contamination and the eradication of emerging populations. Category C noxious weeds are generally widespread, and abatement is at the discretion of the state quarantine officer. Other weeds are considered “nuisance” and have no legal requirement for eradication/control even if the nuisance weed may be ecologically more damaging than any given noxious weed.

Invasive Plants

While saltcedar is one of the most dominant weeds on the property, it is relatively stable when compared to Russian knapweed which is expanding and has the potential to dominate new areas on the WSNA. Similarly, Malta starthistle is highly invasive due to its mode of dispersal. It is commonly found along roads and trails where it is dispersed as a hitchhiker on people, animals, or vehicles. Russian thistle is problematic due to its potential risk for wildfire. Russian thistle can grow in dense stands and is extremely flammable when dry. Wind commonly piles Russian thistle along fence lines or hedgerows, creating an opportunity for rapid fire movement over long distances. Russian thistle can also roll across the landscape while on fire during windy conditions, further exacerbating fire spread.

Bermudagrass was originally planted as a pasture grass and dominates much of the grassland and mesquite understory. Due to its competitive nature, it precludes many desirable native species especially herbaceous forbs which are distinctly lacking on the property. Eelgrass, an aquatic plant, is of particular importance to Moapa dace habitat, though it is already widespread and has likely reached its maximum distribution on the WSNA. The remaining species occupy small areas and/or comprise a minimal threat but will either be monitored or treated as time and resources permit.

The WSNA management strategy follows an Integrated Pest Management (IPM) approach to weed control and/or eradication. Mechanical, chemical, and biological control measures will be given due consideration as control treatments. Because of the contamination potential for chemical

residues into surface waters supporting Moapa dace and other sensitive aquatic species, non-chemical control options will be given priority in areas where contamination is possible. Chemicals that can directly or indirectly affect fish will not be used within a generous buffer zone, in windy conditions, or during inclement weather. The use of any chemical within or bordering dace habitat will require coordination with the US Fish and Wildlife Service. In all instances, best management practices will apply. Use of any restricted chemical will require an on-site, licensed person for the duration of chemical application. Care will be taken to prevent the bioaccumulation of systemic chemicals in soils or systems caused by multiple applications or by using highly persistent chemicals. The development of an IPM Plan for the property would address the various issues associated with managing pest species at the WSNA.

Noxious Weeds	Acres Infested	Category	Management Priority
Russian knapweed (<i>Acroptilon repens</i>)	157.5	B	1
Malta starthistle (<i>Centaurea melitensis</i>)	47.9	A	2
Saltcedar (<i>Tamarisk</i> spp.)	35.4	C	3
Perennial pepperweed (<i>Lepidium latifolium</i>)	*	C	8
Sahara mustard (<i>Brassica tournefortii</i>)	1.5	B	9
Hoary cress (<i>Cardaria draba</i>)	*	C	10
Giant reed (<i>Arundo donax</i>)	*	A	12
White horse-nettle (<i>Solanum elaeagnifolium</i>)	*	B	**
Johnson grass (<i>Sorghum halepense</i>)	*	C	**
Puncture vine (<i>Tribulus terrestris</i>)	*	C	**

* Less than one acre

** Low management priority

Nuisance Weeds	Acres Infested	Management Priority
Prickly Russian thistle (<i>Salsola tragus</i>)	150.0	4
American eelgrass (<i>Vallisneria spiralis</i>)	*	5
Bermudagrass (<i>Cynodon dactylon</i>)	150.0+	6
Red brome (<i>Bromus rubens</i>)	*	7
Field bindweed (<i>Convolvulus arvensis</i>)	*	11
Common reed (<i>Phragmites australis</i>)	*	**
Russian olive (<i>Elaeagnus angustifolia</i>)	*	**



Malta starthistle



Tamarisk



Tamarisk



SPECIAL MANAGEMENT

4.04 CULTURAL RESOURCE MANAGEMENT

Many of the important resources found on the WSNA property are cultural and historical. Historic property can include buildings, structures, objects, sites, and traditional cultural properties that are at least 50 years old. Protecting cultural resources on the WSNA is a management goal of SNWA. In 2008, an intensive archaeological survey was conducted to identify and document the archaeological resources on WSNA and evaluate the eligibility of these resources for nomination to the National Register of Historic Places (NRHP) (HRA 2008 and 2009). The survey identified three previously recorded sites and 16 previously unrecorded archaeological sites. Of these 19 sites, 16 are prehistoric habitations, trails, artifacts scatters, and rock shelters; and three are historic. The historic sites include the Home Ranch, irrigation ditches, and a recreational facility built by Xavier Cougat for Folies Bergère showgirls in the late 1950s.

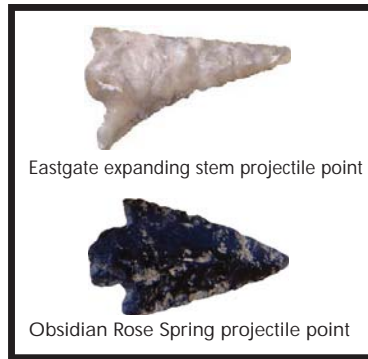
HRA recommended that 12 of the 19 properties are eligible for nomination to the NRHP because they are likely to yield information important to prehistory or history. Most of the NRHP-eligible sites are prehistoric artifact scatters located on the upland terraces and hills. Only a few archaeological sites were identified in the low-lying floodplain where past agriculture would have been practiced.

Management of known archaeological sites includes protection from public access and future development plans. Most of the area's archaeological resources are fragile and can be impacted in direct and indirect ways. Direct impacts occur when a site is affected by construction activities such as grading or digging, and indirect impacts are typically damages that are visual or result from visitors or daily operations. Impacts to the archaeological sites can be avoided by taking these resources into consideration during the early stages of planning. Areas containing known cultural resources should be avoided during future development projects. If avoidance is not possible, then a treatment plan to mitigate impacts to cultural resources should be developed in consultation with the State Historic Preservation Office. These treatment plans may include surface mapping, artifact collection and analysis, monitoring, and in some cases excavation.

Interpretive opportunities for public interest and education will be explored. Signs and other interpretive displays explaining the area's unique history may be incorporated into visitor facilities and trails.



Great Basin metate



Eastgate expanding stem projectile point

Obsidian Rose Spring projectile point

5.01 PUBLIC USE

5.02 MANAGEMENT PRIORITIES

5.03 ACCOMPLISHMENTS AND NEXT STEPS

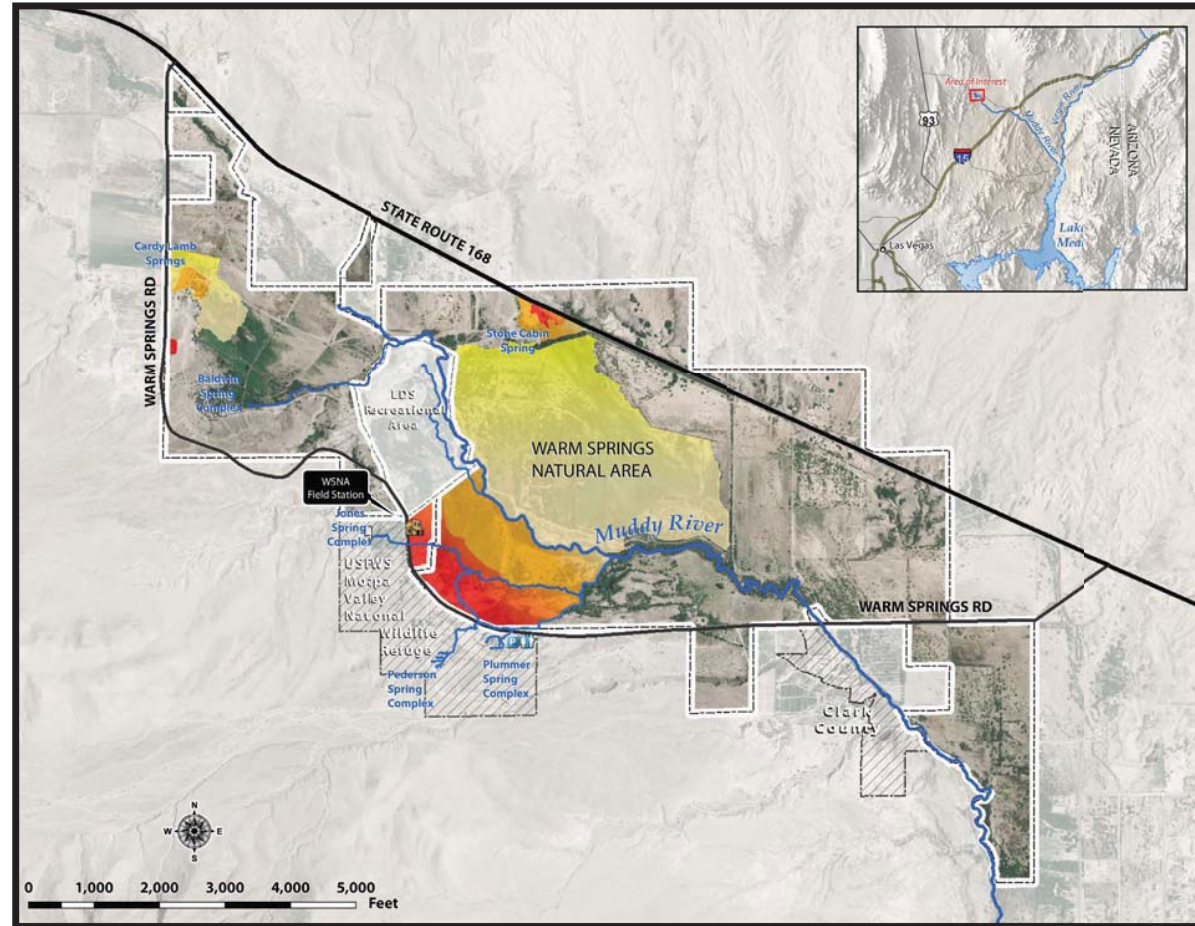
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IMPLEMENTATION AND NEXT STEPS




5.01 PUBLIC USE

CONCEPTUAL PLAN






Public Sites

Type

-  WSNA Field Station
-  Parking Area
-  Restrooms

Interpretive Zones

Usage

-  High Interpretive Zone
-  Medium Interpretive Zone
-  Low Interpretive Zone

Public Use

The Warm Springs Natural Area is an expansive and unique oasis resting in the Mojave Desert, yet the adjacent neighbors surrounding the property serve as a critical link to maintaining the important ecosystems on site. The biological and cultural diversity of this place is not limited or defined by the property boundaries, therefore the neighbors serve as important partners in the public use of the property. Since the establishment of the Moapa Valley National Wildlife Refuge (Refuge) in 1979, area residents have expressed a strong desire to see the area open for public use. Plans for the Refuge include a program of environmental education showcasing the uniqueness of the springs' fauna and ecology. Visitor access on the Warm Springs Natural Area would reflect the goals of the public use of the Refuge. The Refuge theme of protecting thermal springs and their associated endemic fish and invertebrate species would be expanded on Warm Springs Natural Area to include the ecology of the fingerling tributaries - formed from the spring outflows - as they traverse the Natural Area and form the headwaters of the Muddy River. In addition to the thermal dependent species on the property, a key theme to be interpreted for visitors to the Warm Springs Natural Area would include viewing the abundant and diverse variety of bird species inhabiting the riparian corridor, mesquite forests and retired pasture land.

