Warm Springs Natural Area Riparian Restoration Project

($189,351)

WaterSMART Drought Response Program
Drought Resiliency Project Grant FY2021

BOR-DO-20-F002

Funding Group I

July 30, 2020

Applicant:
Southern Nevada Water Authority

Contact for Further Information:
Julie Schoolmeester
1001 South Valley View Blvd., MS 760
Las Vegas, Nevada 89153

E-mail: julie.schoolmeester@lvvwd.com
Office: (702) 258-3173
Cell: (702) 539-2965
Fax: (702) 258-7146

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1. Technical Proposal: Executive Summary

Date: July 30, 2020
Applicant: Southern Nevada Water Authority
Location: 1001 South Valley View Boulevard, Las Vegas, Nevada 89153 (Clark County)

Project Summary:
As severe and sustained drought conditions in the lower Colorado River basin continue to threaten ecosystems, building drought resiliency is crucial to providing habitat for our most vulnerable species. Southern Nevada Water Authority (SNWA) will restore 21 acres and protect an additional 24 acres of habitat from drought impacts at Warm Springs Natural Area (WSNA), a 1,250-acre property located approximately seven miles northwest from the town of Moapa, Nevada. The property is regionally significant as it contains more than 20 perennial springs that form the headwaters of the Muddy River and numerous landscape types. These resources provide habitat for a number of protected and sensitive species, including the endangered Moapa dace (the U.S. Fish and Wildlife Service estimates that nearly 80 percent of its remaining habitat is found on the property), endangered southwestern willow flycatcher, and threatened yellow-billed cuckoo. WSNA also supports other native birds and important wildlife populations, as well as diverse plant communities. The proposed project will widen existing riparian corridors adjacent to deeply incised streams and expand tree zones, restore native riparian vegetation within the flood plain, and enhance mesquite bosques. These actions will increase habitat for listed species, improve hydrologic conditions, and reduce wildfire risk and erosion and sedimentation during flood events. Non-native vegetation will be removed and replaced with native vegetation to restore the area to the natural habitat that existed before the area was converted to agriculture. The project is supported by SNWA's Water Resource Plan. Funding will allow SNWA to rent equipment, purchase materials, and hire contractors to accomplish the proposed work. Volunteers will also be used. Project activities will not negatively impact listed species or cultural resources.

Length of Time and Estimated Completion Date
The proposed project encompasses activity from January 2021 through December 2022. All project work will be completed by December 2022.

Federal Facilities
The proposed project is not located on a Federal facility.

2. Technical Proposal: Project Location
The proposed Warm Springs Natural Area Riparian Restoration Project is located in Clark County, Nevada, approximately seven miles northwest from the town of Moapa, Nevada, at 36° 42' 42" N, 114° 42' 47" W. A map of the Warm Springs Natural Area is included as Appendix A.

3. Technical Proposal: Technical Project Description
Warm Springs Natural Area (WSNA) is a 1,250-acre property owned and operated by the Southern Nevada Water Authority (SNWA), largely as a nature preserve. Management is guided by the WSNA Stewardship Plan. The property is regionally significant and contains more than 20 perennial springs that form the headwaters of the Muddy River, as well as numerous habitat

types. This project will increase and protect riparian and mesquite bosque habitats at WSNA to make these habitats and the wildlife they support more resilient to drought. The increase will be accomplished by widening riparian corridors along 0.5 miles of tributaries of the Muddy River, expanding or joining existing corridors along 0.25 miles of manmade ditches, meadows, and marsh edges, and by establishing mesquite bosques along riparian corridors, resulting in the creation of 21 acres of new habitat and the protection of 24 acres of existing habitat.

Widening Riparian Corridors along Streams

During the 1860s, the Muddy River and its tributaries were moved and straightened to maximize the area for agriculture. This action increased the slope and stream velocities leading to channel incision and the upstream migration of head cutting. Currently, the Muddy River and its tributaries are entrenched approximately 15 feet below the surface of the flood plain, drastically changing the hydrology. As entrenchment progressed, the water table dropped, and plants that depended upon the groundwater died because their roots were no longer able to reach water.

Due to the steep banks, riparian habitat along the streams is currently less than three feet wide in most areas and mostly devoid of trees. To increase the area of this habitat, the banks will be excavated back from the stream edge approximately 10 feet and down to the water table. This effort will increase the width of riparian corridor habitat from almost none to up to 20 feet. Trees and understory vegetation will then be established. Existing vegetation consisting mostly of undesirable weeds and upland species will be removed and disposed. The soil will be excavated with a large excavator, placed in dump trucks, and hauled to other locations on WSNA. Some of the soil may be spread in place near the project site. The trees (mostly velvet ash [*Fraxinus velutina*] with some cottonwood [*Populus fremontii*] and Goodding's willow [*Salix gooddingii*]) will be installed as one-gallon propagated plants or poles or cuttings in the newly excavated area. Propagated plants will be grown in the WSNA nursery (over 1,000 trees are currently in stock and available for this project) or grown by other local nurseries using local seed. Poles and cuttings will be obtained at WSNA or nearby properties.

Plants will be enclosed with hardware-cloth cages and surrounded with weed-barrier fabric to slow the spread of weeds. Understory plants such as yerba mansa (*Anemopsis californica*), alkali sacaton (*Sporobolis airoides*), saltgrass (*Distichlis spicata*), scratchgrass (*Muhlenbergia asperifolia*), and limewater brookweed (*Samolus ebracteatus*) will be installed around the trees and on the water edge. No irrigation will be required because all plants will be installed in water-saturated soil. Plantings will be kept free of weeds, and regular monitoring will determine success and the need for additional maintenance.

Expanding Existing Riparian Areas

Existing stands of riparian trees will be connected and/or expanded by densely planting cottonwood, Goodding's willow, sandbar willow (*S. exigua*), and ash. Trees will be added to these existing habitats by installing poles and cuttings and propagated plants in areas near surface water or high-water tables. Propagated plants will be grown in the WSNA nursery or grown by other local nurseries using local seed. Poles and cuttings will be obtained at WSNA or nearby properties. Selected sites for trees may be found along or near existing manmade ditches, and wet meadow or marsh edges. Surveys will identify appropriate sites for installing trees. Sites must have soils with moderate to high permeability that are moist at or near the surface most of

the year to be considered as a candidate. Existing competitive vegetation will be removed with an excavator and spread nearby or disposed offsite. Holes or trenches for poles, cuttings, and propagated trees will be dug with an excavator or auger. Plant materials will be inserted in the trenches and holes to the appropriate depth, and then the holes and trenches will be backfilled. No irrigation will be necessary. Fencing will be used around trees installed in areas with known beaver activity. Plantings will be kept free of weeds, and regular monitoring will determine success and the need for additional maintenance.

Establishing Mesquite Bosques
Western honey and screwbean mesquite (*Prosopis glandulosa* var *torreyana* and *P. pubescens*) and associated understory plants will be installed along newly planted riparian corridors. Propagated plants will be grown in the WSNA nursery or grown by other local nurseries using local seed. Trees will be installed in augered holes and enclosed in cages fabricated from hardware cloth. Each tree will be surrounded with weed-barrier fabric. A drip-irrigation system will be installed to provide water for the trees during the first 2-3 years. Additional plants will be installed between the trees and sustained with irrigation. Plantings will be kept free of weeds, and regular monitoring will determine success and the need for additional maintenance.

4. Technical Proposal: Performance Measures

Since it takes several years for riparian and mesquite habitat to mature and begin to be utilized by wildlife, the benefits of this project will not be fully realized in the two-year period. Thus, performance measures will occur in two timeframes and across two categories. The first will occur in the two-year project period and measure planting success and other site criteria. The second will occur 3-5 years after project implementation and measure project benefits:

1. Measures of Planting Success and Other Site Criteria

- ***Survival Data.*** *Propagated Plants.* Survival data will be reported as the percent of living plants (usually separated by species) of the total number installed in a project area. *Poles and cuttings.* Data will be reported as the percentage of installed poles or cuttings producing buds.
- ***Species Richness.*** Species richness is the number of different desirable native species represented at a site and will be derived from survival data for each site and compared to the species richness of untreated reference areas.
- ***Photo Points.*** Photo points will be established at each project site before any work is initiated, and then photos will be taken after various treatments such as ground preparation and planting have been implemented.
- ***Soil Erosion.*** Soils exposed by project actions will be susceptible to erosion by water or wind. Straw wattles will be installed next to streams to protect them from sediment during rain events. Qualitative measurements of erosion (soil and plant litter deposits, breaches, pedestalling, and rilling) will be taken after storms.
- ***Irrigation.*** Trees and understory plants not planted in wet soils must be irrigated until established. Irrigation will be monitored and repaired routinely to maximize survival.

2. Measures of Project Benefits

- ***Bird Surveys.*** The true measure of project benefits will be use of the new riparian and mesquite vegetation by the targeted species, especially the southwestern willow flycatcher (riparian) and yellow-billed cuckoo (both). Surveys are conducted in the breeding season using federal protocols. For the flycatcher, standard measurements are number of territories, pairs, nests, and fledged young. For the cuckoo, results are measured in detections and then in detections across survey periods, yielding possible, probable, or confirmed breeding territory designations. Results will be analyzed at the property level for overall increases, and new sites will be compared against existing sites.

5. Technical Proposal: Evaluation Criteria

E.1.1. Evaluation Criterion A—Project Benefits

How will the project build long-term resilience to drought? How many years will the project continue to provide benefits?

Riparian and wetland areas in Southern Nevada are both limited and fragmented. This makes them and the wildlife that rely on them especially susceptible to drought impacts. This natural susceptibility is further impacted by non-native plant species replacing native species and erosion reducing flood plains and the area in which native wetland and riparian species can survive. This project aims to replace non-native species with native species along the banks of springs, streams, and the Muddy River as well as in the mesquite areas that surround and protect these sensitive zones. Riparian areas provide important functions in watersheds. Enhancing and expanding the riparian corridor and increasing patch sizes will help increase flood water retention and groundwater recharge. Many native riparian trees can develop vast root systems that are resilient to drought and will live for many decades, sometimes over 80 years. With large enough populations, it is expected that they will be able to reproduce in a way that makes the habitat sustainable without human intervention.

Will the project make additional water supplies available?

This project is not expected to increase water supplies.

Will the project improve the management of water supplies?

This project is not expected to have impacts on water management.

Will the project have benefits to fish, wildlife, or the environment? If so, please describe those benefits.

This project will have substantial benefits. It will improve aquatic habitat for the endangered Moapa dace (the U.S. Fish and Wildlife Service estimates that nearly 80 percent of its remaining habitat is found on the property) and other native fishes by removing non-native plants that cause stream shading and replacing them with deciduous native plants that allow more sunlight to reach the stream and increase nutrient-rich leaf fall into the stream. The project will increase the amount of potentially suitable nesting habitat for two federally listed bird species, as well as for dozens of other bird species including many that are conservation priorities due to various regional initiatives. The project will also reduce wildfire risk by removing fire-adapted non-native vegetation.

If the proposed project includes any of the following components, please provide the applicable additional information:

Environmental/Wildlife Projects

What are the types and quantities of environmental benefits provided, such as the types of species and their numbers benefited, acreage of habitat improved, restored or protected, or the amount of flow provided? How was this estimate calculated?

Birds stand to benefit the most from this project. Riparian areas tend to have a greater diversity and density of birds than surrounding habitats, and many of the breeding birds in the region utilize the riparian zone, including the endangered southwestern willow flycatcher and threatened yellow-billed cuckoo. A small breeding colony of southwestern willow flycatchers (≤ 8 territories) has been documented by surveys at WSNA for about 20 years, and the cuckoo is regularly detected during surveys in the breeding season, although typically just 1-2, which is in line with its abundance in the state. Mesquite habitat is also bird-rich and is particularly important for Nevada's largest population of vermilion flycatcher, which nests in it, and also for the cuckoo. Bird surveys conducted by Great Basin Bird Observatory from 2004 to 2019 identified 187 species on property. The 16 bat species confirmed by acoustic monitoring in riparian areas on property will also benefit, and three species of fish documented during various surveys will benefit from stream improvements. For habitat, 21 acres of riparian and mesquite habitat will be created, and 24 acres will be protected/or improved, for a total of 45 acres as measured in ArcGIS using recent aerial imagery.

What is the status of the species of interest (i.e. endangered, threatened, etc.)? How has the drought impact the species?

The southwestern willow flycatcher and Moapa dace are federally listed as endangered; the yellow-billed cuckoo is threatened. A total of 45 of the property's bird species are considered conservation priorities by various regional initiatives, including the Lower Colorado River Multi-Species Conservation Plan. Of the bats, six are listed as a Nevada State sensitive, protected, or threatened species. Where drought has reduced water availability, the habitat quality and quantity for these species has been degraded and has become more threatened by the potential of wildfire.

If the proposed project will benefit federally listed threatened or endangered species please consider the following elements:

Is the species subject to a recovery plan or conservation plan under the ESA?

The southwestern willow flycatcher and Moapa dace have recovery plans.

What is the relationship of the species to water supply?

Of the southwestern willow flycatcher and yellow-billed cuckoo, both are tied to water by the requirements of their nesting habitat, but the flycatcher more so of the two. In the region, the southwestern willow flycatcher only nests in dense riparian habitat with either surface water or saturated soils in the stand. The cuckoo generally nests in riparian habitat but will also nest in adjacent mesquite and does not require standing water or saturated soils in the patch itself. Still, its habitat requires substantially more water than the surrounding desert. The Moapa dace and

other native aquatic species in the Muddy River have adapted to spring-fed stable, warm water supplies.

What is the extent of the proposed project that would reduce the likelihood of listing, or would otherwise improve the status of the species?
This project should benefit both listed bird species by increasing potentially suitable nesting habitat, with the added benefit that it can be easily colonized by the current populations and their offspring, overcoming a large hurdle faced by other habitat creation programs that are geographically isolated. By increasing the size of the breeding colony of southwestern willow flycatchers at WSNA, the project will increase the resilience of the colony and increase the likelihood that it will become a population source with individuals dispersing to other, smaller nesting colonies or even colonizing new sites in the region. This will in turn help improve metapopulation stability. The project should particularly benefit the cuckoo, which prefers a larger patch size for its breeding territories and uses riparian areas and adjacent mesquite for foraging and nesting. At the time of its listing in 2014, the U.S Fish and Wildlife Service estimated just 10 pairs of cuckoos in the state of Nevada. At least one potential breeding territory is detected in most years at WSNA, and it is one of just two sites where the species has been confirmed to nest in the state. Thus, any increase in the ability of the property to support more cuckoos should have a beneficial impact on the status of the cuckoo in Nevada.

Is the species adversely affected by a Reclamation project?
No.

E.1.2. Evaluation Criterion B—Drought Planning and Preparedness

SNWA's 2019 Water Resource Plan is included as Appendix B of this application.

Explain how the applicable plan addresses drought. Explain whether the drought plan was developed with input from multiple stakeholders. Was the drought plan developed through a collaborative process? Does the drought plan include consideration of climate change impacts to water resources or drought?
SNWA has a cooperative agreement among the member water and wastewater agencies (Big Bend Water District, City of Boulder City, City of Henderson, City of Las Vegas, City of North Las Vegas, Clark County Water Reclamation District, and Las Vegas Valley Water District) and requires the SNWA Board of Directors to adopt a Water Resource Plan annually. The first Water Resource Plan was adopted in 1996. SNWA's 21-member Resource Planning Advisory Committee, comprised of a diverse group of citizens, was formed in 2012 to assist with planning efforts. The 2019 planning process involved these public stakeholders. The 2019 Plan addresses drought through adaptive management strategies employed to meet supply in our region. In addition to strong conservation strategies, the 2019 Plan prioritizes collaboration with interstate and Federal partners, banking resources and growing temporary supplies, preserving access to Colorado River supplies, and protecting the availability of future resources. The 2019 Plan does consider climate change and its potential impacts on water resource availability to Southern Nevada. Climate change must be considered in tandem with the extended drought conditions in the region.

Describe how your proposed drought resiliency project is supported by an existing drought plan. Does the drought plan identify the proposed project as a potential mitigation or response action? Does the proposed project implement a goal or need identified in the drought plan? Describe how the proposed project is prioritized in the referenced drought plan.