A well-visited Natural Area devoted to

environmental education will increase citizen awareness about the challenges of water management and land development, threats from invasive species, historic use of the Warm Springs Area to early Mormon agricultural practices, and the value of biodiversity in areas of regional spring complexes and desert riparian systems.

Adjacent access between the Warm Springs Natural Area and the Wildlife Refuge serves to manage public access cooperatively with the US Fish and Wildlife Service as identified in the "Park, Trails, and Natural Area" category of the Southern Nevada Public Land Management Act. It is also important to reconnect the local community with the resources and values of the Muddy River region. By creating opportunities for appropriate, low-impact public use, as well as the tremendous opportunities that would come from the potential to establish the property as a field research station, the education opportunities are endless.

The level of public use will be carefully evaluated by SNWA to assess the number of visitors, appropriate uses of the property, security issues, desired messaging, and minimization of long-term impacts to the property. To thoroughly evaluate these issues, it is anticipated that public use may be implemented in phases.

Nature Trail and Kiosk

The initial development of a public use component may involve a roadside kiosk,

parking area, and primitive nature trail. Interpretation may include orientation to the property and the important ecology of the system, and SNWA's plans for the Natural Area. If the approach is implemented, visitors to the Natural Area and those driving the perimeter of the property would be able to view the kiosk with roadside interpretive signage of the Natural Area to illustrate interesting aspects of the property to folks out for a Sunday drive as well as roadside tourists pulling off the highway for a rest.

This initial phase may involve opening the property to a target audience to enjoy a nature trail or limited foot trail use of the property. Target audiences could include school groups and the birding community. To date, bird watchers have traveled from the Northwestern United States hoping to access the Warm Springs Natural Area to see the vermilion flycatcher. In this scenario, school groups and tours could be accompanied by interpretive biologists able to guide students and enhance the experience.

Interpretive Zones

Conceptual zones of interpretation have been proposed to encompass projected compatible public use interests. The high interpretive zone (see map) includes easy access along Warm Springs Road and is immediately adjacent the Moapa Valley National Wildlife Refuge. This zone has abundant wildlife viewing opportunities as well as a rich history of early settlement for historical interpretation. Zones of medium and low interpretation

represent areas where visitors experience nature first-hand with minimal trailside interpretation. For lower-level interpretive zones, interpretation assistance may be provided in the form of pamphlets and trail guides obtained at trailhead kiosks. Trails in these areas will be more primitive and may be as simple as a rock lined trail or mowed path.

Future Plans

Depending on available resources, the next phase of the public use component could be implemented about five years after the initial phase. This may involve a loop trail for hiking and accessing the interior of the property. Interpretive storylines could be refined to target important interpretive elements. Themes may include the natural environment and ecology; current-day water resource use in the area; history of the property such as prehistoric use by early peoples and Native Americans, agricultural development by early settlers in the valley and historic uses of the property such as ownership by Howard Hughes.

The natural area will provide controlled public access to enjoy the abundant natural resources...
SNPLMA Objective





IMPLEMENTATION AND NEXT STEPS

5.02 MANAGEMENT PRIORITIES

Stewardship Plan

SNWA committed to join with stakeholders to develop a long-term plan for the property. The purpose of this document is to establish long-term management direction for the Warm Springs Natural Area. It is SNWA's intention that the Stewardship Plan will establish a framework for appropriate land uses that preserves the integrity of natural resources and lays a foundation for fostering stakeholder relationships. The Stewardship Plan is intended to clarify SNWA's responsibilities and management direction as they pertain to conservation on the Warm Springs Natural Area and ensures consistency with SNWA's commitments in the SNPLMA Nomination and the Muddy River Recovery Implementation Program.

While the Stewardship Plan is intended to provide guidance for SNWA management and future land uses and activities on the Warm Springs Natural Area, it is important to note that the Stewardship Plan is a conceptual document to begin dialogue and is not intended to require implementation of any specific management action. Implementation of such actions is left to the discretion of the SNWA Board of Directors through the annual budgeting process and through specific contract approvals as needed.

Restoration falls under one of two categories:

- 1) Moapa dace recovery
- 2) Natural Area restoration

Prioritization Process

The prioritization process was formulated by the Core Team and technical experts in various fields. The Mission Statement developed by the Core Team - "To manage the property as a natural area for the benefit of native species and for the recovery of the endangered Moapa dace - consistent with the Southern Nevada Water Authority's commitments to the Southern Nevada Public Land Management Act funding of the property" - establishes prioritization of management goals and serves to frame future decision processes.

The Moapa dace has been designated as the highest management priority for consideration when restoring the property as a natural area and restoring the riparian ecosystem. This includes protecting the natural thermal springs on the property. The next highest priority is to manage for federal and state-protected species and thermal endemic species identified in the Muddy River RIP and, in general, prioritize restoration for management of the 28 sensitive species on the property. The next highest priority is to manage the property as a Natural Area - which means promoting native species and their habitats and controlling invasive species. Reducing fuel loads and establishing fire breaks to protect habitat and property is the next priority. Lastly, it is a priority to carry out SNPLMA commitments for the property for public use and scientific research.

Management Priorities

The following are management priorities for the property as determined by the interagency Core Team, biological experts, and SNPLMA commitments:

- Manage the property for the benefit and recovery of the Moapa dace. This includes restoring and protecting the thermal springs and their outflows.
- Manage the property for the benefit of federally-protected, state-protected, sensitive, and thermal endemic species.
- Manage the property as a Natural Area - which means promoting native species and their habitats and controlling invasive species.
- Reduce fuel loads and establish fire breaks on the Natural Area to protect neighbors and property.
- Carry out SNPLMA commitments for the property for controlled public access of the Natural Area.

Moapa Dace Recovery

The highest priority at WSNA is to protect and aid in the recovery of the Moapa dace. Moapa dace recovery is an important objective as a component for managing SNWA's water rights in Coyote Spring Valley and the Muddy River. Restoration activities are designed to substantially improve Moapa

dace habitat in order to increase populations and contribute to recovery of the species.

Actions that protect existing Moapa dace habitat will likely protect other sensitive aquatic species. Moapa dace "restoration" actions, however, will need to consider impacts to all other affected sensitive species both aquatic and terrestrial. The BAC has prioritized dace restoration projects by reach. Some restoration projects identified by the BAC have already been completed or are in the beginning stages of execution. The main objectives of the BAC dace restoration projects by reach are to:

- Restore stream thermal properties
- Restore stream flow dynamics
- Eradicate tilapia
- Install dace habitat features
- Restore stream connectivity

It is expected that controlling invasive species whether of terrestrial or aquatic origin will directly or indirectly aid in the recovery and stability of sensitive species.

Protected Species Management

In addition to the endangered Moapa dace, other federally and state protected species live at WSNA. Managing for protected species is a priority as well as managing for rare or sensitive species (Appendix 2) which could receive protection status in the future due to habitat loss or population declines. Protected species include species protected under the Endangered Species Act of 1973, the Migratory Bird Treaty Act of 1918, the Bald Eagle Protection Act of 1940, and Nevada Revised Statutes Chapters 501 & 503 which include game species. Other species identified for management consideration include those species listed by the Nevada Natural Heritage Program, Nevada At-Risk Species Tracking List, and Nevada Plant and Animal Watch-List. Species under these categories are prime candidates for scientific research which can contribute in future status assessments.

Natural Area Management

Management of the Natural Area includes property management for all wildlife species and their habitats with an emphasis on restoring natural systems and processes. The Natural Area also consists of facilities, equipment, and support infrastructure used to carry out the management objectives for the property. Implementation of management objectives are slated to occur over several years.

Important components for managing the property as a natural area include: 1) resource protection, 2) habitat restoration, and 3) property maintenance.

Resource Protection: It is more cost-effective to protect existing quality habitat from degradation than to restore quality habitat after it has been lost. Noxious and nuisance weeds have the ability to stress ecosystem health and even displace native plant communities. Weeds also contribute to the buildup of fine fuels, which in combination with natural plant decadence can contribute to catastrophic wildfires. Wildfires can in turn impact Moapa dace habitat and alter plant community composition trajectories in favor of invasive species and novel plant communities. Implementation of proactive management strategies to accomplish weed control and fuels reduction is an imperative long-term management requirement at WSNA. Long-term natural resource monitoring is also an important management component for assessing biological trends and measuring progress. Cultural resources are also important property facets that require careful management consideration and protection.

Habitat Restoration: The goal in habitat restoration is to advance the recovery of native species by encouraging diversity in species, habitat structure, and ecological processes. The current condition in habitat quality varies across the property. Methods to enhance habitat need to be identified and evaluated based on individual site characteristics and available resources.

The property overall lacks a native herbaceous component across the alluvial floodplain. Floodplain soils were used for intensive crop production or in combination with grazing. Bermudagrass was widely planted as a forage species and still persists over much of the property. Restoring the native herbaceous cover will require a long-term commitment, entailing reintroduction of lost native forbs and a gradual replacement of bermudagrass with saltgrass (*Distichlis spicata*), alkali sacaton (*Sporobolus airoides*), and scratch grass (*Muhlenbergia asperifolia*). To preserve the genetic integrity of local germplasm, revegetation material should be sourced from the property or from the same drainage system. A plant nursery may be utilized to grow native plant material and store transplant material for revegetation projects.

Property Maintenance: Capital assets such as the manager's residence, field station, sheds, equipment, etc., have ongoing maintenance needs with associated costs. Roads and fences traversing the property also require routine management attention. As with all properties owned by SNWA, property maintenance is an ongoing commitment and may be conducted by both internal staff and outside services. Maintaining property infrastructure is an important element for effective, sustainable management of the natural area over time.

Fire Management

Of highest priority is protection of neighbors, life, and property from wildfire. Protecting species requires protecting their habitat. Implementing a fire management program can be helpful in protecting neighbors and habitat from catastrophic wildfires. Fire management as addressed under special management (Section 4.02) will include a fuels reduction plan and the establishment of appropriate fuel breaks.

Public Use

Objectives identified in the SNPLMA Financial Assistance Agreement for public use are detailed in Section 5.01. Implementation of actions facilitating the controlled public access component identified in the SNPLMA Objective is projected to begin in about 2012. The extent of limited public use is in part dependent upon funding availability from grants and budgeting processes and may be implemented over time. Initially, primitive trails with nominal interpretive features may be installed. The public interpretive component of the Natural Area would focus on natural features with low impact on the natural environment. To that end, trail development features could emphasize trailhead entrances, trail quality, and interpretation, while maintaining a primitive look and feel. Trail maintenance will be a continuous management commitment.

MANAGEMENT PRIORITIES

Manage the property for the benefit and recovery of the Moapa dace. This includes restoring and protecting the thermal springs and their outflows.

Manage the property for the benefit of protected species: federal, state, sensitive and thermal endemic species.

Manage the property as a Natural Area – which means promoting native species and their habitats and controlling invasive species.

Reduce fuel loads and establish fire breaks on the Natural Area to protect neighbors and property.

Carry out SNPLMA commitments for controlled public access of the Natural Area.



IMPLEMENTATION AND NEXT STEPS

5.03 ACCOMPLISHMENTS AND NEXT STEPS

Accomplishments to Date

As a ranch for the last one hundred years, Warm Springs Natural Area underwent an identity change when SNWA took possession of it in Fall of 2007. Lands that had been watered via a spiderweb of irrigation ditches for growing crops and grazing over 800 head of roping steers in the winter, were committed to transition back to the native vegetation that once grew there. Years of buildup of weighty palm trees - knocked back only when wildfire fire ripped through the property - were slated to be trimmed or removed to reduce the fire hazard or to improve Moapa dace habitat.

Staff Assigned

SNWA sought important advice from neighbors and resource agencies and then set in motion some basic plans. With the new land responsibility, SNWA hired a caretaker to look after its acquisition. In 2008, SNWA hired a manager for the Warm Springs Natural Area to further protect the property, live on site, and interface with the citizens of the Moapa Valley. SNWA biologists and hydrologists were dedicated to the property and surrounding region.

Inventories Completed

SNWA also set out to inventory what it had acquired.

Boundary surveys as well as rights-of-way crisscrossing the property were defined before purchase. Resource inventories on site were lacking since the property had been previously held in private ownership. Access for

Moapa dace surveys was now guaranteed. Next, SNWA contracted cultural surveys to identify archeological and historic sites (HRA, 2008, 2009).

Bird surveys were conducted by the Great Basin Bird Observatory, San Bernardino County Museum, and Nevada Department of Wildlife. As expected in a sensitive setting, abundant varieties of birds were found, including an endangered bird, a candidate bird, and other birds considered sensitive (Appendix 2).

Aquatic invertebrates were surveyed on the property (Albrecht et al., 2008). This was a valuable characterization of the other thermal dependent species inhabiting the spring outflows over this previously-ranched property. Four of these species are included in the 1996 USFWS Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem.

Pollinators and their habitat affinities relative to habitat quality were studied in 2009 (Nelson, 2009).

A floral inventory was completed in 2010 by Dr. Robert L. Johnson, the Warm Springs Natural Area Manager (Appendix 5). Bat species on the property were described previously by Williams and O'Farrell (2004) and Williams, O'Farrell and Riddle (2006). In addition, the Warm Springs Area Hydrologic Monitoring Network is established for the area (Appendix 6).

All in all, the Warm Springs Natural Area was found to be home to 28 Sensitive Species (Appendix 2) and a host of other native species drawn to the warm springs oasis. At the time of acquisition, a number of the species were not known to occur on the property, but will be important to the development of regional resource management strategies for the Muddy River Recovery Implementation Program.

Maintenance Accomplished

Upon acquisition, SNWA began management of the property. Clean-up of trash, a dump site, and an abandoned building were undertaken. Weeds were mapped and treated by Tri-County Weed Control. Weed treatments are being continued to date to reduce persistent weed problems. The Muddy River Regional Environmental Impact Alleviation Committee (MRREIAC) treated tamarisk along the Sim Road property boundary in 2009. Palm trees were trimmed along Warm Springs Road and the Refuge Stream in 2009, and stimulus funding provided for fuels reduction in 2010. SNWA acquired equipment and tractors to maintain the property. Mowing weeds in abandoned agricultural fields is an ongoing job.

Stream Restoration Work

Upon the recommendations of the Muddy River Biological Advisory Committee, SNWA funded construction of the Lower Pederson Stream channel in 2008. This reconnected the thermal springs on the Refuge to the lower

Apcar stream thereby providing contiguous Moapa dace habitat and allowing for movement upstream for spawning. The investment has proven profitable in dace numbers, as they have significantly climbed in the Lower Pederson Stream since the restoration.

MOA Accomplishments

A number of conservation actions required by the 2006 MOA were implemented and have contributed toward recovery of the Moapa dace. They include:

- Improvement and restoration of Moapa dace habitat on the Apcar Unit of the Moapa Valley National Wildlife Refuge.
- Development of the Muddy River Recovery Implementation Program.
- Funding for development of an Ecological Model for the Moapa dace by the USGS.
- Construction of a fish barrier in the South Fork of the Muddy River.
- Funding for eradication of non-native fish in the South Fork of the Muddy River.
- Formation of a technical committee, the Hydrological Review Team.

Next Steps

The Stewardship Plan is intended to be an overarching umbrella document to guide the future of Warm Springs Natural Area. It establishes property commitments, documents accomplishments, and sets a course for the future. By no means does it encompass the details of how all will be accomplished.

Step-down Plans

It is envisioned that there will be step-down plans to further formulate critical components and guide resource management. For example, step-down plans may include a Restoration Plan, a Public Use Plan, and a Fire Management Plan. A Restoration Plan provides the roadmap for a rich, viable Natural Area with local, native species replacing areas claimed by weeds. A Public Use Plan directs limited public uses which are compatible with the Refuge and with a Natural Area. The Fire Management Plan insures the property is managed for protection of neighbors' property and to insure safety. These plans would be implemented as directives from SNPLMA documents and as directed by the SNWA Board of Directors.

Process Forward

As a template for the Stewardship Plan process, it has been successful to enlist the help of property stakeholders to advise and provide important information and feedback. Management of the property will benefit with this kind of cooperative effort forward. It is envisioned that stakeholders would continue

to include the US Fish and Wildlife Service, Nevada Department of Wildlife, The Nature Conservancy, the Executive Committee of the Muddy River Recovery Implementation Program, the Biological Advisory Committee, Clark County, the Moapa Town Advisory Board, the Moapa Valley Town Advisory Board, and technical experts, as needed.

Fuels Reduction

Reducing the fire hazard and build-up of fuels will be an on-going management responsibility. Progress has been made and will continue. SNWA is blading fire breaks adjacent to neighboring properties; reducing palm-tree fuel loads; cutting fire breaks between palm trees; eliminating tamarisk; and reducing other vegetation that is known to transmit fire across properties. These are continuing maintenance activities associated with the Warm Springs Natural Area. SNWA contracted a company with technical fire expertise to compile a fire management plan after the 2010 fire.

Restoration Forward

Progress has been made since 2002 when restoration for Moapa dace habitat was first initiated on the Moapa Valley National Wildlife Refuge. Much of the Refuge has been restored. And as discussed on the previous page, reaches have also been restored and reclaimed on the Warm Springs Natural Area. The Biological Advisory Committee identified a plan for stream reaches that still need to be restored as high priority reaches.

SNWA is looking to restore additional reaches on the Warm Springs Natural Area as part of the Muddy River Recovery Implementation Program (RIP). Restoration of Moapa dace habitat for the major thermal spring systems identified in the 1996 Recovery Plan for Rare Aquatic Species of the Muddy River Ecosystem is feasible to be accomplished under the RIP. As new streams are restored on the Refuge and on the Warm Springs Natural Area, they will require maintenance, weeding aquatic invasive plants, and trapping and removal of invasive fish.

Natural Area restoration is a gradual and long-term process. It will continue to be accomplished and worked at over time. As habitats for sensitive species are restored, often grants are readily available to do so. Funding will be sought to augment native habitat replenishment and the Natural Area restoration through time.

Public Use

Careful planning is essential to shape the limited public use component of the property. It will be a delicate balance to provide an enjoyable experience for the public that respects the sensitive environment. SNPLMA funding is being sought to provide for a public use component that would potentially include a primitive nature trail, a shade structure or a bird-viewing platform. Providing meaningful interpretation for the public will also be important.