The 2019 Plan's Chapter 5, "Protecting the Environment," addresses environmental programs that SNWA participates in that assist in species recovery and protection throughout Southern Nevada. The 2019 Plan identifies WSNA and its focus on restoration of fish habitat, as well as control and eradication of invasive species as conservation actions to provide mitigation benefits for water development. The 2019 Plan also recognizes that additional actions, such as the proposed project, are needed to protect the Moapa dace, which occurs only in the Muddy River and was listed as an endangered species in 1967.

E.1.3. Evaluation Criterion C—Severity of Actual or Potential Drought Impacts to be addressed by the Project

Describe the severity of the impacts that will be addressed by the project. What are the ongoing or potential drought impacts to specific sectors in the project area if no action is taken (e.g., impacts to agriculture, environment, hydropower, recreation and tourism, forestry), and how severe are those impacts? Impacts should be quantified and documented to the extent possible.

WSNA is an important breeding site for the southwestern willow flycatcher and yellow-billed cuckoo in Nevada. The current patches of potentially suitable nesting habitat for each species are small and fragmented and are thus more at risk of drought-caused degradation. This could lead to a reduction in carrying capacity and, if severe enough, could lead to the loss of all breeding territories on property. In addition to the direct impact from less water availability, non-native plant species have the potential to increase in abundance during drought, further reducing habitat quality and increasing the risk of wildfire. During the most recent major wildfire in 2010, hundreds of acres burned, including two southwestern willow flycatcher nests. No young fledged that year, and it took seven years for the colony to return to pre-fire levels. Also, no yellow-billed cuckoos were detected for five years. In addition, WSNA is a well-known location for birders and others who enjoy recreating in a natural setting. Drought impacts that negatively impact forested habitat and wildlife will have a negative impact on these recreational activities.

Are there public health concerns or social concerns associated with current or potential drought conditions (e.g., water quality concerns including past or potential violations of drinking water standards, increased risk of wildfire, or past or potential shortages of drinking water supplies)?

Dryness and non-native species, particularly the California fan palm (*Washingtonia filifera*), increase the risk of wildfire. By replacing non-native species with native species and increasing the size and resiliency of native vegetation areas, the risk of wildfire will be reduced. WSNA has been impacted by several wildfires fueled by non-native vegetation, in 1987, 1994, and 2010. During the 2010 fire, in addition to the loss of hundreds of acres of habitat, several structures including a private home were destroyed on neighboring properties. This project will help protect the area from future wildfires.

Does the community have another water source available to them if their water service is interrupted?
Not applicable to this project.

Are there ongoing or potential environmental impacts (e.g., impacts to endangered, threatened or candidate species or habitat)?
Non-native trees are impacting the habitat of the endangered Moapa dace by shading the water year-round and not providing the nutrients historically added by native deciduous trees. Non-native vegetation is also threatening all species in the project area, including the southwestern willow flycatcher and yellow-billed cuckoo, by being a potential fuel source for wildfires.

Are there ongoing, past or potential, local, or economic losses associated with current drought conditions (e.g., business, agriculture, reduced real estate values)?
In the 2010 fire, Clark County Fire Department estimated that more than 600 acres burned, and seven structures were damaged at an estimated cost of $2.5 million.

Are there other drought-related impacts not identified above (e.g., tensions over water that could result in a water-related crisis or conflict)?
Not applicable to this project.

Describe existing or potential drought conditions in the project area.
The project is located in the Mojave Desert, which has experienced many years of drought. This combined with historical agricultural uses including water diversion and land conversion have resulted in decreases in native riparian and wetland habitat and an increase in non-native vegetation. These factors have resulted in many large-scale fires on the property and the reduction of habitat for many species of wildlife including threatened and endangered species.

Is the project in an area that is currently suffering from drought or which has recently suffered from drought? Please describe existing or recent drought conditions, including when and the period of time that the area has experienced drought conditions (please provide supporting documentation, [e.g., Drought Monitor, droughtmonitor.unl.edu]).
Per the United States Drought Monitor (droughtmonitor.unl.edu), Clark County, Nevada (where the project is located) has been experiencing drought conditions at least some parts of the year going back to the year 2000. Because the average rainfall for the area is already a low 4.25 inches a year, even minor drought conditions can significantly impact vegetation and wildlife in the area.

Describe any projected increases to the severity or duration of drought in the project area resulting from changes to water supply availability. Provide support for your response (e.g., reference a recent climate informed analysis, if available).
The freezing elevation during the winter in nearby mountains has a statistically significant increasing trend over the time period of 1949-2016 (WRCC, North American Freezing Level Tracker, www.wrcc.dri.edu/cwd/products/), suggesting that snowpack in the region may already be affected by warming. Decreased snowpack would decrease regional water supply availability.

E.1.4. Evaluation Criterion D—Project Implementation

Describe the implementation plan of the proposed project. Please include an estimated project schedule that shows the stages and duration of the proposed work, including major tasks, milestones, and dates.
All plantings will be kept weed free and regularly monitored.

Stream Bank Excavation Project
This project will increase the width of the riparian corridor along the North and South forks of the Muddy River by excavating their banks back from the stream edge approximately 10 feet and down to the water table. Trees and understory vegetation will then be established. Plants will be enclosed with hardware-cloth cages and surrounded with weed-barrier fabric. Understory plants will be installed around the trees and along the water's edge. No irrigation will be required.

Riparian Expansion Project
This project will increase the size of existing riparian habitat by installing poles and cuttings of riparian tree species along or near existing ditches, and wet meadow or marsh edges. This will be accomplished by identifying appropriate sites for installing trees; removing existing competitive vegetation; digging holes or trenches for poles, cuttings, and propagated trees; and then inserting the plant material. No irrigation will be necessary. Fencing will be installed around trees in areas with known beaver activity.

Mesquite Bosque Establishment Project
This project will establish bosques (groves or woodlands) of mesquites to protect riparian systems and streams from floods, exotic species invasions, soil deposition, and other direct and indirect drought impacts. Propagated plants will be grown in the WSNA nursery or grown by other nurseries using local seed. Trees will be installed in augered holes and enclosed in cages fabricated from hardware cloth. Each tree will be surrounded with weed-barrier fabric. A drip-irrigation system will be installed to provide water for the trees during the first 2-3 years. Additional plants will be installed between the trees and sustained with irrigation.

Schedule 2021

January – March
Grant awarded
Prepare plans
Identify plant-material providers
Procure contracts (excavation and labor contractors and plant nurseries)
Procure materials (propagation, irrigation, and fencing materials)
Identify specific project sites (stake sites, check condition of soils and water ways)
WSNA nursery and other nurseries begin to produce trees and understory plants
Conduct biological surveys
Conduct cultural resource surveys

If grant is awarded by December 2020, do the following:
Procure labor contract

Harvest tree poles and cuttings
Prepare riparian-expansion areas by removing existing vegetation, till soils as needed
Dig holes and trenches and install poles and cuttings; install fencing as needed

April – May
Remove existing vegetation and excavate 600 feet of North Fork stream banks
Remove existing vegetation and excavate 150 feet of South Fork stream banks
Install trees with cages and weed barrier along 600 feet of North Fork excavation
Install trees with cages and weed barrier along 150 feet of South Fork excavation
Install straw wattles along stream edges in excavations to prevent sediment flow into streams
Control weeds in all plantings
Continue biological surveys

June – August
Control weeds in all plantings
Collect seed

September – December
Install understory plants along spring 2021 North and South Fork stream bank excavations
Monitor trees for survival and soil for erosion
Excavate 800 feet of South Fork stream banks
Install trees with cages and weed barrier along 800 feet of South Fork excavation
Install straw wattles along stream edges in excavations to prevent sediment flow into streams
Install mesquite trees along North Fork with irrigation and cages and weed barrier
Irrigate mesquite trees

2022

January – March
Harvest tree poles and cuttings
Prepare riparian-expansion areas by removing existing vegetation; till soils as needed
Dig holes and trenches and install poles and cuttings; install fencing as needed
Install mesquite trees along South Fork with irrigation and cages and weed barrier
Prepare and submit 1st year grant report
Irrigate mesquite trees
Conduct biological surveys
Conduct cultural resource surveys

April – May
Install understory plants along spring 2021 North and South Fork stream bank excavations
Install understory plants in North Fork mesquite bosques
Irrigate mesquite trees
Irrigate understory plants in mesquite bosques
Control weeds in all plantings
Continue biological surveys

June – August
Control weeds in all plantings
Irrigate mesquite trees
Irrigate understory plants in mesquite bosques

September – December
Install understory plants in South Fork mesquite bosques
Irrigate mesquite trees
Irrigate understory plants in mesquite bosques
Conduct final plant and soil monitoring

2023
Prepare and submit final grant report

Describe any permits that will be required, along with the process for obtaining such permits.
There are no known permits that will be required for this project.

Identify and describe any engineering or design work performed specifically in support of the proposed project.
There will be no engineering or design work with this project.

Describe any new policies or administrative actions required to implement the project.
There are no new policies or administrative actions required for this project.

E.1.5. Evaluation Criterion E—Nexus to Reclamation

How is the proposed project connected to a Reclamation project or activity?
WSNA is located in the lower Colorado River basin, and the Muddy River is a tributary to the lower Colorado River via Lake Mead. Reclamation operates the Lower Colorado River Multi-Species Conservation Program (LCRMSCP) and has been a partner in the region. Through 2017, the LCRMSCP operated in Southern Nevada, conducting and helping to support other threatened and endangered bird monitoring, specifically flycatcher and cuckoo surveys.

Will the project benefit any tribe(s)?
The Moapa Band of Paiutes Reservation is located just downstream of the project area. The restoration activities described in this project will improve wildlife habitat and decrease erosion along the Muddy River. This will improve water quality for downstream users, including those on the reservation.

Does the applicant receive Reclamation project water?
Yes, but not for this site or project.

Is the project on Reclamation project lands or involving Reclamation facilities?
No.

Is the project in the same basin as a Reclamation project or activity?
Yes, it is in the lower Colorado River basin where Reclamation operates the LCRMSCP.

Will the proposed work contribute water to a basin where a Reclamation project is located?
The project is located along streams and springs at the headwaters of the Muddy River which flows into Lake Mead (and thus the Colorado River), which is operated by Reclamation. There are likely to be minimal water contributions from this project, but it will reduce erosion and non-native vegetation along the river, improving habitat and water quality for downstream users.

E.1.6. Evaluation Criterion F—Department of the Interior and Bureau of Reclamation Priorities

Department of Interior Priorities
1a. ***Creating a conservation stewardship legacy second only to Teddy Roosevelt by utilizing science to identify best practices to manage land and water resources and adapt to changes in the environment***.
These three treatments and the habitat they create will be extensively monitored to determine which is most successful in providing benefits for threatened and endangered bird species and provides the greatest long-term sustainability.

Reclamation Priorities
4.***Address Ongoing Drought***
This project also addresses ongoing drought in the Southwest. Coupled with mismanaged lands, drought has resulted in a decreased resiliency of natural areas. Drought increases erosion by reducing native vegetation that lines the banks of rivers and streams and increasing non-native species. This project will address both issues by expanding the flood plain, armoring the banks with native vegetation and removing non-native vegetation. These combined efforts will create resilient habitat for a variety of wildlife.

6. Project Budget: Funding Plan
SNWA as an organization is funded by diverse sources, including a quarter-cent sales tax, connection fees, commodity fees, and reliability charges. Funding for its work at WSNA is provided by an expansion bond. This revenue source ensures the financial stability of the work conducted at the site and several other SNWA properties. Matching contributions for this project will be provided by SNWA, through the salary and fringe benefits of project staff and travel to and from WSNA in Moapa, Nevada, from its offices in Las Vegas.

No funding will be provided by a source other than the applicant, so no letters of commitment are required. The value of third-party contributions noted in Tables 1 and 2 is in the form of in-kind contributions of volunteer labor and is described in the Budget Narrative section.

7. Project Budget: Budget Proposal

Table 1. Total Project Cost Table

SOURCE	AMOUNT
Costs to be reimbursed with the requested Federal funding	$189,351
Cost to be paid by the applicant	$221,543
Value of third-party contributions	$11,848
TOTAL PROJECT COST	$422,742

Table 2. Budget Proposal

BUDGET ITEM DESCRIPTION	$/Unit	Qty	Unit	Total
Salaries and Wages				
Administrative Secretary (Bella Castro)	37	60	Hour	$2,220
Assistant Management Analyst (Julie Schoolmeester)	38	40	Hour	$1,520
Warm Springs Maintenance Coordinator (Robert Shakespear)	32	330	Hour	$10,560
Preserve Restoration Ecologist (Von Winkel, Project Manager)	64	865	Hour	$55,360
Preserve Archaeologist I (Nathan Harper)	54	100	Hour	$5,400
Environmental Biologist I (Timothy Ricks)	54	25	Hour	$1,350
Environmental Biologist II (Nicholas Rice, Jason Eckberg, David Syzdek, Deborah Van Dooremolen)	65	650	Hour	$42,250
Division Manager (Keiba Crear)	84	90	Hour	$7,560
Fringe Benefits				
Administrative Secretary	37	60	70%	$1,554
Assistant Management Analyst	38	40	70%	$1,064
Warm Springs Maintenance Coordinator	32	330	70%	$7,392
Preserve Restoration Ecologist	64	865	70%	$38,752
Preserve Archaeologist I	54	100	70%	$3,780
Environmental Biologist I	54	25	70%	$945
Environmental Biologist II	65	650	70%	$29,575
Division Manager	84	90	70%	$5,292
Travel				
Mileage for roundtrip travel - Las Vegas to WSNA	0.575	12,120	Mile	$6,969
Equipment				
Track hoe (excavator) - rental	7,000	2	Month	$14,000
Supplies and Materials				
Plants from Nevada Division of Forestry Nursery	7	2,000	Plant	$14,000
Plants from Mountain States Wholesale Nursery	3	900	Plant	$2,700
Propagation materials (pots, trays, soil)	925	Misc.	Misc.	$925
Fencing fabric (cages)	2	4,000	Sq. yd	$8,000

Fence posts	4	1,500	Post	$6,000
Weed barrier fabric	0.5	2,000	Sq. yd	$1,000
Straw wattles and stakes	1.1	2,500	Lin. ft	$2,750
Irrigation pump, fittings, and shelter	4,500	1	Pump	$4,500
Irrigation materials (pipe, fittings, emitters, glue)	2,000	Misc.	Misc.	$2,000
Contracts				
Soil-Tech (or equivalent)				
Laborer	18	3,000	Hour	$54,000
Equipment Operator	22	1,000	Hour	$22,000
Field Supervisor	30	135	Hour	$4,050
Site preparation supplies and materials including but not limited to hand tools and rental equipment	9,300	Misc.	Misc.	$9,300
Indirect cost: 20%-labor,12%-supplies/materials	17,126	Misc.	Misc.	$17,126
L.J. McCormick (or equivalent)				
Excavator and operator	150	120	Hour	$18,000
Dump truck and driver	75	120	Hour	$9,000
In-kind Contributions				
Volunteer labor (16 years or older)	22.61	524	Hour	$11,848
TOTAL DIRECT COSTS				$422,742
TOTAL ESTIMATED PROJECT COSTS				$422,742

8. Project Budget: Budget Narrative

All costs included in this proposal are directly related to the project and necessary for its implementation. The non-federal contribution is 55.2 percent; the federal contribution is 44.8 percent.

Salaries and Wages

Von Winkel, Preserve Restoration Ecologist, will be the Project Manager. He will develop and implement the project plan and oversee contract development. He will also purchase plants, assist with plant propagation, and coordinate and oversee contractor and volunteer efforts. He will also conduct site and plant monitoring to ensure success and take the lead on grant reporting. He will spend an estimated 865 hours on the project and is at the top of his salary range at $64/hour. Robert Shakespear, Warm Springs Maintenance Coordinator, will maintain the propagation facility and will assist with contractor and volunteer training and oversight. Robert will spend an estimated 330 hours on the project and is at the mid-point of his salary range at $32/hour. Nathan Harper, Preserve Archaeologist I, will conduct all cultural resource compliance work needed for the project, spending an estimated 100 hours at a rate of $55/hour, at the top of his salary range. Nicholas Rice, Environmental Biologist II, will assist with contractor and volunteer communication, training, and oversight, and help with plant material acquisition and grant reporting. Nicholas will spend an estimated 300 hours on the project and is at the top of his salary range at $65/hour. Jason Eckberg, Environmental Biologist II, will propagate plants and help with plant material acquisition for the project. He will also assist with contractor and

volunteer communication, training, and oversight. Jason will spend an estimated 250 hours on the project and is at the top of his salary range at $65/hour. Keiba Crear, Division Manager, supervises the staff conducting the project and will review project plans and reports and approve invoices. She will spend an estimated 90 hours on the project and is at the top of her salary range at $84/hour. Other staff who will support the effort include Bella Castro, Administrative Secretary, 60 hours at $37/hour; Julie Schoolmeester, Assistant Management Analyst, 40 hours at $38/hour; Timothy Ricks, Environmental Biologist I, 25 hours at $54/hour; David Syzdek and Deborah Van Dooremolen, both Environmental Biologist II, combined 100 hours at $65/hour.