Management Components

Management Components	
HABITAT RESTORATION	
	Hydrological data collection
	Stream restoration
	Stream maintenance
	Invasive aquatic control
	Terrestrial habitat restoration
	Restoration nursery
LIMITED PUBLIC USE	
	Public use planning
	Trail establishment
	Interpretive elements
RESOURCE PROTECTION	
	Noxious weed eradication
	Fuels reduction
	Biological monitoring
	Hydrological monitoring
	Cultural resource inventory
	Property access issues/security
	Perimeter fencing
	Property acquisition
PROPERTY MAINTENANCE	
	Equipment maintenance
	Maintenance shed
	Field station maintenance
	Facility maintenance
	Property interior fence removal
	Residence maintenance
	Road/trail maintenance



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- Page 40: Western yellow-billed cuckoo, US Bureau of Reclamation. Southwestern Willow Flycatcher, US Bureau of Reclamation. Summer tanager, Jerry Oldenettel (shared under a Creative Commons license for non-commercial use at www.flickr.com/photos/jroldenettel/2146321428/). Western yellow bat, Allen Calvert.
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- Page 54: Metate, HRA, Inc. Conservation Archeology Staff. Arrowheads, HRA, Inc. Conservation Archeology Staff.
- Page 51: GLO Plat, Government Land Office Plat surveyed September 1881.
- All other photos by SNWA staff and Lucchesi Galati.
- Pages 18 and 19: Background map is 1918 map drawn by L. Tanner. Southern Paiute basket weaver Mary Ann Pepo at Moapa in 1940 by Arthur Rothstein.
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- Page 28: From left to right. Common buckeye on sunflower, Bruce Lund. Old world swallowtail, Bruce Lund.
- Page 33: Moapa dace illustrations by Joseph R. Tomelleri.

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- A.01** SNPLMA NOMINATION
- A.02** SENSITIVE SPECIES TABLE
- A.03** RESOURCE INVENTORIES
- A.04** BIRD CHECKLIST
- A.05** FLORAL INVENTORY
- A.06** HYDROLOGIC MONITORING TABLE





APPENDICES

A.01 SNPLMA NOMINATION

THE PROCESS

The Secretary of the Department of Interior approved funding to acquire the Warm Springs Natural Area under Round 6 of the SNPLMA "Park, Trails and Natural Area" category.

- October 2005 – SNWA submitted an application under Round 6 of the Southern Nevada Public Land Management Act (SNPLMA) to acquire the Warm Springs Ranch under the "Park, Trails and Natural Area" category.
- February 7, 2006 - the Secretary of the Department of Interior approved SNWA's request for funding to acquire Warm Springs Ranch.
- July 20, 2006 - SNWA Board of Directors approved an agreement between South Fifteen, LLC, Sunburst Properties, LLC, Pay Dace, LLC, and SNWA for the acquisition of the Warm Springs Ranch by SNWA and authorized the General Manager to negotiate and execute the agreement and documents necessary to effectuate the transfer.
- May 16, 2007 - The Financial Assistance Agreement between SNWA and the United States Department of Interior Bureau of Land Management (BLM) was signed. SNWA was awarded funding to purchase the property and committed to manage it as a Natural Area.
- September 13, 2007 – Purchase of the Warm Springs Ranch was finalized and SNWA renamed the property "Warm Springs Natural Area".

Financial Assistance Agreement

SNWA signed the Southern Nevada Public Land Management Act (SNPLMA) Financial Assistance Agreement (FAA) with the United States Department of Interior Bureau of Land Management on May 16, 2007 to purchase the property under the "Parks, Trails and Natural Area" category. The following are key excerpts from the FAA:

Section I. "Statement of Joint Objectives"

A. PURPOSE

This Agreement is made and entered into by the Department of the Interior, Bureau of Land Management (BLM), Nevada State Office for the Las Vegas Field Office, and the Southern Nevada Water Authority, through implementation of the Southern Nevada Public Land Management Act, for the purpose of developing parks, trails, and natural areas in Clark and Lincoln County, Nevada.

B. OBJECTIVE

Cooperation between BLM and Clark County in order to facilitate the construction of the Warm Springs Ranch Acquisition for Development of a Natural Area. The property will be acquired as a Parks, Trails, and Natural Area (PTNA) acquisition with the objective to develop a natural area under the PTNA category in a future round. Totalling approximately 1179 acres this property is located in the upper Muddy River Valley approximately 7 miles northwest of the Town of Moapa and borders the Moapa Valley National Wildlife Refuge.

There is approximately 3.8 miles of Muddy River and tributary frontage and substantial wetland and riparian habitat. The natural area will provide controlled public access to enjoy the abundant natural resources, will include interpretation of the resources and T&E species located on the site, and will include measures to preserve and protect those resources. Natural Resources on the Property include, aquatic habitat for the Virgin River Roundtail Chub, the endemic Moapa Dace (listed), the Southwestern Willow Flycatcher, and the Yellow-Billed Cuckoo. The property includes Nevada's largest breeding population of Vermilion Flycatcher. Within this section of the Muddy River reside pockets of native Mesquite Bosque and Cottonwood-Willow riparian habitat.

Section II. "Definitions"

Section III. "Project Management"

A. THE RECIPIENT (SNWA) AGREES TO:

1. Accomplish the stated Objective of the Project as approved by the Secretary of the Interior or as otherwise modified.
2. Adhere to the policies and procedures identified in the IA.
3. Furnish qualified personnel for the coordination, oversight, and performance of the objective for the Project.
4. Provide supervision for the Project to include responsibility for all technical aspects, development, implementation, scheduling, safety, coordination, and other Project needs.

5. Make certain necessary permits or environmental clearances are obtained.
6. Own and maintain in perpetuity any land, buildings, trails, facilities, or other features improved or constructed, unless a shorter period is specifically stated in a separate project nomination authorized through the approval by the Secretary of the Interior.

B. THE BLM AGREES TO:

1. Provide coordination and assistance during all phases of Project development, including, but not limited to providing guidance regarding SNPLMA policies and procedures.
2. Conduct Project inspections and meet with Project staff to confirm project progress and assist in achieving objectives for this Project
3. Facilitate and coordinate the processing of funding, to include amendments to this Agreement.
4. Adhere to the policies and procedures identified in the IA.
5. Recipient's submitted documents are incorporated by reference: Project Proposal entitled Warm Springs Ranch Acquisition for Development of a Natural Area, as approved by the Secretary of the Interior on February 7, 2006, SF 424, Application for Federal Assistance, SF 424A, Budget Information - Non-Construction Programs, SF 424B, Assurances - Non-Construction Programs, SF424B, Assurances - Non-Construction Programs, DI-2010 and Appendix B-6 Estimated Necessary Expenses & Key Milestone Dates.

Nomination by the Secretary of the Interior

The following are excerpts from the SNPLMA Special Account Nomination Round 6 to the Secretary of the Department of Interior for the purchase of the Warm Springs Ranch (Warm Springs Natural Area).

Project: Warm Springs Ranch Acquisition

A. The Southern Nevada Water Authority (SNWA) proposes to acquire and manage 1,179 acres of privately held property along the upper Muddy River, also referred to as the Warm Springs Ranch as a natural area under the PTNA category. This property is the single most ecologically significant privately held property along the Muddy River. The property is approximately seven miles northwest of the Town of Moapa in Clark County, Nevada. The property is bordered by State Route 168 to the north, Warm Springs Loop Road to the south and the Moapa National Wildlife Refuge to south and west (see attached map). The property is bisected by approximately 3.8 miles of the Muddy River. The acquisition will address the potential need to acquire water rights for sustainability of the natural area. It will also address acquisition of mineral and mining rights, including any that may be held by third parties, to ensure that the resources within the natural area will not be subject to damage or destruction from mining operations.

Upon acquisition of the Warm Springs Ranch property, the SNWA will work cooperatively with stakeholders to implement a series of management and conservation actions. Principle among these may include:

- Development of educational and recreational area/trails emphasizing the natural resources for public use consistent with the Moapa National Wildlife Refuge and other adjacent lands
- Invasive plant management
- Invasive fish and invertebrate management
- Bank and channel stabilization activities
- Construction and/or enhancement of wetlands
- Restoration and/or enhancement of riparian and upland habitat
- Spring pool restoration/enhancement

B. The SNWA will be responsible for the operation, maintenance and management of the property over the long-term as a natural area under the PTNA category. However it is anticipated that this will be accomplished cooperatively with other stakeholders.

C.1. The acquisition of this property will place in public ownership one of the most biologically and culturally significant properties in Southern Nevada. In addition to the significant benefits to species and habitat that would accrue from acquisition and restoration of the property, the Warm Springs Ranch also provides an opportunity to reconnect the local community

with the resources and values of the Muddy River region. By creating opportunities for appropriate, low-impact public access, as well as the tremendous opportunities that would come from the potential to establish the property as a field research station, the educational opportunities are endless.

C.2. Acquisition of the property by the SNWA would place the property in public trust in perpetuity.

C.3. Once acquired, the SNWA has committed to working with all relevant stakeholders (including, but not limited to, The Nature Conservancy, Clark County, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, Nevada Division of Wildlife, Town of Moapa, etc.) to determine how the property should be improved and managed for the long-term benefit of the species and habitat within the context of a natural area under the PTNA category.

C.4. Acquisition of the property will increase the opportunity to acquire funding and engage in collaborative joint management of the property.

Acquisition of this property is considered as one of the highest priority action items for conservation in southern Nevada by Clark County, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, Red Rock Audubon Society and The Nature Conservancy.

Property Deed

The Deed for the Warm Springs Natural Area was signed on August 31, 2007 and recorded on September 13, 2007. In it, the Warm Springs Ranch and 16 other parcels were conveyed to the Southern Nevada Water Authority (Grantee) from the following Grantors: South Fifteen, LLC; Sunburst Properties LLC; Dace 2 Fish, LLC; Moapa Express, LLC; Pay Dace, LLC; and TNES, LLC. The following is an excerpt from the Property Deed:

THE GRANT & CONVEYANCE HEREUNDER IS EXPRESSLY SUBJECT TO A RESTRICTION & COVENANT RUNNING WITH THE LAND:

IT IS EXPRESSLY UNDERSTOOD AND AGREED that the conveyance of the Land described herein to the GRANTEE, SOUTHERN NEVADA WATER AUTHORITY, a political subdivision of the State of Nevada, is made for the benefit of the people of the State of Nevada for the exclusive use as a public park, trail, or natural area under Section 4(e)(3)(A)(iv) of the federal Southern Nevada Public Land Management Act of 1998, Public Law 105-263, 112 Stat. 2343, as amended. If the Land described herein is not used or ceases to be used as a public park, trail, or natural area within ninety-nine (99) years from the date of this conveyance, any person or entity may enforce the terms of this use restriction in a court of competent jurisdiction.

A.O2 SENSITIVE SPECIES TABLE

28 Sensitive Species on WSNA				
Common Name	Scientific Name	USFWS	NNHP State Status	Footnotes
Fish				
1 Moapa White River springfish	<i>Crenichthys baileyi moapae</i>		critically imperiled in state	4,6,8
2 Virgin River chub	<i>Gila seminuda</i> (Muddy River Population)		globally - critically imperiled	4,5,6,8
3 Moapa dace	<i>Moapa coriacea</i>	Endangered	critically imperiled in state	1,4,5,6,8
4 Moapa speckled dace	<i>Rhinichthys osculus moapae</i>		critically imperiled in state	4,5,6,8
Invertebrates				
5 Western naucorid	<i>Ambrysus mormon</i>			7
6 Warm Springs crawling water beetle	<i>Haliplus eremicus</i>		not ranked	4
7 MacNeill sooty wing skipper	<i>Hesperopsis gracielae</i>		critically imperiled in state	4,5,6
8 Moapa naucorid	<i>Limnocois moapensis</i>		critically imperiled in state	4,7,8
9 Moapa riffle beetle	<i>Microcylloepus moapus</i>		critically imperiled in state	4,5,7
10 Pahrnagat naucorid	<i>Pelocoris biimpressus shoshone</i>			4,7
11 Moapa pebblesnail	<i>Pyrgulopsis avernalis</i>	petitioned for listing	imperiled in state due to rarity	4,7,8
12 Moapa Valley pyrg	<i>Pyrgulopsis carinifera</i>	petitioned for listing	critically imperiled in state	4,7
13 Moapa skater	<i>Rhagovelia becki</i>			7
14 Moapa Warm Springs riffle beetle	<i>Stenelmis moapa</i>		critically imperiled in state	4,5,7,8
15 Grated tryonia	<i>Tryonia clathrata</i>	petitioned for listing	imperiled in state due to rarity	4,7,8
Birds				
16 Western yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	Candidate	globally - vulnerable to decline	3,4,5,6
17 Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Endangered	critically imperiled in state	1,4,5,6
18 Phainopepla	<i>Phainopepla nitens</i>		imperiled in state due to rarity	4,5,6
19 Vermilion flycatcher	<i>Pyrocephalus rubinus</i>			6
20 Summer tanager	<i>Piranga rubra</i>			6
Bats				
21 Townsend's big-eared bat	<i>Corynorhinus townsendii</i>		imperiled in state due to rarity	4,5,6
22 Spotted bat	<i>Euderma maculatum</i>		imperiled in state due to rarity	4,5,6
23 Western red bat	<i>Lasiurus blossevillii</i>		critically imperiled in state	4,5
24 Western yellow bat	<i>Lasiurus xanthinus</i>		critically imperiled in state	4
25 California leaf-nosed bat	<i>Macrotus californicus</i>		imperiled in state due to rarity	4,5,6
26 Fringed myotis	<i>Myotis thysanodes</i>		imperiled in state due to rarity	4,5,6
27 Big free-tailed bat	<i>Nyctinomops macrotis</i>		imperiled in state due to rarity	4,5,6
Reptiles				
28 Desert tortoise	<i>Gopherus agassizii</i>	Threatened	vulnerable to decline	2,4,5,6

FOOTNOTES:

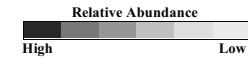
- 1 Listed as Endangered under the Endangered Species Act
- 2 Listed as Threatened under the Endangered Species Act
- 3 Candidate species under the Endangered Species Act
- 4 State of Nevada Department of Conservation & Natural Resources. 2009

- 5 Bureau of Land Management - Nevada Special Status Species
- 6 Clark County Multiple Species Habitat Conservation Plan (MSHCP). 2000
- 7 Muddy River Headwaters Macroinvertebrate Report - Albrecht et al. 2008
- 8 U.S. Department of the Interior Fish and Wildlife Service. 1996. Recovery plan for the rare aquatic species of the Muddy River ecosystem

A.03 RESOURCE INVENTORIES

Resource Inventories for WSNA				
Data	Completed	Survey Frequency	Source	Data Collection Methodology
Property Ownership				
ALTA survey	yes	once	SNWA	ALTA survey standard
Site Geography				
Aerial photo coverage	yes	biannual	SNWA	Aerial photography
LiDAR elevation	yes	once	SNWA	Laser altimetry
Soil survey	yes	once	NRCS	
Hydrological features	ongoing	progressive	SNWA	Multiple methods
Cultural Resources				
Class I archeological survey	yes	once	HRA Inc.	Literature search
Class III archeological survey	yes	once	HRA Inc.	30 m. transects, total coverage
Biological Resources				
Moapa dace survey	yes	biannual	SNWA, USGS, NDOW, USFWS	Snorkel survey - reach
Aquatic invertebrate survey	yes	5 years	Bio-West Inc.	D-frame kick net - reach segment
Small mammal survey	partial	5 years	SNWA	Sherman live trap - transect
Floral inventory	yes	10 years	SNWA	Observation
Lepidoptera	yes	5 years	BOR	Observation, netting
Hymenoptera survey	partial	10 years	BOR	observation, pan trapping
Bird survey	yes	annually	SNWA, GBBO, NDOW	GBBO transect, intensive area surveys, breeding bird census; Christmas bird count
Herpetological survey	no	5 years	SNWA	Observation, pitfall arrays

PRELIMINARY CHECKLIST OF MONTHLY RELATIVE ABUNDANCE OF BIRDS ON THE WARM SPRINGS NATURAL AREA



SPECIES*	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cassin's Vireo												
Red-eyed Vireo												
Warbling Vireo												
Shrikes												
Loggerhead Shrike												
Northern Shrike												
Waxwings and Silky-Flycatchers												
Phainopepla												
Cedar Waxwing												
Thrushes												
Varied Thrush												
Western Bluebird												
Mountain Bluebird												
Townsend's Solitaire												
American Robin												
Mockingbirds and Thrashers												
Northern Mockingbird												
Sage Thrasher												
Crissal Thrasher												
Starlings												
European Starling												
Nuthatches and Creepers												
White-breasted Nuthatch												
Brown Creeper												
Wrens												
Cactus Wren												
Rock Wren												
Marsh Wren												
Bewick's Wren												
Winter Wren												
House Wren												
Gnatcatchers and Bushitts												
Verdin												
Blue-ray Gnatcatcher												
Black-tailed Gnatcatcher												
Bushitt												
Swallows												
Tree Swallow												
Violet-green Swallow												
Northern Rough-winged Swallow												
Barn Swallow												
Chiff Swallow												
Kinglets, Chickadees												
Ruby-crowned Kinglet												
Golden-crowned Kinglet												
Mountain Chickadee												
Larks												
Horned Lark												
Old World Sparrows												
House Sparrow												
Wagtails and Pipits												
American Pipit												
Siskins, Crossbills, and Allies												
Pine Siskin												
American Goldfinch												
Lesser Goldfinch												
Cassin's Finch												
House Finch												
Evening Grosbeak												
New World Warblers												
Orange-crowned Warbler												
Nashville Warbler												
Virginia's Warbler												
Lucey's Warbler												
Northern Parula												
Yellow Warbler												
Yellow-rumped Warbler												
Black-throated Gray Warbler												

SPECIES*	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Townsend's Warbler												
Hermit Warbler												
Black-and-White Warbler												
American Redstart												
Worm-eating Warbler												
MacGillivray's Warbler												
Common Yellowthroat												
Wilson's Warbler												
Yellow-breasted Chat												
Buntings, Sparrows, Tanagers, Allies												
Song Sparrow												
Lincoln's Sparrow												
Swamp Sparrow												
White-crowned Sparrow												
Dark-eyed Junco												
Savannah Sparrow												
Baird's Sparrow												
Chipping Sparrow												
Brewer's Sparrow												
Vesper Sparrow												
Lark Sparrow												
Black-throated Sparrow												
Sage Sparrow												
Green-tailed Towhee												
Spotted Towhee												
Abern's Towhee												
Hepatic Tanager												
Summer Tanager												
Western Tanager												
Rose-breasted Grosbeak												
Black-headed Grosbeak												
Blue Grosbeak												
Lazuli Bunting												
Indigo Bunting												
Blackbirds, Grackles, and Orioles												
Hooded Oriole												
Bullock's Oriole												
Orchard Oriole												
Scott's Oriole												
Yellow-headed Blackbird												
Red-winged Blackbird												
Western Meadowlark												
Great-tailed Grackle												
Brewer's Blackbird												
Brown-headed Cowbird												

* This checklist was compiled by GBBO using the Nevada Bird Atlas, Nevada Bird Count point count transects, two area search plots, and grid inventory/rapid area searches (April through June, and September 2009), as well as a checklist provided by Bruce Lund, containing the results of his birding on the property between 1998 and 2007.
 # Based on limited data; the Eurasian Collared-Dove was not recorded during the 1998-2007 time period but has been prevalent 2008-2009; however, winter surveys have not yet been completed on the property.

Footnotes:

- (1) Species names in **bold** indicate that they are confirmed or probable breeders. However, not all birds breeding on the property may be highlighted, since each year of surveys produces breeding evidence for new species.
- (2) The relative abundance of a species in a particular month is indicated by the shading (white indicates no records, black indicates high relative abundance). There are not specific numbers or densities attached to these because much of the non-breeding data was from Lund's checklist which has uncertain effort/standardization for each month.