Fringe Benefits
Retirement = 38%
Medical Insurance = 17%
Other = 15%
Total = 70%

Travel
Most staff that will work on this project are based in SNWA's Las Vegas office, and WSNA is approximately 60 miles away, or 120 miles roundtrip. Staff members will make 101 trips to the property for this project for a total of 12,120 miles at the federal rate (2020) of $0.575. These trips will be conducted to propagate plants in the greenhouse; oversee site preparation; conduct cultural resource and other needed clearance surveys; perform contractor oversight; coordinate planting events; and soil, site, and plant monitoring.

Equipment
A track hoe (excavator) will be rented at $7,000/month for two months to prepare sites.

Supplies and Materials
Staff will purchase an estimated 2,000 plants from the Nevada Division of Forestry Nursery at $7/plant and an estimated 900 plants from Mountain States Wholesale Nursery at $3/plant. Staff will buy various propagation materials (pots, trays, soil) costing an estimated $925 to grow plants for the project. Staff will purchase an estimated 4,000 square yards of fencing fabric at $2/square yard and an estimated 1,500 fence posts at $4 each for plant cages. Staff will buy an estimated 2,000 square yards of weed barrier fabric at a cost of $0.50/square yard to protect areas from weeds. Staff will purchase an estimated 2,500 linear-feet of straw wattles and stakes for $1.1 each. Finally, staff will buy an irrigation pump, fittings, and shelter at a cost of $4,500, as well as various other irrigation materials (pipe, fittings, emitters, glue) at a cost of $2,000 to construct irrigation systems. Costs were calculated from vendor webpages and prior invoices (provided in Appendix C).

Contracts
Labor and soil excavation contracts are required for this project. Tasks to be completed by the labor contract include harvesting, preparing, and installing poles and cuttings; installing trees and understory plants with irrigation where necessary; installing cages and weed barrier fabric around trees; and weeding and maintaining cages and weed barrier. This $106,476 contract will be procured through a formal bidding process. Tasks to be completed by the soil excavation contract will include excavating stream banks and transporting soil to various parts of the

property. This $27,000 contract will be procured through a formal bidding process. The contractor will use a mid-sized excavator (track hoe) and a dump truck. Costs were generated from contractor quotes (provided in Appendix C).

Third-Party In-Kind Contributions
A portion of the labor to complete this project will be provided in-kind through volunteer hours. Volunteers will plant vegetation associated with this project, including container plants and poles, and may assist with propagation. Based on previous restoration efforts that used volunteer labor, it is anticipated that 80 volunteers 16 years or older will donate 524 hours. Independent Sector's Nevada Volunteer Hourly Rate is $22.61, providing an in-kind match of $11,848.

Environmental and Regulatory Compliance Costs
Please review responses in the Environmental and Cultural Resources section. SNWA does not anticipate additional costs associated with environmental compliance. If SNWA receives an award, possible costs will be discussed during the development of the financial agreement.

Other Expenses
There are no other expenses requested for this project.

Total Direct Costs
Reclamation is requested to contribute $189,351.00 toward direct costs. SNWA will provide a cash match of $221,543.00, with in-kind contributions as noted above of $11,848.

Indirect Costs
Not applicable. All direct costs align with eligible categories. SNWA does not have a federally negotiated indirect cost rate agreement. No funds are requested for indirect costs.

9. Environmental and Cultural Resources Compliance

Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.
Yes, the proposed project will impact the surrounding environment. Restoration work involving earth disturbance will include removing non-native vegetation, excavating to widen the riparian corridor along the North and South forks, and augering holes and digging trenches for the planting of vegetation. Soils exposed by project actions will be susceptible to erosion by water or wind. Straw wattles will be installed next to streams to protect them from sediment during rain events. While some of this work may have negative impacts in the short-term, long-term impacts will be positive. Replacing non-native vegetation with native vegetation will reduce shading of adjacent streams and increase nutrient input by leaf fall, which will increase food supplies for native fish. Expanding the riparian corridor and connecting adjacent patches of riparian vegetation will improve the habitat quality of these stands for bird species, including the southwestern willow flycatcher and yellow-billed cuckoo. Any habitat that will be removed by project activities is of marginal quality. A Secretary of Interior-qualified cultural resources specialist will monitor any earth-disturbing activities.

Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?
The federally endangered Moapa dace occurs in the project area in springs and streams. Project work will avoid direct impacts to aquatic habitat. However, riparian restoration work will improve dace habitat by replacing non-native vegetation with natives, which will reduce stream shading by palm trees, increase nutrient input by native tree leaf fall, and reduce wildfire risk and impacts. Both the federally endangered southwestern willow flycatcher and threatened yellow-billed cuckoo have been documented as nesting on WSNA and are regularly detected in the breeding season. This project, with its focus on riparian and mesquite restoration, should benefit both species by increasing potentially suitable nesting habitat. The work will occur outside of the breeding season for both species and so will not negatively impact them. There is no designated critical habitat for the flycatcher in the project area; critical habitat has not been designated for the cuckoo or dace.

Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as "Waters of the United States?" If so, please describe and estimate any impacts the proposed project may have.
The area contains springs, streams, and the Muddy River which are "Waters of the United States." However, restoration will not directly impact these waters.

When was the water delivery system constructed?
GIS analysis of contemporary maps and 1940s water rights applications indicates that the ditches were constructed after 1948.

Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.
This project will not impact any irrigation system features.

Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at your local Reclamation office or the State Historic Preservation Office can assist in answering this question.
Fifteen cultural sites within WSNA are eligible for listing on the National Register. No significant cultural sites are located in the proposed restoration areas.

Are there any known archeological sites in the proposed project area?
No.

Will the proposed project have a disproportionately high and adverse effect on low income and minority populations?
No.

Will the proposed project limit access to and ceremonial use of Indian sacred sites or result in other impacts to tribal lands?
No.

Will the proposed project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?
No. This project will remove non-native invasive trees and noxious weeds and will reduce seed sources for non-native weeds in riparian areas. Staff will take steps such as cleaning equipment entering the area for soil and weed seeds and utilizing weed barrier fabric and will monitor restoration sites for non-native plants and noxious weeds to ensure restoration success.

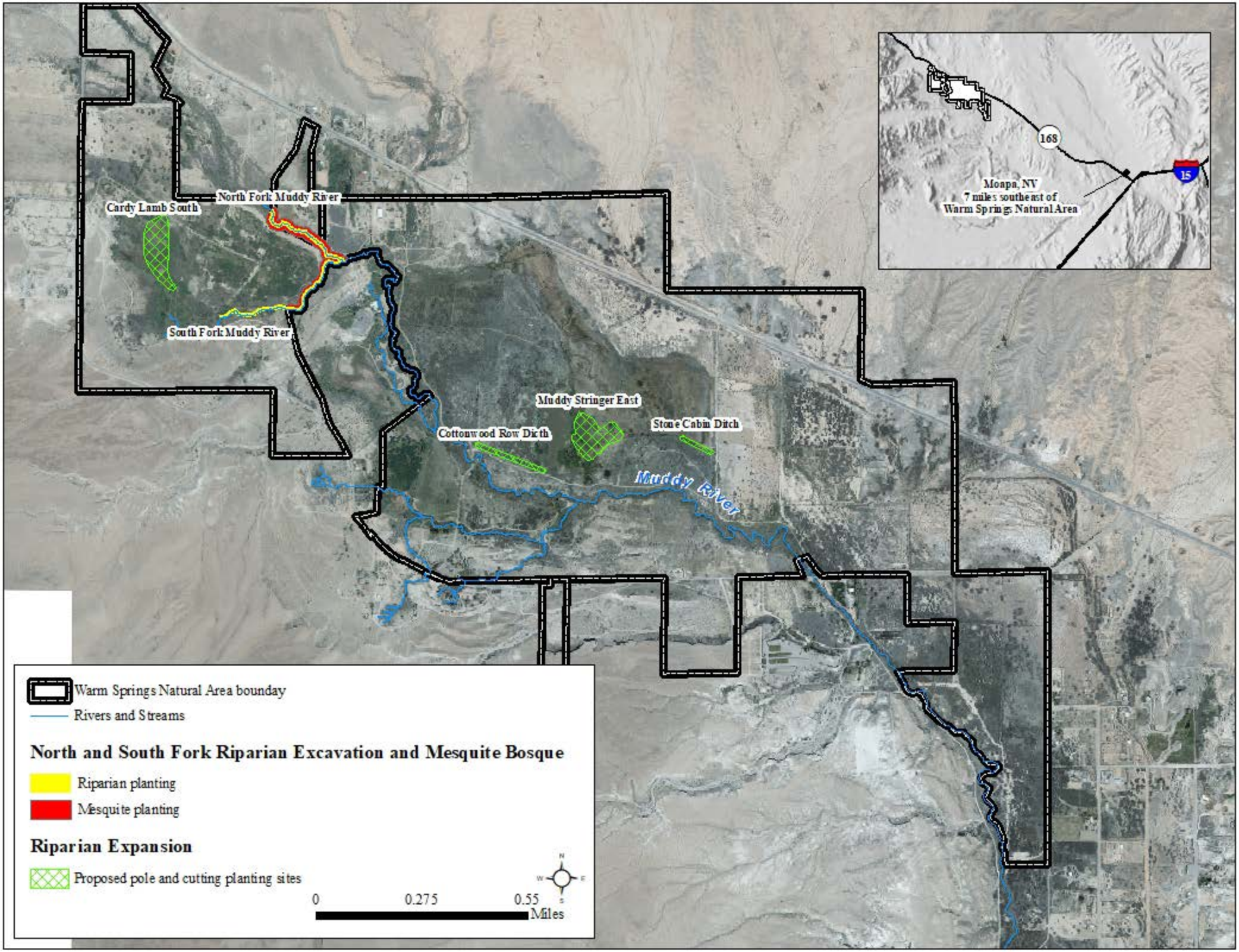
10. Required Permits or Approvals
None.

11. Letters of Support
Attached as Appendix D.

12. Official Resolution
An official resolution authorizing the submission of this proposal and confirming the subject matching requirements will go before the SNWA Board of Directors at its September 17, 2020 meeting due to the August 20, 2020 Board Meeting cancelation. A copy will be forwarded to Reclamation at that time, as communicated to the Program Director.

13. Unique Entity Identifier
SNWA maintains an active registration in SAM.gov. Its Cage Code is 3NRT9. SNWA's unique entity identifier, or DUNS No., is 135965650.

Appendix A Warm Springs Natural Area Map


Cardy Lamb South
North Fork Muddy River
South Fork Muddy River
Muddy Stringer East
Cottonwood Row Ditch
Stone Cabin Ditch
Muddy River
168
15
Moapa, NV
7 miles southeast of
Warm Springs Natural Area
Warm Springs Natural Area bounday
Rivers and Streams
North and South Fork Riparian Excavation and Mesquite Bosque
Riparian planting
Mesquite planting
Riparian Expansion
Proposed pole and cutting planting sites
0
0.275
0.55
Miles

Appendix B Water Resource Plan

SOUTHERN NEVADA WATER AUTHORITY™

2019 WATER RESOURCE PLAN

SOUTHERN NEVADA WATER AUTHORITY

BOARD OF DIRECTORS

Marilyn Kirkpatrick, CHAIR
Las Vegas Valley Water District

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Big Bend Water District

Justin Jones
Clark County Water Reclamation District

John Lee
City of North Las Vegas

John J. Entsminger
General Manager

The Southern Nevada Water Authority (SNWA) is a cooperative, not-for-profit agency formed in 1991 to address Southern Nevada's unique water needs on a regional basis.

SOUTHERN NEVADA WATER AUTHORITY

MISSION

Our mission is to provide world class water service in a sustainable, adaptive and responsible manner to our customers through reliable, cost effective systems.

GOALS

Assure quality water through reliable and highly efficient systems.

Deliver an outstanding customer service experience.

Anticipate and adapt to changing climatic conditions while demonstrating stewardship of our environment.

Develop innovative and sustainable solutions through research and technology.

Ensure organizational efficiency and manage financial resources to provide maximum customer value.

Strengthen and uphold a culture of service, excellence and accountability.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

SINCE ITS INCEPTION IN 1991, THE SOUTHERN NEVADA WATER AUTHORITY HAS WORKED TO SECURE NEW WATER RESOURCES FOR SOUTHERN NEVADA, MANAGE EXISTING AND FUTURE WATER SUPPLIES, CONSTRUCT AND OPERATE REGIONAL WATER FACILITIES, AND PROMOTE CONSERVATION.

The Southern Nevada Water Authority (SNWA) was formed in 1991 by a cooperative agreement among seven water and wastewater agencies. Collectively, the SNWA member agencies serve more than 2.2 million residents in the cities of Boulder City, Henderson, Las Vegas, North Las Vegas and areas of unincorporated Clark County. As their wholesale water provider, the SNWA is responsible for water treatment and delivery, as well as acquiring and managing long-term water resources for Southern Nevada.

SNWA Member Agencies:

- Big Bend Water District
- City of Boulder City
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Clark County Water Reclamation District
- Las Vegas Valley Water District

The SNWA Cooperative Agreement calls for the adoption of a water resource plan to be reviewed annually by the SNWA Board of Directors. The 2019 SNWA Water Resource Plan fulfills this requirement, providing a comprehensive overview of projected water demands in Southern Nevada, as well as the resources available to meet those demands over time.

THE CURRENT PLANNING ENVIRONMENT

Beginning in 2000 and continuing today, several water supply and demand changes have occurred—both locally and regionally—that create uncertainty for water planning agencies across much of the western United States. By far, the most significant change affecting Southern Nevada has been the onset and persistence of drought in the Colorado River Basin.

Between 2000 and 2019, overall snowfall and runoff into the Basin were well below normal, representing one of the lowest 20-year periods on record. While snowpack and runoff conditions improved in 2019, the persistence of decades-long drought conditions has resulted in significant water-level declines in major system reservoirs. As of late 2019, the combined water storage in the Colorado River's two primary reservoirs (Lake Mead and Lake Powell) was at just 47 percent of capacity.

In the near term, hydrologic modeling indicates a high probability that Lake Mead water levels will continue to decline. Under the Colorado River Drought Contingency Plan (DCP), water users in the Lower Basin, including Nevada, will begin making additional contributions to Colorado River storage when Lake Mead is projected to be at or below 1,090 feet. These contributions are in addition to mandatory shortages and together serve to bolster Lake Mead water levels and preserve critical operations.

Beyond the current challenges presented by drought, climate change is another unpredictable variable associated with the long-term availability of water supplies. Multiple studies project a warmer and drier future, both locally and regionally. Projected climate change impacts range from decreased snowpack, precipitation and soil moisture to increased evaporation and stronger, longer and more frequent droughts. According to the U.S. Bureau of Reclamation's 2012 Colorado River Basin Water Supply and Demand Study, the Colorado River is projected to experience a median imbalance of 3.2 million acre-feet per year (AFY) between supply and demand by the year 2060 as a result of climate change and increased demands within the Basin.

The current planning environment also includes uncertainty associated with facility operations, the availability of future resources, and the accuracy of long-term water demand forecasts. These considerations, as well as how they are addressed in

the 2019 Plan, are detailed briefly in the following sections.

SUPPLY & DEMAND

Water resource planning is based on two key factors: supply and demand. Supply refers to the amount of water that is available or that is expected to be available for use. Water demand refers to the amount of water expected to be needed in a given year. Water demand projections are based on population forecasts and include assumptions about future water use, such as expected achievements toward water conservation goals.

Projecting future demands is uncertain, particularly during periods of significant social and economic change. Assumptions are a necessary part of the planning process and conditions are unlikely to occur exactly as assumed. Likewise, climate variations, policy changes, implementation of new regulations and other factors can influence water resource availability over time.

The SNWA has worked for more than 25 years to develop and manage a portfolio of water resource options that can be used flexibly to meet short- and long-term water demands. The portfolio approach allows SNWA to assess water demand conditions and resource options, and make appropriate decisions regarding what resources to bring online when necessary.

The SNWA's water resource portfolio includes permanent, temporary and future resources. Some of these resources are available for immediate use, such as Nevada's Colorado River allocation, Las Vegas Valley groundwater, Intentionally Created Surplus (ICS) and banked resources, while others may require the construction of additional infrastructure or are pending state and/or federal review processes.

Likewise, water conservation plays a critical role in helping the community to balance supply and demand. Conservation helps to reduce demands and extend the availability of current and future water supplies. SNWA projects an estimated savings of 24,000 - 28,000 acre-feet of water in 2035 by achieving the community's current water conservation goal of 105 gallons per capita per day (GPCD) by 2035. As of 2018, Southern Nevada's use is at 113 GPCD.

To promote water efficiency and reduce water waste, the SNWA continues to implement one of the most comprehensive water conservation programs in the nation. The program has helped the region reduce per capita water use by approximately 46 percent between 2002 and 2018, despite the addition of approximately 690,000 new residents.

While conservation gains have been remarkable over the past two decades, progress towards the community's conservation goal slowed over the last few years. This could be the result of several factors, including favorable economic conditions, warmer and dryer local weather conditions, and/or a fading community conservation drought response.

Improving water efficiency and reducing water waste is integral to SNWA's resource planning efforts and conservation must remain a top priority for the community over the long-term planning horizon. As described in later portions of this Plan, the SNWA has expanded conservation education, outreach and incentive programs to help the community get back on track with conservation progress. These efforts are ongoing, with notable improvement for 2019.

PLANNING FOR UNCERTAINTY

While preparing the 2019 Plan, SNWA also considered other factors related to water supply and demand conditions, including:

- The potential impact of continued drought and climate change on water resource availability, particularly for Colorado River supplies; and
- The potential impact of economic conditions, climate change and water use patterns on long-term water demands.

As in prior years, the SNWA used a scenario-based planning approach for its 2019 Plan. Key factors evaluated include possible reductions of Colorado River supplies, variation in future demands, and additional conservation.

As part of its planning process, SNWA considered the increasing likelihood that water supply reductions would be imposed for Colorado River supplies in the near-term planning horizon. Mandatory water use reductions and other

contributions are based on the projected surface elevation of Lake Mead. Under federal shortage rules and the DCP, Nevada 's total obligation ranges from 8,000 to 30,000 acre-feet per year (AFY) when Lake Mead's surface elevation is projected to be at or below 1,090 feet. At the time of Plan publication, Lake Mead's elevation was at 1,083 feet. Additional information about Colorado River water use reductions is provided in Chapter 3.

The SNWA also considered economic growth in Southern Nevada. Long-term projections indicate that the region will continue to grow in the future. However, a high level of uncertainty remains as to the magnitude and timing of population change, and what impact that change will have on associated short- and long-term water demands.

As further described in Chapter 4, SNWA's resource planning scenarios consider these factors and bracket the range of reasonable supply and demand conditions that may be experienced over the 50-year planning horizon. This is a conservative approach that demonstrates how SNWA plans to meet future needs, even if conditions change significantly over time.

ADAPTIVE MANAGEMENT

Working with the community, SNWA has implemented several adaptation strategies to respond to drought impacts. From the development of new facilities and aggressive water conservation to water banking and system conservation initiatives, these efforts have reduced the potential for customer impacts.

SNWA's adaptation response measures include the construction of a new Low Lake Level Pumping Station at Lake Mead to help protect Southern Nevada from potential impacts of continued Lake Mead water level declines. When complete in 2020, the pumping station will work in conjunction with SNWA's Lake Mead Intake No. 3 to preserve Southern Nevada's access to Colorado River water supplies below 1,000 feet.

Likewise, water conservation has reduced the potential for near-term supply impacts associated with mandatory reductions and other contributions due to ongoing drought and declining Lake Mead water levels. Nevada's Colorado River consumptive use was approximately 244,000 AFY in 2018, as described in Chapter 2. This is well below the minimum amount of basic Colorado River supply available to Nevada as further described in this Plan.

Water conservation has far-reaching benefits to the community and the Colorado River system as a whole. Locally, water conservation increases water efficiency and reduces demands. It also allows SNWA to store or "bank" unused supplies. This, in turn, provides SNWA with added flexibility in responding to drought conditions and meeting future demands. As of 2018, the SNWA stored nearly two million acre-feet (AF) of water. This is more than eight times Nevada's 2018 consumptive Colorado River water use.

Water conservation helped SNWA to meet its commitments with interstate and federal partners to store water in Lake Mead. Together, partners have bolstered Lake Mead storage through Intentionally Created Surplus, as well as System Conservation and other initiatives that benefit the Colorado River system as a whole. Likewise, efforts by interstate and federal partners to develop and implement new Drought Contingency Plans in 2019 are helping to slow the decline of Lake Mead and Lake Powell water levels. To date, collaborations have reduced Lake Mead's water level decline by approximately 32 feet.

These efforts have provided SNWA with time to complete new intake and pumping infrastructure, helped to forestall a Colorado River shortage declaration, and offer greater opportunities for water storage and recovery. Other benefits to the community include reduced pumping costs, enhanced operational flexibility and increased access to temporary supplies during shortages.

CURRENT PRIORITIES

As discussed in the chapters that follow and with continued progress toward the community's water conservation goals, SNWA has sufficient permanent, temporary and future resources to meet all future planning scenarios described in Chapter 4.

Continued persistence and resolve will be required as the region faces prolonged drought, and as the entire Southwest region responds to hydrologic challenges related to climate change. Top priorities for SNWA are to:

- Preserve access to Colorado River supplies by completing the development of new facilities at Lake Mead.
- Reduce water demands and maximize the use of available resources through aggressive water conservation.
- Bank conserved resources and grow temporary supplies that can be used flexibly to meet demands and/or offset potential supply reductions.
- Work with interstate and federal partners on initiatives designed to slow the decline of Lake Mead water levels, reduce the magnitude of potential supply reductions, and investigate temporary and future resource opportunities.
- Continue to make progress on water rights and environmental permitting processes for the development of future resources, participating in legal and regulatory processes as needed to protect the availability of future resource options.

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PLAN INTRODUCTION

THIS CHAPTER PROVIDES AN OVERVIEW OF SNWA RESOURCE PLANNING EFFORTS. IT INCLUDES AN ABBREVIATED HISTORY OF WATER IN SOUTHERN NEVADA, FOCUSING ON MAJOR ISSUES AND INITIATIVES THAT OCCURRED DURING THE LAST CENTURY.

INTRODUCTION

For much of its past, the area now known as Clark County was little more than a collection of scarce watering holes for various trails through the Mojave Desert. With the coming of the railroad in 1905, the privately operated Las Vegas Land and Water Company was formed to build and operate the area's first system for conveying local spring water. In these early years, the community viewed its supply of artesian water as virtually inexhaustible and more than adequate to meet the needs of any growth that might occur.[1]

In 1922, the Colorado River Compact defined the geographic areas of the upper and lower basins of the Colorado River, apportioning 7.5 million acre-feet of water per year (AFY) to each. Of the Lower Basin's 7.5 million AFY, the Boulder Canyon Project Act authorized the apportionment of 300,000 AFY to Nevada, 2.8 million AFY to Arizona and 4.4 million AFY to California. At the time, Nevada's negotiators viewed 300,000 AFY as more than a reasonable amount; Southern Nevada had no significant agricultural or industrial users, and groundwater seemed plentiful.[2]

These conditions changed significantly over time. By 1940, local resource managers began expressing concerns about limited groundwater supplies, water waste and declining groundwater levels. While the Colorado River Compact and subsequent construction of Hoover Dam in 1936 made Colorado River water a viable future resource, the lack of infrastructure and sufficient funding for capital improvements precluded any immediate use to support development in the growing region.

In 1947, the Nevada Legislature created the Las Vegas Valley Water District (LVVWD) to help manage local water supplies. The LVVWD acquired the assets of the Las Vegas Land and Water Company and began operations in 1954 as the municipal water purveyor for Las Vegas and unincorporated Clark County.

Shortly thereafter, LVVWD entered into agreements with what is now known as Basic Water Company (BWC) for the expansion of BWC's small industrial water line to deliver Colorado River water to the LVVWD service area.

Given the astonishing pace of growth that occurred over the next several years and the limits of the existing pipeline, LVVWD initiated formal engineering studies for new facilities to import additional Colorado River water into the Las Vegas Valley from Lake Mead. This effort ultimately resulted in the construction of the Alfred Merritt Smith Water Treatment Facility and associated intake, pumping and transmission facilities (collectively referred to as the Southern Nevada Water System or SNWS), which became operational in 1971. The SNWS was first expanded in 1982 (and again in the years to follow) in response to increasing demands.

By the latter part of the 20th century, water planners estimated that the region would soon reach the limits of its Colorado River apportionment.[3] In 1989, as a result of profound uncertainty created by population growth and future resource availability, the LVVWD filed applications for unappropriated groundwater in eastern Nevada and began storing its remaining unused Colorado River water for future use (see Chapter 2). During this time, the community also implemented its first significant conservation effort—Operation Desert Lawn. The program resulted in ordinances by the local municipalities restricting landscape irrigation during the hottest times of the day.

CREATION OF SNWA

By the end of the 1980s, resource challenges had reached a critical point; with the new decade, local leaders began to aggressively explore different options for extending and managing water resources, while meeting the ongoing demands of the community.

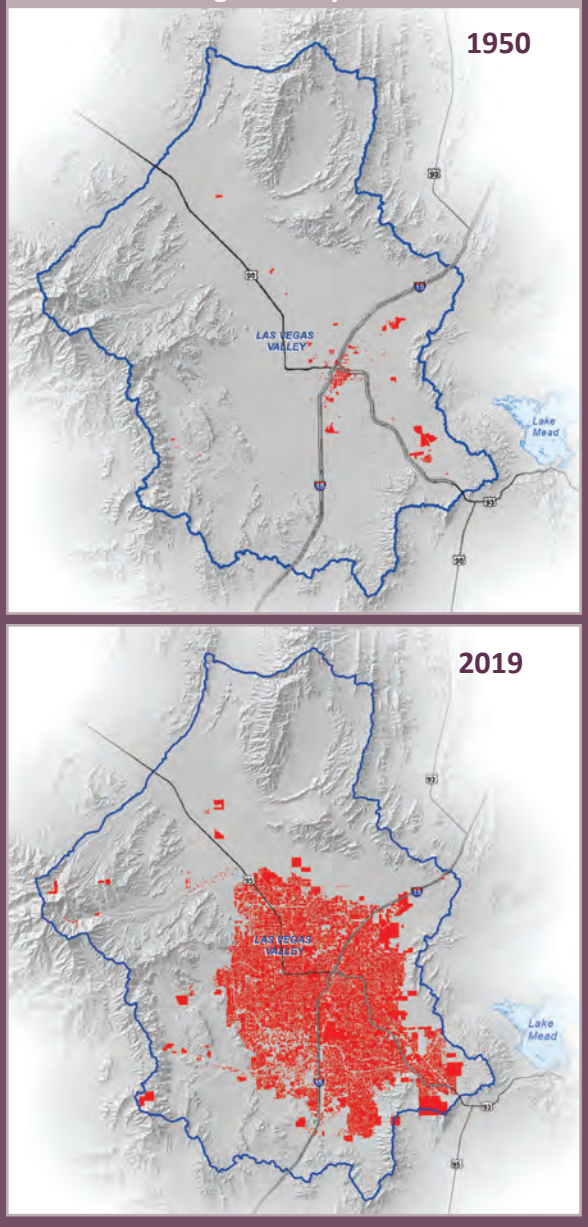
A Century of Change

With the birth of Las Vegas in 1905 as a way station for the San Pedro, Los Angeles and Salt Lake Railroad, Southern Nevada began to attract a large number of residents and businesses.

From an estimated population of more than 40,000 in 1950 to nearly 2.3 million in 2018, the Southern Nevada region has experienced change faster than almost any other region in the nation during this same time. Population density in the Las Vegas area is the highest in the interior western U.S.[4]

Today, Southern Nevada is home to 74 percent of Nevada's total population. The region uses less than five percent of all water available for use in the state.

Las Vegas Valley Land Use



One of the most significant events to occur during this time was the formation of the Southern Nevada Water Authority (SNWA) in 1991 through a cooperative agreement among seven water and wastewater agencies:

- Big Bend Water District
- City of Boulder City
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Clark County Water Reclamation District
- Las Vegas Valley Water District

Today, these seven agencies provide water and wastewater service to more than 2.2 million residents in the cities of Boulder City, Henderson, Las Vegas and North Las Vegas, and portions of unincorporated Clark County (Figure 1). Since its inception, SNWA has worked to acquire and manage water supplies for current and future use; construct and operate regional water facilities; and promote conservation.

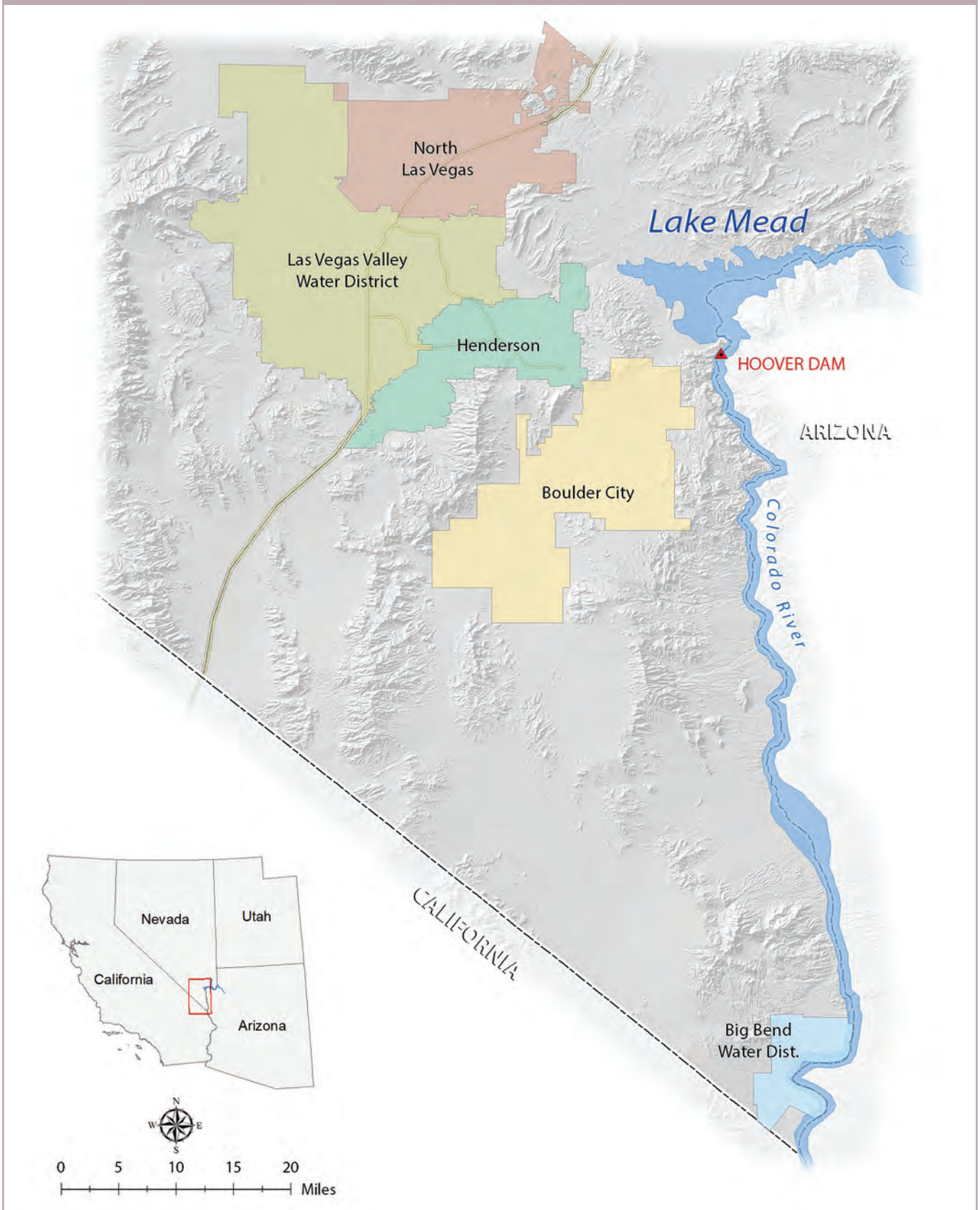
Water Supply Acquisition and Management

Since 1991, SNWA has worked diligently to develop and manage a flexible portfolio of diverse water resource options resulting from years of in-state, interstate and international collaborations. These resources include groundwater and surface water rights in the state of Nevada, Colorado River water, as well as temporary resources that are stored in the form of storage credits. A detailed summary of the SNWA Water Resource Portfolio is provided in Chapter 3.