A.05 FLORAL INVENTORY

Floral Inventory: Warm Springs Natural Area

Prepared by: Robert L. Johnson PhD, Southern Nevada Water Authority, May 2011

Family	Scientific Name Common Name	Author
Amaranthaceae	<i>Amaranthus retroflexus</i> Redroot amaranth	L.
Amaranthaceae	<i>Tidestromia oblongifolia</i> Arizona honeysweet	(S. Watson) Standl.
Apiaceae	<i>Apium graveolens</i> Wild celery	L.
Apiaceae	<i>Berula erecta</i> Cut-leaf water-parsnip	(Hudson) Cov
Apiaceae	<i>Cicuta maculata</i> Water-hemlock	L.
Apiaceae	<i>Hydrocotyle verticillata</i> Whorled marshpennywort	Thunb.
Apocynaceae	<i>Apocynum cannabinum</i> Indianhemp	L.
Apocynaceae	<i>Nerium oleander</i> Oleander	L.
Arecaceae	<i>Washingtonia filifera</i> California fan palm	(Linden ex André) H. Wendl.
Asteraceae	<i>Acroptilon repens</i> Hardheads, Russian knapweed	(L.) DC.
Asteraceae	<i>Ambrosia dumosa</i> Burrobush	(A. Gray) Payne
Asteraceae	<i>Ambrosia eriocentra</i> Woolly fruit bur ragweed	(A. Gray) Payne
Asteraceae	<i>Ambrosia salsola var. salsola</i> Burrobush	(Torrey & A. Gray) Strother & B. G. Baldwin
Asteraceae	<i>Amphipappus fremontii ssp. fremontii</i> Fremont's chaffbush	Torr. & A. Gray ex A. Gray
Asteraceae	<i>Antheropeas lanosum</i> White easterbonnets	(A. Gray) Rydb.
Asteraceae	<i>Atrichoseris platyphylla</i> Parachute plant	(A. Gray) A. Gray
Asteraceae	<i>Baccharis emoryi</i> Emory's baccharis	A. Gray
Asteraceae	<i>Baccharis salicifolia</i> Mule-fat	(Ruiz & Pav.) Pers.
Asteraceae	<i>Baileya multiradiata</i> Desert marigold	Harv. & A. Gray ex A. Gray
Asteraceae	<i>Bebbia juncea</i> Sweetbush	(Benth.) Greene
Asteraceae	<i>Centaurea melitensis</i> Maltese star-thistle	L.
Asteraceae	<i>Chaenactis carphoclinia</i> Pebble pincushion	A. Gray
Asteraceae	<i>Chloracantha spinosa</i> Spiny chloracantha	(Benth.) G.L. Nesom
Asteraceae	<i>Cirsium mohavense</i> Mojave thistle	(Greene) Petr.

Family	Scientific Name Common Name	Author
Asteraceae	<i>Conyza canadensis</i> Canadian horseweed	(L.) Cronquist var. glabrata (A. Gray) Cronquist
Asteraceae	<i>Encelia farinosa</i> Brittlebush	A. Gray ex Torr
Asteraceae	<i>Geraea canescens</i> Hairy desertsunflower	Torr. & A. Gray
Asteraceae	<i>Geraea canescens</i> Hairy desertsunflower	Torr. & A. Gray
Asteraceae	<i>Gutierrezia sarothrae</i> Broom snakeweed	(Pursh) Britton & Rusby
Asteraceae	<i>Helianthus annuus</i> Common sunflower	L.
Asteraceae	<i>Isocoma acradenia</i> Alkali goldenbush	(Greene) Greene
Asteraceae	<i>Lactuca serriola</i> Prickly lettuce	L.
Asteraceae	<i>Laenecia couleri</i> Couler's horseweed	(A. Gray) G.L. Nesom
Asteraceae	<i>Palafoxia arida</i> Desert palafox	B.L. Turner & Morris
Asteraceae	<i>Pluchea odorata</i> Sweetcent	(L.) Cass.
Asteraceae	<i>Pluchea sericea</i> Arrowweed	(Nutt.) Coville
Asteraceae	<i>Psathyrotes pilifera</i> Hairybeast turtleback	A. Gray
Asteraceae	<i>Psathyrotes ramosissima</i> Velvet turtleback	(Torr.) A. Gray
Asteraceae	<i>Psilostrophe cooperi</i> Whitestem paperflower	(A. Gray) Greene
Asteraceae	<i>Rafinesquia neomexicana</i> New Mexico plumeseed	A. Gray
Asteraceae	<i>Solidago spectabilis</i> Nevada goldenrod	(D.C. Eaton) A. Gray var. confinis (A. Gray) Cronquist
Asteraceae	<i>Sonchus asper</i> Spiny sowthistle	(L.) Hill
Asteraceae	<i>Sonchus oleraceus</i> Common sowthistle	L.
Asteraceae	<i>Stephanomeria pauciflora</i> Brownplume wirelettuce	(Torr.) A. Nelson
Asteraceae	<i>Stylocline micropoides</i> Woollyhead neststraw	A. Gray
Asteraceae	<i>Symphotrichum divaricatum</i> Southern annual saltmarsh aster	(Nutt.) G.L. Nesom
Asteraceae	<i>Xanthium strumarium</i> Rough cocklebur	L.
Asteraceae	<i>Xylorhiza tortifolia var. tortifolia</i> Mojave woodyaster	(Torr. & A. Gray) Greene
Asteraceae	<i>Chaenactis carphoclinia var. carphoclinia</i> Pebble pincushion	A. Gray
Boraginaceae	<i>Amsinckia menziesii var. intermedia</i> Common fiddleneck	(Lehm.) A. Nelson & J.F. Macbr. var. (Fisch. & C.A. Mey.) Ganders

Family	Scientific Name Common Name	Author
Boraginaceae	Amsinckia tessellata Bristly fiddleneck	A. Gray
Boraginaceae	Cryptantha angustifolia Narrowleaf cryptantha	(Torr.) Greene
Boraginaceae	Cryptantha barbiger Bearded cryptantha	(A. Gray) Greene
Boraginaceae	Cryptantha gracilis Narrowstem cryptantha	Osterh.
Boraginaceae	Cryptantha nevadensis Nevada cryptantha	Nelson & Greene
Boraginaceae	Cryptantha pterocarya var. cycloptera Wingnut cryptantha	(Torr.) Greene var. (Greene) J.F. Macbr.
Boraginaceae	Cryptantha recurvata Recurved cryptantha	Cov
Boraginaceae	Cryptantha utahensis Scented cryptantha	(A. Gray) Greene
Boraginaceae	Heliotropium curassavicum Salt heliotrope	L.
Boraginaceae	Pectocarya platycarpa Broadfruit combseed	Munz & I.M. Johnst.) Munz & I.M. Johnst.
Boraginaceae	Pectocarya recurvata Curvenut combseed	I. M. Johnston
Boraginaceae	Plagiobothrys jonesii Jones's popcornflower	A. Gray
Brassicaceae	Brassica tournefortii Sahara mustard	Gouan
Brassicaceae	Chorispora tenella Crossflower, Muskmustard	(Pall.) DC.
Brassicaceae	Descurainia pinnata ssp. Glabra Western tansymustard	(Walter) Britton ssp. (Woot. & Standl.) Detling
Brassicaceae	Guillenia lasiophylla California mustard	(Hook. & Arn.) Greene
Brassicaceae	Lepidium fremontii Desert pepperweed	S. Watson
Brassicaceae	Lepidium lasiocarpum var. lasiocarpum Shaggyfruit pepperweed	Nutt.
Brassicaceae	Lepidium latifolium Broadleaved pepperweed	L.
Brassicaceae	Malcolmia africana African mustard	R. Br.
Brassicaceae	Physaria tenella Moapa bladderpod	(A. Nelson) O'Kane & Al-Shehbaz
Brassicaceae	Rapistrum rugosum Annual bastardcabbage	(L.) All.
Brassicaceae	Sisymbrium irio London rocket	L.
Brassicaceae	Sisymbrium orientale Indian hedgemustard	L.
Brassicaceae	Thelypodium integrifolium ssp. affine Entireleaved thelypody	(Nutt.) Endl. ex Walp ssp. (Greene) Al-Shehbaz
Cactaceae	Cylindropuntia bigelovii Teddybear cholla	(Engelm.) F.M. Knuth

Family	Scientific Name Common Name	Author
Cactaceae	Cylindropuntia echinocarpa Wiggins' cholla	(Engelm. & Bigelow) F.M. Knuth
Cactaceae	Cylindropuntia ramosissima Branched pencil cholla	(Engelm.) F.M. Knuth
Cactaceae	Echinocactus polycephalus Cottonop cactus	Engelm. & Bigelow
Cactaceae	Echinocereus engelmannii Engelmann's hedgehog cactus	(Parry ex Engelm.) Lem.
Cactaceae	Echinomastus johnsonii Johnson's fishhook cactus	(Parry ex Engelm.) E.M. Baxter
Cactaceae	Ferocactus cylindraceus Leconte's barrel cactus	(Engelm.) Orcutt var. lecontei (Engelm.) H. Bravo
Cactaceae	Mammillaria tetrancistra Common fishhook cactus	Engelm.
Cactaceae	Opuntia basilaris Beavertail pricklypear	Engelm. & Bigelow
Cactaceae	Opuntia polyacantha var. erinacea Grizzlybear pricklypear	Haw. var. (Engelm. & Bigelow ex Engelm.) Parfitt
Campanulaceae	Nemacladus glanduliferus Glandular threadplant	Jeps.
Caryophyllaceae	Spergularia salina Salt sandspur	J. Presl & C. Presl
Chenopodiaceae	Allenrolfea occidentalis Iodine bush	(S. Watson) Kuntze
Chenopodiaceae	Atriplex confertifolia Shadscale saltbush	(Torr. & Frém.) S. Watson
Chenopodiaceae	Atriplex elegans var. elegans Wheelscale	(Moq.) D. Dietr
Chenopodiaceae	Atriplex hymenelytra Desertholly	(Torr.) S. Watson
Chenopodiaceae	Atriplex lentiformis Big saltbush, Quailbush	(Torr.) S. Watson
Chenopodiaceae	Atriplex polycarpa Cattle saltbush	(Torr.) S. Watson
Chenopodiaceae	Atriplex semibaccata Australian saltbrush	R. Br.
Chenopodiaceae	Bassia hyssopifolia Fivehorn smotherweed	(Pall.) Kuntz
Chenopodiaceae	Monolepis nuttalliana Nuttall's povertyweed	(Schult.) Greene
Chenopodiaceae	Nitrophila occidentalis Boraxweed	(Moq.) S. Watson
Chenopodiaceae	Salsola tragus Prickly Russian thistle	L.
Chenopodiaceae	Suaeda calceoliformis Pursh seepweed	(Hook.) Moq.
Chenopodiaceae	Suaeda moquinii Mojave seablite	(Torr.) Greene
Convolvulaceae	Calystegia sepium Hedge false bindweed	(L.) R. Br.
Convolvulaceae	Convolvulus arvensis Field bindweed	L.