Construction and Operation of Regional Water Facilities

To meet the community's current and long-term water resource needs, SNWA is responsible for constructing and operating regional water facilities, including the SNWS, which was expanded in 2002 to include the River Mountains Water Treatment Facility. The SNWA has completed several improvements and expansions to these facilities over the years to increase capacity to 900 Million Gallons per Day (MGD). Pumping facilities and state-of-the-art treatment and laboratory facilities were also constructed and updated to ensure the availability of high-quality, reliable water supplies. These efforts were phased, coming online just in time to meet demands.

FIGURE 1 **SNWA Purveyor Service Areas**



The SNWA is responsible for managing Southern Nevada's long-term water resources, constructing and operating facilities and encouraging water conservation.

Planning for the Future

The SNWA's 2019 Plan is based on an integrated resource planning process that involved public stakeholders.

In 1996, the SNWA Cooperative Agreement was amended to require adoption of a Water Resource Plan. The SNWA's first Water Resource Plan was adopted in 1996;[7] the SNWA has reviewed its plan annually since then, adopting revisions as needed.

The plan reflects changing developments in Southern Nevada's overall water resource picture. Since the plan's inception, those developments have come principally from water demand changes as well as from landmark changes in rules, agreements or other factors affecting the region's water supplies.

The SNWA's 21-member Integrated Resource Planning Advisory Committee was asked to address issues related to the Colorado River drought, the effects of climate change, and the effects of declining water reservoir levels on the reliability of Southern Nevada's municipal water system. The committee was formed in 2012 to assist SNWA with its long-term planning efforts and was comprised of citizens representing diverse areas of the community. Phase 1 and 2 committee recommendations were presented to the SNWA Board of Directors in September 2013 and December 2014, respectively.

As discussed in Chapter 2, SNWA recently put its new raw water intake (Intake No. 3) into production and is working to construct a new Low Lake Level Pumping Station at Lake Mead. Together, these facilities will preserve access to existing Colorado River water supplies. These efforts are in response to extraordinary drought conditions in the Colorado River Basin and to offset risk associated with future Lake Mead water level declines.

Water Conservation

The SNWA and its member agencies have worked diligently over the years to maximize the availability of existing water supplies and reduce overall water demands. The community's first water conservation plan was adopted in 1995[5] and the SNWA's current plan was adopted in 2019.[6] During this time frame, the community has consistently set and achieved aggressive water conservation goals.

To promote conservation efforts, SNWA developed and implements a comprehensive water conservation program consisting of regulation, pricing, education and incentives designed to work together to improve water efficiency and reduce demands. The SNWA member agencies also implemented a number of water use and development ordinances, which have since become a permanent part of the community's overall conservation effort. Information on Southern Nevada's conservation efforts is provided in Chapter 3. Detailed program information and other conservation resources are available online at snwa.com.

2019 Water Resource Plan and Water Budget

The SNWA's 2019 Plan provides a comprehensive overview of water resources and demands in Southern Nevada, and discusses factors that will influence resource availability and use over a 50-year planning horizon. The plan does not intend to specifically address all aspects of water resource management and development; rather, it serves as a companion to other detailed planning documents, including:

- SNWA Major Construction and Capital Plan
- SNWA Water Conservation Plan
- Regional Water Quality Plan for the Las Vegas Valley Watershed
- Annual Operating Plan for the Las Vegas Valley Watershed

- SNWA Financial Budget and Comprehensive Annual Financial Report
- SNWS Operating Plan
- SNWA Water Budget

Integrated Resource Planning

As part of its overall water resource planning efforts, the SNWA has completed a number of integrated water resource planning processes. Integrated resource planning applies important concepts to traditional resource and facility planning, including involvement of the public early in the planning process as well as frequent reassessment, particularly as conditions change. These efforts have helped identify the appropriate combination of resources, facilities, conservation programs and funding formulas needed to meet current and future water demands in Southern Nevada.

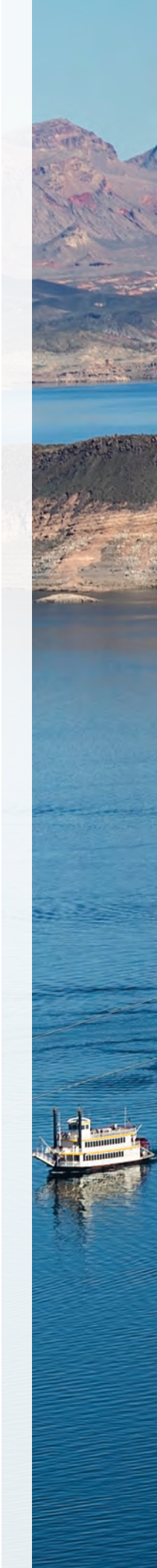
Recommendations resulting from these integrated resource planning processes are presented to the SNWA Board of Directors for consideration and incorporated into overall water resource planning efforts as approved. The 2019 Plan incorporates the recommendations from SNWA's most recent Integrated Resource Planning Advisory Committee, which were approved by the SNWA Board of Directors in December 2014.

CHAPTER SUMMARY

The SNWA Water Resource Plan is an important tool designed to help SNWA anticipate and plan for future water supply and related facility needs, which have changed significantly over the years.

Since its formation in 1991, the SNWA has worked closely with its member agencies to meet the region's long-term water demands by acquiring and managing current and future water supplies; constructing and operating necessary facilities; and promoting conservation. In addition, SNWA has developed partnerships with other Colorado River Basin States (Basin States), working collaboratively to maximize opportunities for the flexible use of Colorado River resources.

These efforts will continue to be of paramount importance in the years to come, particularly as climate change and drought are anticipated to reduce the availability of supplies, and as economic expansion continues in Southern Nevada. These challenges, as well as SNWA's associated response efforts, are discussed in Chapter 2. The balance of this document provides a comprehensive overview of the SNWA Water Resource Portfolio (Chapter 3); a detailed discussion of how SNWA plans to meet current and future regional water demands (Chapter 4); and a discussion on environmental initiatives underway to support water resource development and management efforts (Chapter 5).



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2 "The Hoover Dam Documents," 1948, Ray Lyman Wilbur and Northcutt Ely.

3 "WRMI Process—Water Supply Planning for the Las Vegas Region," January 1991, published May 1992, prepared for Las Vegas Region Water Utilities by Water Resources Management, Inc.

4 Metropolitan Statistical Area Distance Profiles 2010, U.S. Census Bureau.

5 "Memorandum of Understanding Regarding Southern Nevada Water Authority's Water Conservation/Efficiency Programs," January 26, 1995, amended March 18, 1999, SNWA.

6 "Southern Nevada Water Authority Joint Water Conservation Plan," November 2019, SNWA.

7 "Southern Nevada Water Authority 1991 Cooperative Agreement," between Big Bend Water District, City of Boulder City, City of Henderson, City of Las Vegas, City of North Las Vegas, Clark County Water Reclamation District (previously Clark County Sanitation District), and Las Vegas Valley Water District. Amended 1994 and 1996.

CURRENT PLANNING ENVIRONMENT

THIS CHAPTER PROVIDES AN OVERVIEW OF CURRENT AND EMERGING ISSUES THAT ARE LIKELY TO INFLUENCE WATER SUPPLY AND DEMAND CONDITIONS IN SOUTHERN NEVADA OVER THE 50-YEAR PLANNING HORIZON.

INTRODUCTION

As discussed in Chapter 1, water supply availability and demand conditions have evolved significantly in Southern Nevada over the past century. As a result, resource strategies have needed to adapt to changing conditions. Time and again, the community rose to these challenges, developing new water resources and facilities, and significantly reducing water demands through aggressive water conservation efforts.

At the beginning of the 21st century, new issues began to emerge that have required a similar approach: close monitoring and adaptive response. Drought, climate change and changing economic conditions have become the persistent challenges of this century. Individually or combined, these factors significantly influence local water demands, as well as the resources and facilities needed to support those demands over time.

This chapter describes the challenges that exist within the current planning environment, as well as potential impacts to SNWA water supplies and facilities. This chapter also details the planning and response efforts taken by the SNWA, with community support, to minimize those impacts and ensure reliable water supplies. As described in Chapter 3 (SNWA Resource Portfolio) and Chapter 4 (Meeting Future Demands), SNWA has sufficient resources to meet the needs of the community over the 50-year planning horizon.

The SNWA is well prepared to respond to evolving conditions as they arise through close monitoring, proactive planning and adaptive management. As discussed in the latter portion of this chapter, shortages and declining lake levels associated with drought in the Colorado River Basin are being addressed to avoid impacts to current customers.

DROUGHT

Colorado River water supplies are derived primarily from snowmelt and runoff from the Rocky Mountains, as well as the Wind River, Uintah and Wasatch mountains (collectively referred to as the Upper Colorado River Basin). Beginning in 2000 and continuing today, the Colorado River Basin has experienced drought conditions that quickly developed into the worst drought in the Basin's recorded history (Figure 2.1).

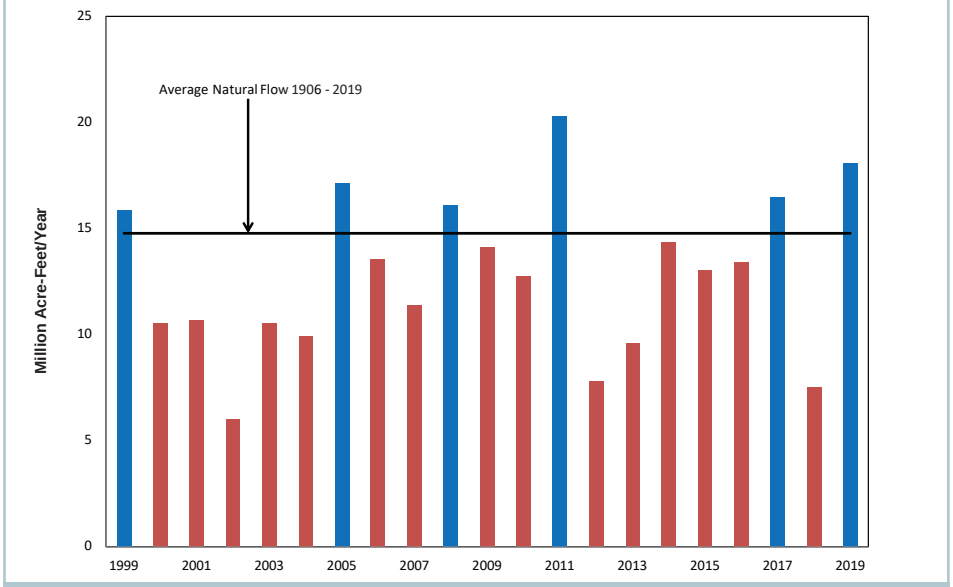
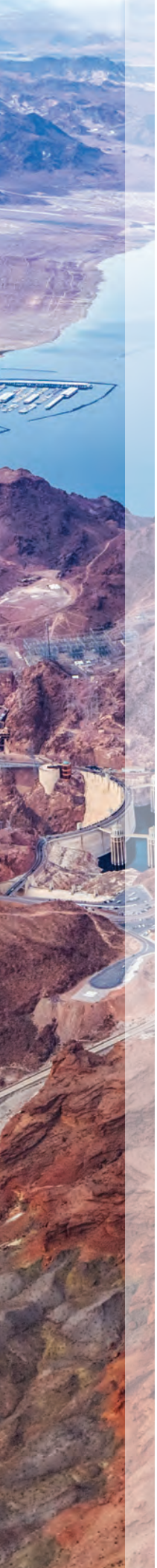


FIGURE 2.1 **Annual Colorado River Natural Flow 1999–2019**[1]



Between 2000 and 2019, overall snowfall and runoff into the Basin were well below normal, representing one of the lowest 20-year periods on record. While conditions in the Basin improved during 2019, the persistence of decades-long drought conditions has resulted in significant water level declines at major system reservoirs. As of late 2019, the combined water storage in the Colorado River's two primary reservoirs (Lake Mead and Lake Powell) was at just 47 percent of capacity.[2] As described in Chapter 4, further water-level declines are expected.

There are two primary consequences for Southern Nevada associated with continued Lake Mead water level declines: possible reduction of Colorado River resources and operating challenges associated with SNWA's water facilities at Lake Mead.

Potential Supply Impacts

In 2007, the Secretary of the Interior issued a Record of Decision for the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead, also referred to as "Interim Guidelines."[3] Among other things, the Interim Guidelines established how shortages in the Lower Basin will be implemented, based upon Lake Mead's elevation.

According to the Interim Guidelines, the Secretary of the Interior will make a shortage declaration based on a projection of Lake Mead water levels as determined by the U.S. Bureau of Reclamation's Colorado River modeling efforts. The forecast is reviewed annually in August; if Lake Mead is forecasted to be at or below 1,075 feet on January 1 of the following year, a shortage declaration will be made.

Modeling efforts conducted by the U.S. Bureau of Reclamation in August 2019 indicate an approximate 4 to 43 percent probability of shortage in years 2021-2024. The probability ranges from approximately 47 to 82 percent on average in the years thereafter.[4] The model applies historical flows to simulate future conditions, representing both wet and dry years on the Colorado River. Under a shortage declaration, the amount of Colorado River water available for use to Nevada will be reduced up to 20,000 AFY.

In addition to mandatory shortage reductions defined by the Interim Guidelines, the SNWA and Lower Colorado River Basin water users in Arizona and California will make contributions as defined by the Lower Basin Drought Contingency Plan (DCP).[5]

Nevada's DCP contribution will be incurred when the projected elevation of Lake Mead is at or below 1,090 feet. As further described in this chapter, the DCP was approved in 2019 to help mitigate the impacts of drought (see also Adaptive Management). Like the Interim Guidelines, thresholds for DCP contributions are based on the U.S. Bureau of Reclamation's August projection of Lake Mead water levels on January 1 of the succeeding year.

As shown in Figure 2.2, SNWA's DCP contributions and shortage reductions are staged to increase as Lake Mead water levels decline. Nevada's obligation under these agreements ranges from 8,000 AFY to a combined maximum of 30,000 AFY. If at any time Lake Mead is projected to fall below an elevation of 1,030 feet, the Secretary of the Interior will consult with Lower Basin stakeholders to determine if additional actions are needed to protect against the potential for Lake Mead to decline below 1,020 feet.[6]

LAKE MEAD WATER LEVEL (FT)	SHORTAGE AMOUNT (AFY)	DCP CONTRIBUTION (AFY)	TOTAL (AFY)
ABOVE 1,090	0	0	0
AT OR BELOW 1,090	0	8,000	8,000
AT OR BELOW 1,075	13,000	8,000	21,000
BELOW 1,050	17,000	8,000	25,000
AT OR BELOW 1,045	17,000	10,000	27,000
BELOW 1,025	20,000	10,000	30,000

FIGURE 2.2 **SNWA Shortage/DCP Obligations**

Potential Facility Impacts

Lake Mead's surface elevation is down by approximately 125 feet since 2000. In 2016, the lake's elevation reached its lowest point since it began filling in the 1930s (Figure 2.3).[7] Lake Mead water levels have experienced some improvement due to strong snowpack and above-average runoff within the Basin during 2019, as well as benefits realized from interstate collaboration (see page 19). As of late 2019, Lake Mead's water level was at approximately 1,083 feet. Based on current and forecasted conditions, however, there remains a high probability that Lake Mead water levels will continue to decline, potentially reaching an elevation of 1,000 feet or lower within the next decade. The SNWA has a combined water treatment and transmission capacity of 900 MGD, consisting of raw water intakes and associated pumping facilities. These facilities are limited in their operating range relative to Lake Mead elevation.