Family	Scientific Name Common Name	Author
Cuscutaceae	Cuscuta californica Chaparral dodder	Hook. & Arn.
Cuscutaceae	Cuscuta indecora Bigseed alfalfa dodder	Choisy
Cuscutaceae	Cuscuta pentagona Fiveangled dodder	Engelm.
Cuscutaceae	Cuscuta salina var. major Goldenthread	Engelm. var. Yunck.
Cyperaceae	Carex nebrascensis Nebraska sedge	Dewey
Cyperaceae	Carex praegracilis Clustered field sedge	W. Boott
Cyperaceae	Cladium californicum California sawgrass	(S. Watson) O'Neill
Cyperaceae	Cyperus odoratus Fragrant sedge	L.
Cyperaceae	Cyperus strigosus Strawcolored flatsedge	L.
Cyperaceae	Eleocharis macrostachya Pale spikerush	Britton
Cyperaceae	Eleocharis rostellata Beaked spikerush	(Torr.) Torr.
Cyperaceae	Schoenoplectus americanus Chairmaker's bulrush	(Pers.) Volkart ex Schinz & R. Keller
Elaeagnaceae	Elaeagnus angustifolia Russian olive	L.
Ephedraceae	Ephedra fasciculata Arizona jointfir	A. Nelson
Euphorbiaceae	Argythamnia neomexicana New Mexico silverbush	Müll. Arg.
Euphorbiaceae	Chamaesyce albomarginata Whitemargin sandmat	(Torr. & A. Gray) Small
Euphorbiaceae	Chamaesyce micromera Sonoran sandmat	(Boiss. ex Engelm.) Woot. & Standl.
Euphorbiaceae	Chamaesyce setiloba Yuma sandmat	(Engelm. ex Torr.) J.B.S. Norton
Fabaceae	Acacia greggii Catclaw acacia	A. Gray
Fabaceae	Glycyrrhiza lepidota Wild licorice	Pursh
Fabaceae	Lotus glaber Narrow-leaf bird's-foot trefoil	Mill.
Fabaceae	Medicago sativa Alfalfa	L.
Fabaceae	Mellilotus indicus Annual yellow sweetclover	(L.) All.
Fabaceae	Mellilotus officinalis Yellow sweetclover	(L.) Lam.
Fabaceae	Prosopis glandulosa var. torreyana Western honey mesquite	Torr. var. (L.D. Benson) M.C. Johnston.
Fabaceae	Prosopis pubescens Screwbean mesquite	Benth.

Family	Scientific Name Common Name	Author
Fabaceae	Psoralemmus fremontii Fremont's dalea	(Torr. ex A. Gray) Barneby
Fabaceae	Trifolium fragiferum Strawberry clover	L.
Geraniaceae	Erodium cicutarium Redstem stork's bill	(L.) L'Hér. ex Aiton
Geraniaceae	Erodium texanum Texas stork's bill	A. Gray
Hydrocharitaceae	Vallisneria americana American eelgrass	Michx.
Hydrophyllaceae	Eucrypta micrantha Dainty desert hideseed	(Torr.) A. Heller
Hydrophyllaceae	Nama pusillum Eggleaf fiddleleaf	A. Gray
Hydrophyllaceae	Phacelia calthifolia Calthaleaf phacelia	Brand
Hydrophyllaceae	Phacelia crenulata var. crenulata Cleftleaf wildheliotrope	Torr. ex S. Watson
Hydrophyllaceae	Phacelia fremontii Fremont's phacelia	Torr.
Hydrophyllaceae	Phacelia incana Hoary phacelia	Brand
Hydrophyllaceae	Phacelia neglecta Alkali phacelia	M.E. Jones
Hydrophyllaceae	Phacelia pulchella var. gooddingii Goodding's phacelia	A. Gray var. (Brand) J.T. Howell
Iridaceae	Sisyrinchium sp. Blue-eyed grass	
Juncaceae	Juncus cooperi Cooper's rush	Engelm.
Juncaceae	Juncus mexicanus Mexican rush	Willd. ex Schult. & Schult. f.
Krameriaceae	Krameria erecta Pima ratany	Schultes
Krameriaceae	Krameria grayi White ratany	Rose & Painter
Lamiaceae	Lycopus americanus Bugleweed	W.C. Barton
Lamiaceae	Salazaria mexicana Mexican bladdersage	Torr.
Lemnaceae	Lemna sp. Duckweed	
Lemnaceae	Spirodela polyrrhiza Common duckmeat	(L.) Schleid.
Liliaceae	Androstephium breviflorum Pink funnel lily	S. Watson
Liliaceae	Calochortus flexuosus Winding mariposa lily	S. Watson
Loasaceae	Mentzelia albicaulis Whitestem blazingstar	(Hook.) Torr. & A. Gray
Loasaceae	Mentzelia oreophila Argus blazingstar	J. Darl.

Family	Scientific Name Common Name	Author	Family	Scientific Name Common Name	Author
Loasaceae	Mentzelia tricuspis Spinyhair blazingstar	A. Gray	Poaceae	Bromus diandrus Ripgut brome	Roth
Lythraceae	Lythrum californicum California loosestrife	Torr. & A. Gray	Poaceae	Bromus rubens Red brome	L.
Malvaceae	Eremalche rotundifolia Desert fivespot	(A. Gray) Greene	Poaceae	Bromus tectorum Cheatgrass	L.
Malvaceae	Malva neglecta Common mallow	Wallr.	Poaceae	Cynodon dactylon Bermudagrass	(L.) Pers.
Malvaceae	Malvella leprosa Alkali mallow	(Ortega) Krapov.	Poaceae	Dasyochloa pulchella Low woollygrass	(Kunth) Willd. ex Rydb.
Malvaceae	Sphaeralcea ambigua Desert globemallow	A. Gray	Poaceae	Distichlis spicata Saltgrass	(L.) Greene
Malvaceae	Sphaeralcea angustifolia Copper globemallow	(Cav.) G. Don	Poaceae	Echinochloa crus-galli Barnyardgrass	(L.) P. Beauv.
Nyctaginaceae	Allionia incarnata var. villosa Trailing windmills	L. var. (Standl.) B.L. Turner	Poaceae	Holcus mollis German velvetgrass	L.
Nyctaginaceae	Boerhavia wrightii Largebract spiderfling	A. Gray	Poaceae	Hordeum brachyantherum Meadow barley	Nevski
Nyctaginaceae	Mirabilis laevis var. retrorsa Wishbone-bush	(Benth.) Curran var. (A. Heller) Jeps.	Poaceae	Hordeum marinum ssp. gussonianum Mediterranean barley	Huds. spp. (Parl.) Thell.
Nyctaginaceae	Selinocarpus nevadensis Desert moonpod	(Standl.) Fowler & Turner	Poaceae	Muhlenbergia asperifolia Scratchgrass	(Nees & Meyen ex Trin.) Parodi
Oleaceae	Fraxinus velutina Velvet ash	Torr.	Poaceae	Paspalum dilatatum Dallisgrass	Poir.
Onagraceae	Camissonia brevipes Sun cup	(A. Gray) Raven	Poaceae	Phalaris minor Littleseed canarygrass	Retz.
Onagraceae	Camissonia refracta Narrowleaf suncup	(S. Watson) P.H. Raven	Poaceae	Phragmites australis Common reed	(Cav.) Trin. ex Steud.
Onagraceae	Epilobium ciliatum Fringed willowherb	Raf.	Poaceae	Pleuraphis rigida Big galleta	Thurb.
Onagraceae	Gaura coccinea Scarlet beeblossom	Nutt. ex Pursh	Poaceae	Polyogon monspeliensis Annual rabbitsfoot grass	(L.) Desf
Papaveraceae	Eschscholzia glyptosperma Desert poppy	Greene	Poaceae	Schedonorus arundinaceus Tall fescue	(Schreb.) Dumort.
Plantaginaceae	Plantago lanceolata Narrowleaf plantain	L.	Poaceae	Schismus arabicus Arabian schismus	Nees
Plantaginaceae	Plantago major Common plantain	L.	Poaceae	Schismus barbatus Common Mediterranean grass	(Loefl. ex L.) Thell.
Plantaginaceae	Plantago ovata Desert Indianwheat	Forskål	Poaceae	Setaria sp. Bristlegrass	
Poaceae	Achnatherum hymenoides Indian ricegrass	(Roemer & Schultes) Barkworth	Poaceae	Sporobolus airoides Alkali sacaton	(Torr.) Torr
Poaceae	Andropogon glomeratus Southwestern bushy bluestem	(Walter) Britton, Sterns, & Pogg	Polemoniaceae	Aliciella hutchinsifolia Desert pale gilia	(Rydb.) J.M. Porter
Poaceae	Aristida purpurea. var. wrightii Wright's threewain	Nutt. var. (Nash) Allred	Polemoniaceae	Aliciella latifolia Broad-leaf gilia	(S. Watson) J.M. Porter
Poaceae	Avena fatua Wild oat	L.	Polemoniaceae	Gilia scopulorum Rock gilia	M.E. Jones
Poaceae	Bouteloua barbata Sixweeks grama	Lag.	Polemoniaceae	Gilia transmontana Transmontane gilia	(H. Mason & A.D. Grant) A.D. Grant & V.E. Grant
Poaceae	Bromus catharticus Rescuegrass	Vahl	Polemoniaceae	Ipomopsis polycladon Manybranched ipomopsis	(Torr.) V.E. Grant