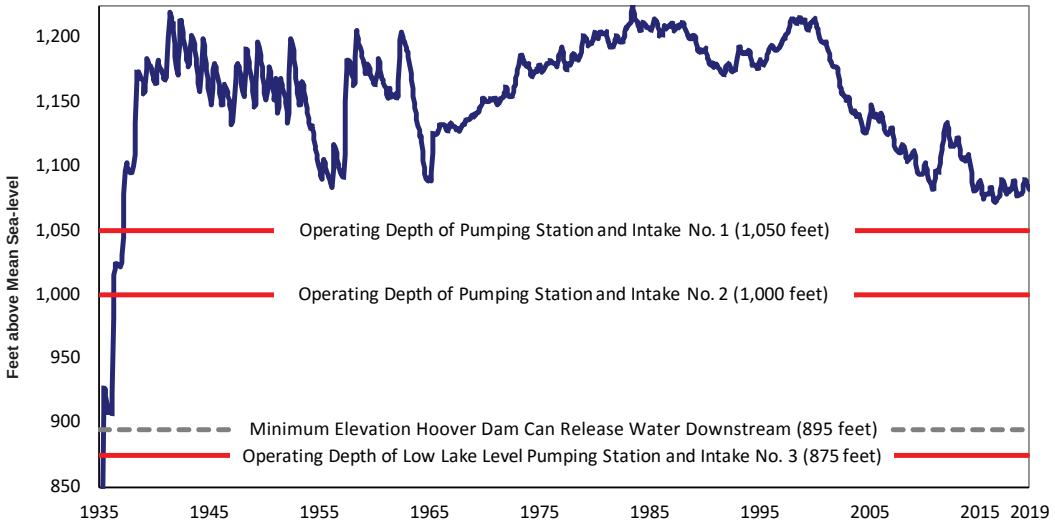


FIGURE 2.3 **Historical Lake Mead Elevations**

The SNWA began exclusive operation of its new Intake No. 3 in late 2015. The intake pulls water from the coolest, clearest water in Lake Mead and works in conjunction with SNWA's pumping stations No. 1 and No. 2, which are expected to remain operational to a Lake Mead elevation of 1,050 feet and 1,000 feet, respectively. A new Low Lake Level Pumping Station is needed and is being constructed to preserve Southern Nevada's access to Colorado River resources below 1,000 feet.

CLIMATE CHANGE

In addition to droughts, which are temporary and cyclical events, climate change is expected to have lasting effects on the availability of future water supplies. Scientific evidence indicates that climate conditions are changing due to global warming, primarily a result of increased concentrations of greenhouse gases (GHGs) in the Earth's atmosphere. Since the early 20th century, observations indicate that global mean annual air temperatures have warmed 1.8°F.[8]

Consistent with global trends, warming has also occurred in the southwestern United States. While climate change models project that warming trends will continue (Figure 2.4), the magnitude of change at a given location will depend in part on global mitigation efforts to reduce GHG emissions. Nevada's Clark County is projected to warm between 5-10°F by the end of the century.[9]

Compared to relatively uniform projected temperature increases in the Southwest, precipitation patterns are highly variable and show substantial shifts in where and how the precipitation falls. In addition, rising temperatures will cause a greater percentage of precipitation to occur in the form of rain rather than snow, and snowpack will melt earlier and be less efficient as runoff due to dry soil conditions and increasing temperatures. In some areas, this may

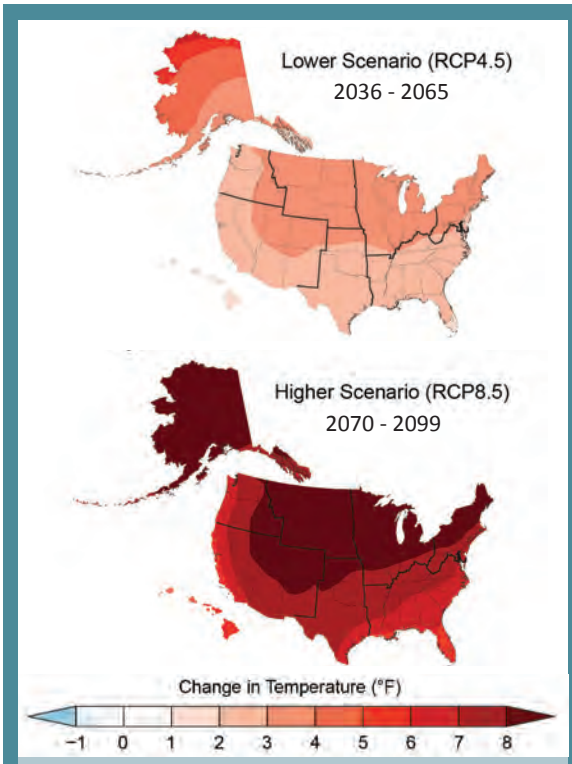


FIGURE 2.4 **Climate Change**
Range of possible future warming in North America 2036 – 2099
(2018) National Climate Assessment.

2018 Climate Change Assessment

In 2018, the U.S. Global Change Research Program (USGCRP) released its report entitled, Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II (Fourth National Climate Assessment).[11] The report concludes that annual average temperature over the contiguous United States has increased by 1.2°F over the last few decades and by 1.8°F relative to the beginning of the last century. Further, additional increases in annual average temperature of about 2.5°F are expected over the next few decades, regardless of future emissions. Temperature is expected to increase between 3°F to 12°F by the end of the century. The range of change in scenario extremes depends on future emissions.

In addition to warmer temperature, the report projections indicate the western and southwestern regions will experience:

- Large declines to snowpack
- Decreased precipitation
- Decreased soil moisture
- Increased evaporation
- Stronger, more frequent and potentially longer droughts

Lake Mead Water Level Decline

result in significant reductions in water supply, while other areas experience greater frequency and severity of flood events.[10]

From a resource planning perspective, direct climate change impacts will revolve around water quantity, particularly the form and distribution of precipitation, and increasing water demands. Rising air temperatures can also affect soil moisture, and ultimately reduce the volume and timing of snowmelt runoff. In addition, changes to water quality from rising stream flow temperatures and changes in reservoir volumes are also important considerations.

To help inform future decision-making efforts in the Colorado River Basin, the U.S. Bureau of Reclamation, in partnership with the seven states and numerous other stakeholders, initiated a comprehensive water supply and demand analysis. The process represented a concerted effort by Colorado River stakeholders to better understand possible future water supply and demand imbalances.

This effort resulted in the Colorado River Basin Water Supply & Demand Study (Colorado River Basin Study),[12] released in 2012. The study considered a range of supply and demand projections using the best available climate change science and global models to evaluate projected increases in temperature by 2060, as well as changes in precipitation over the same period. The combined impact of projected changes in air temperature and precipitation translated into diminished stream flows in the Colorado River watershed over the mid- to long-term, worsening over time. The study recognizes that climate change will not only affect the amount of water available for use but is also likely to affect overall water demands. As temperatures warm, water evaporation and evapotranspiration rates will increase, resulting in higher water demands for agricultural irrigation and landscaping uses.

Potential Supply and Demand Impacts

The Colorado River Basin Study projects a median imbalance of 3.2 million AFY in Colorado River supply and demand by the year 2060 through a combination of climate change and increased demand.[13] In Southern Nevada, the impacts of climate change are expected to be similar to that of drought. This includes extended durations of low Lake Mead elevations, water quality changes, possible reductions of Colorado River resources, and potential increases in water use to compensate for warmer and drier conditions.[14]

ECONOMIC DECLINE AND RECOVERY

Southern Nevada's economic situation changed drastically in 2007, when the national economy began to experience its most significant decline since the 1930s. Southern Nevada was hit harder than almost any other region in the nation. This period of recession marked the first time in decades that the Las Vegas area experienced a sustained period of little or no growth (Figure 2.5).[15] For a few years following the downturn, gaming and tourism revenues declined. This was followed by a record spike in unemployment. Most new residential and commercial development projects came to a halt, and home foreclosures flooded the real estate market.

Economic conditions have improved steadily in the region over the past seven years. According to the U.S. Bureau of Economic Analysis, the Las Vegas metropolitan area's economic output rose an average of three percent per year between 2012 and 2017.[16] Building permits also are on the rise. According to the Center for Business and Economic Research (CBER) at the University of Nevada, Las Vegas, the number of new housing permits that are likely to generate new water demands is projected to increase by 7.1 percent in 2019.[17]

Potential Supply and Demand Impacts

CBER forecasts that Southern Nevada population growth will continue, although actual growth rates will occur faster or slower than forecasted as demonstrated by Southern Nevada's unpredictable past.[18] While the region's economy has recovered and is growing, it is difficult to predict future population changes and how these changes will translate into water demands over the long-term planning horizon.

ADAPTIVE MANAGEMENT

Adaptive management relies on continuous assessment, flexible planning and action. As the region's wholesale water provider, SNWA is responsible for anticipating future demands and taking the steps necessary to meet those demands over time. As discussed earlier in this chapter, the current planning environment contains significant uncertainties—drought and climate change have the potential to impact water facilities, water supply availability, water quality and—to some extent—long-term water demands. In addition, factors associated with Southern Nevada's local economy and its rate of growth make predicting future water demands challenging, particularly in light of the region's previous growth history.

The following sections detail how SNWA plans to address these challenges—while some steps are being taken now to protect current water supplies from the effects of drought, other steps are considered long-term continuous efforts that will remain a priority for many years to come.

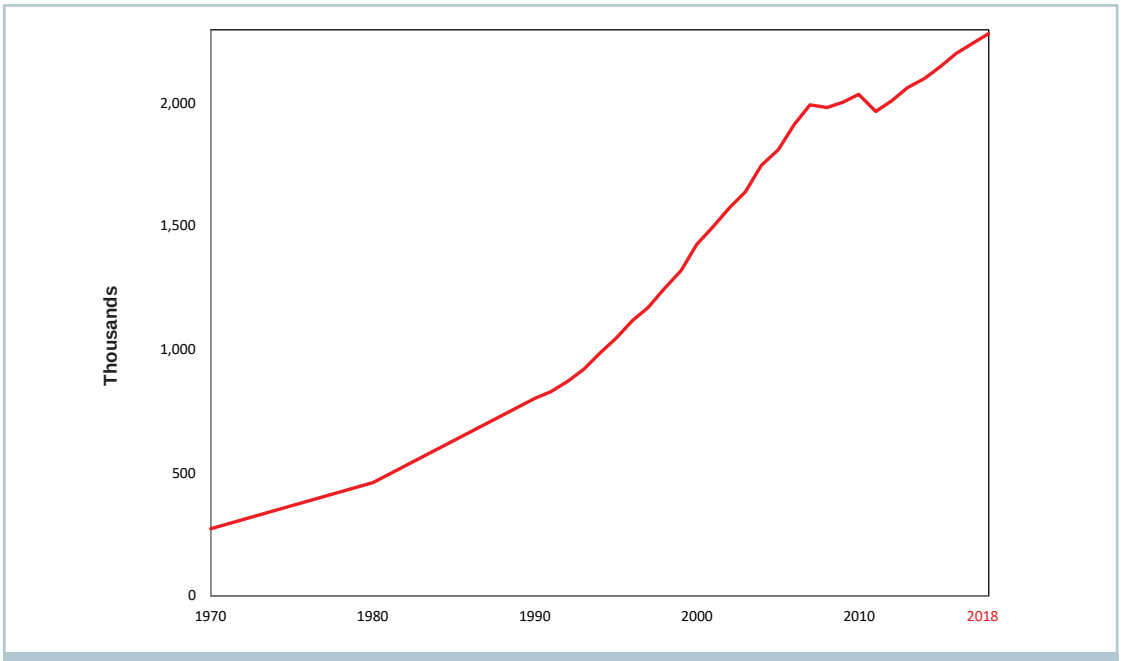


FIGURE 2.5 **Historical Clark County Population**

Adaptive Management in Action

Over the years, SNWA has taken several adaptive management steps to reduce impacts to water supplies and facilities in response to persistent drought conditions. These include:

- Reduced consumptive use of Colorado River supplies by approximately 82,000 AFY (approximately 27 billion gallons), between 2002 and 2018 despite the addition of nearly 690,000 new residents.
- Stored more than eight times Nevada's 2018 Colorado River consumptive use through increased water banking, storage and recharge efforts.
- Completed new Intake No. 3 and began constructing a new Low Lake Level Pumping Station to ensure continued delivery of Colorado River water supplies under low reservoir conditions.
- Initiated legal and environmental permitting associated with the development of in-state groundwater resources.
- Acquired and developed permanent water resources in Clark County through resource leases and purchases.
- Worked with Colorado River stakeholders to develop and implement innovative programs and agreements to improve resource management, preserve Colorado River operations for Lower Basin water users and increase the flexible use of Colorado River resources.

Low Lake Level Pumping Station Construction

Lake Mead Facility Improvements

To mitigate impacts associated with a potential Lake Mead water level decline below 1,000 feet and potential water quality concerns during low reservoir conditions, the SNWA constructed a new intake and initiated construction of pumping facilities that will ensure continued access to Colorado River resources. These facilities are being developed to address current and future projected drought conditions, as well as the potential effects of long-term climate change.

The SNWA authorized construction of a new raw water intake (Intake No. 3) in 2005 and put the new intake into service in 2015. The new intake is at an elevation of 860 feet, approximately 35 feet below the minimum elevation that Hoover Dam can release water downstream. In May 2015, the SNWA awarded a pre-construction services contract to a construction contractor for the Low Lake Level Pumping Station, which will work in tandem with Intake No. 3. These efforts are based in part on the recommendation of SNWA's Integrated Resource Planning Advisory Committee (IRPAC), which determined that the risk of Lake Mead's elevation falling below 1,000 feet is not acceptable for Southern Nevada due to the potential impacts on water delivery and resource availability.

New intake and pumping facilities will preserve existing capacity and will allow SNWA to pump from a Lake Mead elevation of 875 feet. The new pumping station is expected to be completed and operational in 2020.

Water Conservation

The SNWA continues to implement one of the most aggressive water conservation programs in the nation and will continue to evaluate higher levels of conservation as goals are achieved. As detailed in Chapter 3, the SNWA and its member agencies utilize regulation, pricing, education and incentives to affect necessary water conservation savings.

SNWA does not anticipate any near-term customer impacts associated with a federal shortage declaration or implementation of the DCP. This is due in large part to the success of local conservation efforts. The Southern Nevada community took both serious and sustained action as the drought took hold in the early 2000s. These efforts have provided a significant buffer against water supply impacts over the near-term planning horizon. By the end of 2018, Southern Nevada's consumptive use of Colorado River resources was 244,000 AFY, well below the state's obligation under the Interim Guidelines and DCP. As further described in Chapter 3, conservation will remain an ongoing priority for Southern Nevada, and the SNWA has taken steps to enhance education, outreach

and incentive programs to support continued water savings.

Interstate Collaboration

The Colorado River Basin states are collaboratively working with U.S. federal partners and Mexico to augment water supply, improve system efficiency, protect power generation and access to water supplies. These efforts range in nature from contributing funds to a cloud seeding program designed to increase the potential yield of snowfall in the Colorado River Basin, to system efficiency and conservation efforts that have mutual benefit to Colorado River Basin water users.

In 2014, the SNWA entered into two agreements with federal, state, philanthropic organizations and other Colorado River water users to help mitigate the impacts of ongoing drought and bolster reservoir elevations.[19] [20] These efforts are intended to protect against critical reservoir elevations that threaten hydropower generation at Glen Canyon and Hoover dams, and access to water supplies for millions of Lower Basin water users. These programs benefit SNWA by reducing the near-term risk of losing access to its primary water supply as the organization works to complete the development of its new Low Lake Level Pumping Station. By the end of 2018, collaborative efforts had reduced Lake Mead's water level decline by an estimated 32 feet.