Family	Scientific Name Common Name	Author
Polemoniaceae	<i>Langloisia setosissima</i> Great Basin langloisia	(Torr. & A. Gray ex Torr.) Greene
Polemoniaceae	<i>Linanthus arenicola</i> Sanddune linanthus	(M.E. Jones) Jeps. & V. Bailey
Polemoniaceae	<i>Linanthus demissus</i> Desert snow	(A. Gray) Greene
Polygonaceae	<i>Chorizanthe brevicornu</i> Brittle spinesflower	Torr.
Polygonaceae	<i>Chorizanthe rigida</i> Devil's spinesflower	(Torr.) Torr. & A. Gray
Polygonaceae	<i>Eriogonum brachypodum</i> Parry's buckwheat	Torr. & A. Gray
Polygonaceae	<i>Eriogonum fasciculatum</i> Eastern Moave buckwheat	Benth.
Polygonaceae	<i>Eriogonum inflatum</i> Desert trumpet	Torr. & Frém
Polygonaceae	<i>Eriogonum thomasii</i> Thomas' buckwheat	Torr.
Polygonaceae	<i>Eriogonum trichopes</i> Little deserttrumpet	Torr.
Polygonaceae	<i>Polygonum punctatum</i> Dotted smartweed	Elliot
Polygonaceae	<i>Rumex crispus</i> Curly dock	L.
Polygonaceae	<i>Rumex hymenosepalus</i> Canaigre dock	Torr.
Primulaceae	<i>Samolus valerandi. ssp. parviflorus</i> Seaside brookweed	L. ssp. (Raf.) Hultén
Punicaceae	<i>Punica granatum</i> Pomegranate	L.
Ranunculaceae	<i>Delphinium parishii ssp. parishii</i> Desert larkspur	A. Gray
Resedaceae	<i>Oligomeris linifolia</i> Lineleaf whitepuff	(Vahl) J.F. Macbr.
Resedaceae	<i>Oligomeris linifolia</i> Lineleaf whitepuff	(Vahl) J.F. Macbr.
Rutaceae	<i>Thamnosma montana</i> Turpentinebroom	Torr. & Frém.
Salicaceae	<i>Populus fremontii ssp. fremontii</i> Fremont cottonwood	S. Watson
Salicaceae	<i>Salix exigua</i> Narrowleaf willow	Nutt
Salicaceae	<i>Salix gooddingii</i> Goodding's willow	C.R. Ball
Scrophulariaceae	<i>Mimulus guttatus</i> Yellow monkeyflower	DC
Scrophulariaceae	<i>Mohavea breviflora</i> Golden desert-snapdragon	Coville
Scrophulariaceae	<i>Neogaerrhinum filipes</i> Yellow twining snapdragon	(A. Gray) Rothm.
Scrophulariaceae	<i>Veronica americana</i> American brooklime	(Raf) Benth

Family	Scientific Name Common Name	Author
Solanaceae	<i>Datura wrightii</i> Sacred thorn-apple	Regel
Solanaceae	<i>Lycium andersonii</i> Water jacket	A. Gray
Solanaceae	<i>Lycium cooperi</i> Peach thorn	A. Gray
Solanaceae	<i>Lycium torreyi</i> Torrey wolfberry	A. Gray
Solanaceae	<i>Nicotiana obtusifolia</i> Desert tobacco	M. Martens & Galeotti
Solanaceae	<i>Physalis crassifolia</i> Yellow nightshade groundcherry	Benth.
Solanaceae	<i>Solanum elaeagnifolium</i> Silverleaf nightshade	Cav.
Suaruraceae	<i>Anemopsis californica</i> Yerba mansa	(Nutt.) Hook. & Arn.
Tamaricaceae	<i>Tamarix aphylla</i> Athel tamarisk	(L.) Karst
Tamaricaceae	<i>Tamarix ramosissima</i> Saltcedar	Ledeb.
Typhaceae	<i>Typha domingensis</i> Southern cattail	Pers.
Verbenaceae	<i>Phyla lanceolata</i> Lanceleaf fogfruit	(Michx.) Greene
Viscaceae	<i>Phoradendron californicum</i> Mesquite mistletoe	Nutt.
Vitaceae	<i>Vitis arizonica</i> Canyon grape	Engelm.
Zygophyllaceae	<i>Larrea tridentata</i> Creosote bush	(DC.) Coville
Zygophyllaceae	<i>Tribulus terrestris</i> Puncture vine	L.

Total Species: 248

A.06 HYDROLOGIC MONITORING TABLE

Basin_no	Name_2	Alias1	Alias2	TYPE	WellType	Hydrogeologic Unit	AGENCY	WL MEASUREMENT FREQUENCY	PRODUCTION/ FLOW DATA FREQUENCY	Remarks	UTM_X	UTM_Y
Groundwater Monitoring:												
219	ABBOTT	UM7		Well	Monitor	Valley Fill	NPC (NVEnergy)	Monthly			706442.8946	4065656.5879
219	ARROW_CANYON			Well	Production	Carbonate	MVWD	Continuous	Continuous		701103.7690	4067755.2460
219	ARROW CANYON 2			Well	Production	Carbonate	MVWD	Continuous	Continuous		701103.3700	4067768.3000
219	BEHMER-MW			Well	Monitor	Valley Fill	NPC (NVEnergy)	Monthly			706030.6983	4065280.1818
219	CSV-1	364601114514301		Well	Monitor	Valley Fill	SNWA	Monthly			691377.9927	4071630.4100
219	CSV-2	364650114432001		Well	Monitor	Carbonate	SNWA/USGS/NV Energy	Continuous		NVEnergy includes data	703217.0806	4072966.7777
219	EH-4			Well	Monitor	Carbonate	NPC (NVEnergy)	Continuous			703929.2650	4064736.4078
219	EH-5B			Well	Monitor	Carbonate	NPC (NVEnergy)	Continuous			701568.7861	4067619.1347
219	LDS CENTRAL	UM49		Well	Production	Valley Fill	NPC (NVEnergy)	Monthly	Daily		704113.9580	4066543.6361
219	LDS EAST	UM50		Well	Production	Valley Fill	NPC (NVEnergy)	Monthly	Daily		704478.9759	4066594.2407
219	LDS WEST	UM18		Well	Production	Valley Fill	NPC (NVEnergy)	Monthly	Daily		702746.2777	4067083.3415
219	LEWIS 1 OLD	UM55		Well	Monitor	Valley Fill	NPC (NVEnergy)	Monthly			702076.8581	4068229.1435
219	LEWIS 2	UM74		Well	Production	Valley Fill	NPC (NVEnergy)	Continuous	Daily		702339.3990	4067921.3381
219	LEWIS NORTH	UM45		Well	Monitor	Valley Fill	NPC (NVEnergy)	Continuous			701588.5926	4067871.6716
219	LEWIS SOUTH	UM43		Well	Monitor	Valley Fill	NPC (NVEnergy)	Continuous			702737.1327	4067265.8985
219	MX-6	CE-DT-6	364604114471301	Well	Production	Carbonate	MVWD	Monthly	Continuous		697482.4475	4071381.1641
219	PERKINS OLD	UM15		Well	Monitor	Valley Fill	NPC (NVEnergy)	Continuous			705637.2978	4065223.3801
219	PERKINS PRODUCTION			Well	Production	Valley Fill	NPC (NVEnergy)	Monthly	Daily		705692.9601	4065206.0659
219	UMVM-1	DEADMAN WASH		Well	Monitor	Carbonate	SNWA	Continuous			694304.6450	4070247.5450
220	EH-3			Well	Monitor	Carbonate	NPC (NVEnergy)	Continuous			721085.0000	4063300.0000
220	EH-7			Well	Monitor	Carbonate	NPC (NVEnergy)	Continuous			720660.0000	4060990.0000
Surface Water Monitoring:												
219	BALDWIN SPRING BOX			Spring		Flow Meter	MVWD	Continuous	Continuous		703257.3243	4066270.2745
219	JONES SPRING BOX			Spring		Flow Meter	MVWD	Continuous	Continuous		703713.6616	4065660.8144
219	PEDERSON EAST SPRING GAGE	PLAYBOY POOL GAGE		Spring		Flume	SNWA/USGS	Continuous	Continuous		704034.2489	4065063.0421
219	PEDERSON SPRING GAGE			Spring		Weir	SNWA/USGS	Continuous	Continuous		704008.0508	4065088.5140
219	WARM SPRINGS WEST GAGE			Spring		Flume	SNWA/USGS	Continuous	Continuous		704210.7611	4065272.2446
219	IVERSON FLUME			Stream		Flume	SNWA/USGS	Continuous	Continuous		704569.9449	4065295.8619
219	MUDDY SPRING GAGE			Spring		Flume	SNWA/USGS	Continuous	Continuous		704018.1277	4066347.6635
219	MOAPA GAGE			Stream		Stream Gage	USGS	Continuous	Continuous		705823.3289	4065349.9049
220	GLENDALE GAGE			Stream		Stream Gage	USGS	Continuous	Continuous		719896.9331	4058057.4259
220	OVERTON GAGE			Stream		Stream Gage	SNWA/USGS	Continuous	Continuous		730091.3558	4046453.5134
215	BLUE POINT SPRING			Spring		Stream Gage	NPS	Continuous	Continuous		730352.7311	4030270.7397
215	ROGERS SPRING			Spring		Stream Gage	NPS	Continuous	Continuous		729419.7449	4028891.3629

Source: List of sites that will be monitored for the duration of the Order 1169 test, as requested by, and submitted to, the Nevada Division of Water Resources

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