Drought Response Actions. The SNWA met its commitments under these agreements by foregoing off-stream banking of its unused apportionment and by participating in system conservation projects. Together the partners have paid an estimated $29.8 million between 2015 and 2019 for conservation projects that benefit the Colorado River System.

As part of one agreement, project partners evaluated and selected projects, and compensated users for voluntary water use reductions. Projects included land fallowing, agricultural water efficiency, wastewater effluent recovery, turf removal and other conservation projects.

Unlike water resources in the SNWA Water Resource Portfolio, water conserved as a part of these agreements benefit the entire Colorado River System by increasing reservoir elevations; these resources cannot be recovered by any individual water user.

Drought Contingency Plan. The Upper and Lower Colorado River Basin states adopted drought contingency plans in 2019 that build upon drought response actions defined by the Interim Guidelines. Authorized by Congress for immediate implementation, the plans recognize the increased potential for lakes Powell and Mead to reach critically low elevations, as well as the increasing potential for water supply interruptions. Together, the plans commit the states and federal government to additional actions designed to improve reservoir storage and preserve system operations during low lake level conditions.

Beyond the mandatory shortage reductions prescribed under the Interim Guidelines, the Lower Basin DCP requires additional water contributions by the Lower Basin states, including Nevada, Arizona and—for the first time—California. Together, the Lower Basin states will contribute between 200,000 AFY and 1.1 million AFY when Lake Mead is at or below 1,090 feet. Like the Interim Guidelines, DCP contribution amounts are based on Lake Mead water levels. Likewise, with implementation of the DCP and as part of its Water Scarcity Plan, Mexico will join the states' efforts to store additional water in Lake Mead as elevations drop.

Implementation of the DCP will help to keep more water in the Colorado River for the benefit of all water users and the environment; help slow Lake Mead water level declines to preserve critical elevations; and allow states to withdraw some of their contributions when Lake Mead water levels recover. It also expands and modifies creation and recovery provisions for Intentionally Created Surplus (ICS). The SNWA intends to meet its commitments under the Interim Guidelines and DCP with conservation savings and temporary resources as described below and in Chapter 3.

Water Banking Efforts. The Seven States have worked collaboratively over the years to store or "bank" available Colorado River water and other unused supplies through various storage efforts. As of 2018, SNWA has banked resources in the Southern Nevada Water Bank, in the Arizona and California water banks, and Lake Mead (in the form of ICS). As noted above, the DCP builds upon the Interim Guidelines by requiring Lower Basin states to store additional water in Lake Mead and expands recovery provisions during a declared shortage. This provides increased access to banked supplies and enhances operational flexibility for the SNWA and other Colorado River water users. To the extent possible, SNWA will continue water

banking efforts to build temporary reserves and help stabilize Lake Mead water levels.

Moving Forward Process. To support continued work associated with the 2012 Colorado River Basin Study, the U.S. Bureau of Reclamation initiated the "Moving Forward" effort. This is a process designed to inform future Colorado River management efforts. As part of the process, three work groups were formed to investigate various aspects of: municipal and industrial conservation and water reuse; agricultural conservation, productivity and water transfers; and environmental and recreational flows. A Phase I report was released in May 2015.[21] Phase II will further expand upon these efforts by implementing pilot projects.

Applying Best Available Climate Science

To better understand and adapt to climate change effects on water-related infrastructure and water resources, SNWA initiated collaborative efforts with both climate scientists and other water agencies. The SNWA has received funding through a WaterSMART grant from the U.S. Bureau of Reclamation to evaluate potential changes in Lake Mead water quality using SNWA's advanced Lake Mead model.[22] The Lake Mead study considered potential impacts of low lake elevations and increasing air temperatures due to climate change on a suite of water quality measures.

The SNWA is also a founding member of the Water Utility Climate Alliance (WUCA), which is comprised of 12 of the largest water agencies in the United States. WUCA is dedicated to enhancing climate change research and improving water management decision-making to ensure that water utilities will be positioned to respond to climate change and protect water supplies.

The SNWA is collaborating with other WUCA members to: advocate for climate change research that better meets the needs of the water sector; evaluate methods used to understand the influence of climate change on water providers; and identify decision and adaptation strategies employed to address long-term climate change.[23]

Supply and Demand Forecasting

As in prior years, SNWA has taken a scenario-based planning approach with its 2019 Plan to address possible changes to water supply availability and demands. As detailed in Chapter 4, SNWA has developed a range of demands that brackets what is likely to be experienced during the planning horizon.

The plan includes a series of future planning scenarios that consider various water demand and supply conditions, including impacts of declared shortage. This is a conservative approach that recognizes that planning assumptions are generally more accurate in the near term and that the potential for change is likely to increase over time.

CHAPTER SUMMARY

The concept of uncertainty is not unique to Southern Nevada. It is a condition increasingly faced by water managers across the United States. This is particularly true in the Colorado River Basin, where climate variability (the result of drought and/or climate change) and economic conditions are influencing both water resource availability and the demand for those resources over time.

While the water supply challenges presented in this chapter need to be taken seriously, SNWA has worked diligently to ensure both resources and facilities are available to meet the community's short- and long-term water resource needs.

By applying adaptive management—evaluating, planning and action—SNWA is well prepared to meet whatever challenges lie ahead. Efforts include:

- Continue setting and achieving water conservation goals through aggressive water conservation efforts;
- Develop new facilities at Lake Mead to preserve Colorado River supply access;
- Collaborate with Colorado River stakeholders for conservation and flexible use of Colorado River supplies (for example, water banking), as well as protect Lake Mead's elevation against future water level declines;
- Continue to secure temporary resources to offset long-term impacts associated with shortage while working to bring other permanent resources online when needed;
- Address uncertainty by planning to a range of future supply and demand possibilities; and
- Collaborate with climate scientists and other agencies to understand and evaluate climate change, and its potential impacts on water supplies and facilities.

ENDNOTES

1 The U.S. Bureau of Reclamation and the U.S. Geological Survey estimate the yearly "natural flow" of the Colorado River at Lees Ferry, defined as the flow of the river without reservoirs, dams or diversions. Natural flow estimates for the period 1906 to 2017 are official, while estimates for the period 2018 and 2019 are provisional, August 2019, U.S. Bureau of Reclamation.

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4 The U.S. Bureau of Reclamation developed the Colorado River Simulation System (CRSS), a long-term planning and operations model. The probabilities of shortage correspond with August 2018 CRSS results, applying historical Colorado River flows, provided by U.S. Bureau of Reclamation to Southern Nevada Water Authority August, 2018.

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11 Ibid.

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13 Ibid.

14 "Changes in Water Use Under Regional Climate Change Scenarios," 2013, Water Research Foundation (Project #4263) prepared by Jack C. Kiefer, John M. Clayton, Benedykt Dzieg-ielewski, and James Henderson.

15 Clark County Population data 1970-1980 are decadal counts from the U.S. Census Bureau. Clark County Population data 1990-2018 are annual estimates prepared by the Clark County Comprehensive Planning Department.

16 Real Gross Domestic Product by Metropolitan Area, 2017 U.S. Bureau of Economic Analysis, September 2018.

17 "Midyear Economic Update 2018 to 2019," Center for Business and Economic Research at the University of Nevada, Las Vegas, June 15, 2019.

18 "Population Forecasts: Long-term Projections Clark County Nevada Population Forecast 2019-2060," June 2019, Center for Business and Economic Research at the University of Nevada, Las Vegas.

19 "Agreement among the United States of America, through the Department of the Interior, Bureau of Reclamation, the Central Arizona Water Conservation District, the Metropolitan Water District of Southern California, Denver Water, and the Southern Nevada Water Authority, for a Pilot Program for Funding the Creation of Colorado River System Water through Voluntary Water Conservation and Reductions in Use," entered into July 30, 2014 and amended August 12, 2015; March 8, 2016; and July 6, 2018.

20 "Memorandum of Understanding among the United States of America, through the Department of the Interior, Bureau of Reclamation, the Central Arizona Water Conservation District, the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, the Arizona Department of Water Resources, the Colorado River Board of California and the Colorado River Commission of Nevada for Pilot Drought Response Actions," entered into December 10, 2014.

21 "Colorado River Basin Stakeholders Moving Forward to Address Challenges Identified in the Colorado River Basin Water Supply and Demand Study Phase 1 Report," 2015, U.S. Bureau of Reclamation.

22 The SNWA's Lake Mead Model was developed with Flow Science Inc., with funding from SNWA member agencies and the National Park Service. Funding for climate change model simulations was provided through a WaterSMART Grant from the Bureau of Reclamation, with matching contributions from the City of San Diego, Metropolitan Water District of Southern California and the SNWA.

23 The Water Utility Climate Alliance (WUCA) has funded and published several reports and whitepapers on climate change. The publications are accessible at: www.wucaonline.org/html/actions_publications.html.

SNWA WATER RESOURCE PORTFOLIO

THIS CHAPTER DISCUSSES THE DIVERSE SET OF WATER RESOURCE OPTIONS ACQUIRED BY THE SNWA TO RELIABLY MEET THE COMMUNITY'S CURRENT AND FUTURE WATER RESOURCE NEEDS.

INTRODUCTION

Since 1991, SNWA has worked to establish and manage a flexible portfolio of water resources, an approach commonly used in resource planning. Having a portfolio of resources allows SNWA to assess its overall water resource options and to make appropriate decisions regarding which resources to develop and use when necessary. Key factors considered in determining acquisition, priority of development, and use include the availability, accessibility, cost and need of the resource. Water supply diversification is also an important consideration. Having a portfolio of resource options helps to offset risks typically associated with dependence on any single resource.

The SNWA's water resource portfolio, along with associated facility planning and permitting efforts, provides SNWA flexibility in adapting to changing supply and demand conditions, and helps ensure that community water demands can be met. Resources in the portfolio are described in consumptive use volumes and are organized into three categories:

- Permanent Resources
- Temporary Resources
- Future Resources

PERMANENT RESOURCES

For the purpose of this plan, "Permanent Resources" are resources anticipated to be available for use over the 50-year planning horizon. These resources make up a base of supplies and can be used during any Colorado River operating condition, including shortage (subject to certain restrictions).

Permanent resources include Colorado River supplies (including return-flow credits); Tributary Conservation Intentionally Created Surplus (ICS); permitted groundwater rights in the Las Vegas Valley; and reclaimed water. Descriptions of these resources and details regarding their availability are discussed in the following section.

Colorado River—Nevada Basic Apportionment

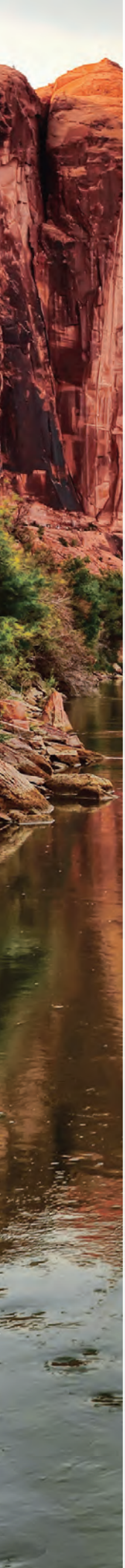
Nevada's 300,000 AFY Colorado River apportionment continues to be Southern Nevada's largest and most critical permanent resource. Nevada's right to this water was established under the 1922 Colorado River Compact and the Boulder Canyon Project Act (BCPA), which together set forth where and how Colorado River water is used.

SNWA Contract. Section 5 of the BCPA requires entities wishing to divert Colorado River water within the states of Arizona, California and Nevada to have a contract with the Secretary of the Interior for that water. Early on, the agencies that would form the SNWA contracted for most of Nevada's Colorado River allocation.

With the creation of the SNWA in 1991, these agencies agreed to collaboratively manage Southern Nevada's current and future water resources, representing a significant shift in the overall management of the region's water supply. In the years that followed, SNWA determined that additional Colorado River water was available and contracted with the Secretary of the Interior in 1992 and 1994 to acquire these resources.[1] SNWA's total estimated Colorado River entitlement is 276,205 AFY of Nevada's 300,000 AFY allocation. This includes 272,205 AFY for use by SNWA member agencies and 4,000 AFY that SNWA delivers to Nellis Air Force Base. Nevada's remaining apportionment is contracted to other users.[2] SNWA also holds contracts for any surplus Colorado River water available to Nevada.

Unused Apportionment. As part of its 1992 Colorado River contract, the SNWA has a right to the unused apportionment of other Nevada Colorado River contract holders. The SNWA anticipates some of this water will be available for use in the planning horizon, and plans to utilize this water if and when it is available.

SNWA's use of Colorado River resources has declined significantly since 2002 due to community water conservation efforts. As a result, Nevada is not currently using its full Colorado River apportionment. As discussed



later in this chapter, the SNWA plans to store this water in Lake Mead to help alleviate the impacts of drought conditions and avoid critical Lake Mead elevations. Water also may be stored in other banking programs. In either case, Nevada will maximize the availability and use of its water conservation savings to offset risk, increase operational flexibility and help meet future demands.

Return-Flow Credits. The BCPA defines all Colorado River apportionments in terms of "consumptive use." Consumptive use is defined as water diversions minus any water that is returned to the Colorado River. These returns are also referred to as "return-flow credits." With return-flow credits, Nevada can divert more than 300,000 AFY, as long as there are sufficient flows returned to the Colorado River to ensure the consumptive use is no greater than 300,000 AFY.[3]

Return-flow credits constitute a significant portion of Southern Nevada's permanent Colorado River resource, expanding SNWA's Colorado River supply. Nevada's Colorado River return-flows consist mostly of highly-treated wastewater that is returned to Lake Mead via the Las Vegas Wash.

Flood Control Surplus. If Lake Mead is full or nearly full, the Secretary of the Interior can declare a flood control surplus. This allows Lower Basin states to use Colorado River water, in excess of their apportionment, that would have been released to control potential flooding along the Colorado River system.[4]

Based on current Lake Mead water levels and climate variability in the Colorado River Basin, SNWA does not assume that flood control surplus water will be available during the planning horizon. However, SNWA will utilize this resource as a priority when it is available.[5]

Domestic Surplus. As discussed in Chapter 2, the Interim Guidelines defined both surpluses and shortages, and detailed provisions for water use during each condition. Under a "Domestic Surplus," SNWA is allowed to consumptively use up to 400,000 AFY of Colorado River water when Lake Mead is above 1,145 feet. The 2019 Plan does not assume the availability or use of domestic surplus water during the planning horizon. However, SNWA will utilize this resource as a priority when it is available.

Intentionally Created Surplus

In 2007, as part of the Interim Guidelines, SNWA entered into a series of agreements that ensure the availability and delivery of water resources developed under provisions for ICS.[6] As discussed below, Tributary Conservation ICS and Imported ICS enable SNWA to develop some of its surface and groundwater rights that are located in Nevada, near the Colorado River. The SNWA may develop these rights as needed by allowing them to flow into Lake Mead in exchange for Tributary Conservation ICS and Imported ICS credits.

Tributary Conservation and Imported ICS credits can be used during the year created and under any operating condition, including shortage (taken as Developed Shortage Supply or "DSS" during a declared shortage).[7] As required by the DCP, these resources are subject to a one-time deduction of 10 percent to offset evaporative loss and benefit Lake Mead system storage. As discussed in the "Temporary Resources" section on the following pages, water that is not used in the year it is created is converted to Extraordinary Conservation ICS. When needed, the credits will be withdrawn as Colorado River water through SNWA facilities and returned to the system for return-flow credits.

Tributary Conservation ICS. The SNWA is allowed to develop the portion of its Muddy and Virgin River surface water rights that have a priority date that precedes the BCPA (pre-1929 rights) as Tributary Conservation ICS. The SNWA can develop up to 50,000 AFY of Tributary Conservation ICS credits. To date, approximately 14,700 AFY of permanent rights have been acquired. In addition to its permanent rights, SNWA has acquired approximately 17,200 AFY of leased rights, with remaining terms up to eight years. The SNWA anticipates acquiring and delivering a total of 36,000 AFY of Tributary Conservation ICS over the planning horizon.

Imported ICS. Under the Interim Guidelines, up to 15,000 AFY of Imported ICS can be created in an entitlement holder's state by introducing non-Colorado River water into the main stream of the Colorado River.

While SNWA has 9,000 AFY of permitted non-Colorado River groundwater rights in Coyote Spring Valley, these and other groundwater rights within the Lower White River Flow System (including Garnet Valley and Hidden Valley resources discussed on page 28) are the subject of an ongoing

process initiated by the State Engineer in June 2018 to evaluate the amount of water that can be pumped from the system sustainably. For the 2019 Plan, SNWA assumes no use of Coyote Spring Valley rights.

Las Vegas Valley Groundwater Rights

All surface water and groundwater rights in the state of Nevada are administered by the Nevada State Engineer and fall under the purview of Nevada Water Law.[8]

Of the seven SNWA member agencies, the LVVWD and North Las Vegas have permanent groundwater rights totaling 40,760 and 6,201 AFY, respectively. These rights are among the most senior groundwater rights in the Las Vegas Valley. As such, they are protected even though new rights were granted to other users. Groundwater remains a critical component of SNWA's Resource Portfolio.

Water Reuse

The term water reuse generally means to recycle wastewater to support a secondary use. In the SNWA service area, nearly all water used indoors is recycled for either direct or indirect reuse. Direct reuse involves capturing, treating and reusing wastewater flows for non-potable uses such as golf course and park irrigation, and other uses. Indirect reuse consists of recycling water by way of treatment and release to the Colorado River for return-flow credits.

Boulder City, City of Las Vegas, Clark County Water Reclamation District, City of Henderson and City of North Las Vegas each operate wastewater treatment facilities in the Las Vegas Valley that contribute to the region's direct and/or indirect reuse.

As shown in Figure 3.1, approximately 40 percent of water used in the SNWA service area results

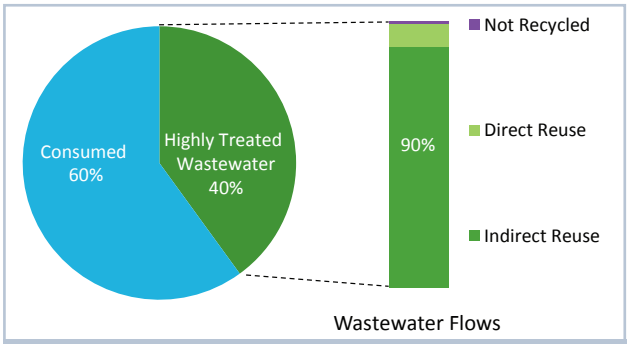


FIGURE 3.1 **SNWA Water Use and Recycling**

The Colorado River Basin

Colorado River operations and water use are governed by a series of contracts, regulatory guidelines, federal laws, compacts, a treaty with Mexico, court decisions and decrees—collectively known as the "Law of the River." The 1922 Colorado River Compact divided the Colorado River Basin into two divisions—the Upper Division and the Lower Division, allocating 7.5 million acre-feet per year (MAFY) to each. As part of the Boulder Canyon Project Act and the 1948 Upper Colorado River Basin Compact, the Upper and Lower Divisions divided their respective share amongst individual states within each division. In addition, 1.5 MAFY was allocated to Mexico as part of a 1944 treaty.[9]

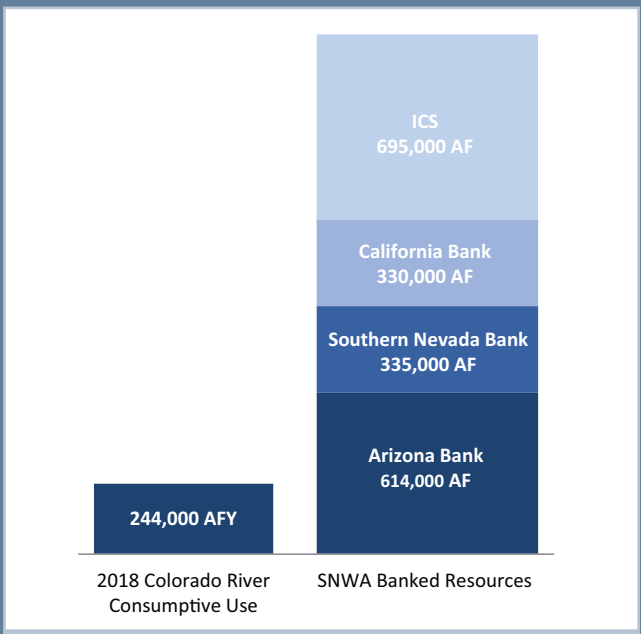
The Compact was forged in a time of abundance, during one of the wettest periods in recorded history. More recent reviews, modeling and studies of Colorado River flows have determined an imbalance in long-term Colorado River resources and future demands. State and federal partners agree that there is a strong potential for significant supply and demand challenges in coming decades, and are working together to offset potential water supply reductions.

Recharge & Banking

The LVVWD began storing or "banking" water in the Las Vegas Valley in the late 1980s. In Southern Nevada, banking is accomplished through artificial recharge or in-lieu recharge.[10] Artificial recharge involves direct injection of treated unused Colorado River water into the local groundwater aquifer; in-lieu recharge is accomplished by not pumping non-revocable groundwater rights to acquire storage credits that are available for future use. Through various programs and agreements , the SNWA has expanded banking efforts to include storage in the Arizona Water Bank and California Water Bank, and in Lake Mead in the form of ICS (see sidebar on right).

The 2019 DCP and associated agreements expanded Lake Mead water banking opportunities for Southern Nevada with the authorization of a new SNWA Extraordinary Conservation ICS project that allows SNWA to leverage its past and future conservation savings and forgone banking to obtain ICS credits. Ongoing accruals will be based on conservation achievements since 2002. Subject to certain conditions, provisions for the recovery of stored ICS credits also were expanded to allow for greater flexibly and use of ICS resources during a declared shortage.

As of 2018, SNWA has accrued approximately 2 million acre-feet of water. This is more than eight times Nevada's 2018 consumptive Colorado River water use.



SNWA Banked Supplies Through 2018

in highly-treated wastewater. Of that, approximately 99 percent is recycled.

While direct reuse of Colorado River water may have advantages over indirect reuse in terms of lower pumping cost, additional direct reuse does not extend Southern Nevada's Colorado River supply, where return-flow credits are available. This is because an increase in direct reuse will reduce the amount of water available for indirect reuse through return-flow credits by a similar amount.

In 2017, SNWA adopted a policy to address water use outside the Las Vegas Valley (Appendix 3).[11] Among other things, the policy prioritizes the return of treated wastewater to Lake Mead for return-flow credits where feasible, and implementation of reuse to achieve full beneficial use of SNWA water resources if returning treated wastewater to Lake Mead is not feasible. This is consistent with SNWA's approach for water reuse in the Las Vegas Valley.

Reuse of In-State Groundwater Resources

The water resources described in this chapter have generally been quantified and discussed based on consumptive use volumes. Water accounting for return-flow credits, which extends SNWA's diversions of Colorado River water, includes provisions for the reuse of imported in-state groundwater resources. Under these provisions, in-state groundwater resources are similarly extended.

TEMPORARY RESOURCES

Beginning in the early 1990s and continuing today, SNWA has worked closely with other basin states to maximize opportunities for flexible use of Colorado River water. Through local and interstate arrangements, SNWA has acquired a number of temporary resources that serve as an important management tool—these resources can be used to meet potential short-term gaps between supply and demand, serving as a bridge to meet demands while other future resources are being developed. In some cases, temporary resources can be used to offset reductions in permanent supplies due to shortages.

For the purpose of this plan, "Temporary Resources" are defined as banked resources. As part of its overall water resource strategy, SNWA reserves water in years when Nevada's Colorado River allocation exceeds the community's demands. These resources are "banked" for future use in the form of storage credits. The volume of storage credits can change over time based on continued storage and use of supplies. As discussed below, SNWA

stores banked resources locally, as well as through banking agreements with other states.

Southern Nevada Water Bank

As of 2018, SNWA has more than 335,000 acre-feet of water stored in the Southern Nevada Water Bank for future use through an agreement with LVVWD. SNWA may recover water banked under this agreement in any water supply condition. This plan assumes a maximum recovery rate of 20,000 AFY.[12]

California Water Bank

Between 2004 and 2012, SNWA entered into various agreements that allow it to store Nevada's unused Colorado River water in California. As of 2018, Nevada has banked more than 330,000 acre-feet of water in California. This plan assumes a maximum recovery up to 30,000 AFY during normal and shortage conditions, subject to agreement terms.[13]

Arizona Water Bank

In 2013, SNWA approved an amendment to the 2001 water banking agreement with the Arizona Water Banking Authority.[14] The SNWA stored approximately 614,000 acre-feet of Colorado River water underground in Arizona's aquifers for SNWA's future use as of 2018. Additional water can be banked on a pay-as-you-go basis up to 1.25 million acre-feet.

For SNWA to recover this stored water, Arizona will utilize the banked water and forgo the use of a like amount of Colorado River water. The SNWA will then divert the water from facilities at Lake Mead. SNWA can recover up to 40,000 AFY during any water supply condition and may recover up to 60,000 AFY during a declared shortage. This plan assumes a maximum recovery of up to 40,000 AFY during normal and shortage conditions.

Intentionally Created Surplus

The SNWA has participated in several efforts to expand its portfolio of temporary resources under provisions specified in the Interim Guidelines and DCP for ICS.

As discussed earlier in this chapter, the Interim Guidelines created several forms of ICS: Tributary Conservation ICS and Imported ICS (discussed under "Permanent Resources"), as well as System Efficiency ICS and Extraordinary Conservation ICS. In 2012, an additional form of ICS was created as part of an international pilot program, referenced here as Bi-National ICS. Provisions for Bi-National ICS were extended through 2026 with

Intentionally Created Surplus

The Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead (Interim Guidelines) were adopted in 2007 by the Secretary of the Interior. Among other things, the Interim Guidelines established requirements for the creation, delivery, and accounting for a new form of surplus called Intentionally Created Surplus.

ICS was instituted to encourage the efficient use and management of Colorado River water and to increase the water supply in Colorado River system reservoirs. The creation of ICS was designed to help reduce the likelihood, magnitude and duration of shortages in the Lower Basin. Additional provisions for the creation and recovery of ICS were authorized and are implemented under the 2019 Drought Contingency Plan.

Efforts to help stabilize Lake Mead water levels are of key importance to the SNWA – the agency has made significant investments in new intake and pumping facilities that will allow for reliable access to community water supplies in the event of low lake level conditions (below 1,000 feet).

Tributary conservation ISC creation

Drought Contingency Plan

In addition to the mandatory shortage reductions defined by the Interim Guidelines, the SNWA and other Colorado River users approved the Lower Basin DCP for Colorado River operations in 2019.[15] Authorized by Congress for immediate implementation, the agreement requires the Lower Basin states to make additional contributions designed to reduce the magnitude and likelihood of continued Lake Mead water level declines, and reduce the risks of potential water supply interruptions for Lower Basin water users.

The DCP:

- Keeps more water in the river for the benefit of all water users and the environment.
- Helps slow Lake Mead water level declines to preserve critical reservoir elevations.
- Authorizes new ICS projects and supplies that contributing states can access during a federally declared shortage and when Lake Mead water levels recover.
- Draws participation from new stakeholders including California and Mexico, and promotes continued collaboration.

Federal, state and municipal partners have worked collaboratively for years to reduce the risk of a Lake Mead water level decline below 1,000 feet, a critical elevation for operation of Hoover Dam and Lower Basin water deliveries. With implementation of the DCP and other related agreements in 2019, the risk of Lake Mead reaching this critical elevation has decreased substantially. Authorization and implementation of the DCP provides greater certainty for Lower Basin water users and represents a significant collaboration milestone among Colorado River stakeholders.

DCP Signing Ceremony at Hoover Dam, Lake Mead

the approval of a new agreement between the U.S. and Mexico in late 2017.

Additional provisions for the creation and delivery of ICS were authorized and implemented in 2019 under the DCP. As further described in this chapter, DCP ICS was created to incentivize additional water storage in Lake Mead and, in turn, to help slow the decline of Lake Mead water levels. SNWA can use its DCP ICS credits without penalty or payback when Lake Mead is above an elevation of 1,110 feet. SNWA can access up to 300,000 AFY of its combined System Efficiency ICS, Extraordinary Conservation ICS, Binational ICS and may "borrow" DCP ICS during a declared shortage and when the elevation of Lake Mead is above 1,025 feet. These resources are further described below.

System Efficiency ICS. In 2007, SNWA collaborated with the U.S. Department of the Interior and other project partners to fund construction of the Warren H. Brock Reservoir. This System Efficiency ICS project provides Southern Nevada with 400,000 acre-feet of ICS credits; no more than 40,000 acre-feet are available for consumptive use each year through 2036. These credits are stored in Lake Mead, helping to bolster Lake Mead water levels.

In 2009, Nevada also collaborated with municipal water agencies in California, Arizona and the U.S. Bureau of Reclamation in a pilot operation of the Yuma Desalting Plant. The plant was constructed in 1992 to treat brackish agricultural drainage water in the United States for delivery to Mexico as part of its treaty obligation. Flood damage in 1993 caused the facility to cease operations.

As part of the 2009 collaborations, the facility was operated at one-third capacity to collect data on operational viability for long-term use. In exchange for funding the pilot test, the states received System Efficiency ICS. SNWA's share was 3,050 acre-feet. These resources are temporarily stored in Lake Mead as System Efficiency ICS.

Extraordinary Conservation ICS. With approval and implementation of the DCP in 2019, the SNWA can create up to 100,000 AFY of Extraordinary Conservation ICS under a newly authorized project.[16] For 2017 and 2018, and through 2026, the SNWA's Extraordinary Conservation ICS account will be credited for SNWA's investments in municipal conservation and off-stream storage, which have reduced Nevada's Colorado River water use below the state's apportionment and created the opportunity for SNWA to store this water in one of its off-stream water banks. Using an established methodology to determine water savings, SNWA will

LAKE MEAD ELEVATION

YEAR	ABOVE 1,110 FT.	1,110 TO ABOVE 1,075 FT.	1,175 TO ABOVE 1,025 FT.	1,125 FT. OR BELOW
2020 - 2026	AVAILABLE	SHORT-TERM ACCESS (REPAY IN 1 YEAR)		NOT AVAILABLE
2027 - 2057 *	AVAILABLE	SHORT-TERM ACCESS (REPAY IN 5 YEARS)	SHORT-TERM ACCESS (REPAY IN 1 YEAR)	NOT AVAILABLE

*2019 Water Resource Plan assumes availability through 2070.

FIGURE 3.2 **Availability of DCP ICS Credits**

accrue Extraordinary Conservation ICS credits when it stores these water savings in Lake Mead as ICS. Tributary Conservation and Imported ICS credits also are converted to Extraordinary Conservation ICS credits if they are not used in the year they are created.

These ICS credits are banked in Lake Mead and are subject to a one-time deduction of 10 percent for system benefit and evaporative loss. As of 2018, SNWA has stored approximately 269,000 acre-feet of Extraordinary Conservation ICS.

DCP Contributions and ICS. The Lower Basin States will begin making DCP contributions when the elevation of Lake Mead is projected to be at or below 1,090 feet. Contribution amounts vary by state and are based on Lake Mead water levels. Nevada's DCP contribution ranges from 8,000 to 10,000 AFY. This volume of water is in addition to any mandatory reductions associated with a federally declared shortage. Mandatory shortage reductions cannot be recovered.

Subject to storage limitations, Nevada's DCP ICS account will be credited each time Nevada makes a DCP contribution. SNWA can utilize its DCP ICS credits with no penalty or repayment obligations when Lake Mead is above 1,110 feet. Below this elevation, SNWA can access or borrow credits, subject to repayment.

As shown in Figure 3.2, access to DCP ICS credits are not available in years when the elevation of Lake Mead is projected to be at or below 1,025 feet. Borrowed DCP ICS credits must be replenished within one to five years, depending on Lake Mead water levels. Beginning in 2027, any unused DCP ICS credits will be reduced by three percent annually to benefit the Colorado River system.

Bi-National ICS. The United States and Mexico finalized Minute 323 to the 1944 U.S./Mexico water treaty in September 2017. Minute 323 extends and modifies key provisions of historic Minute 319, which enhanced Colorado River system sustainability by quantifying water deliveries to Mexico under both high- and low-reservoir conditions. In addition, Minute 323 contains Mexico's commitment to a Water Scarcity Plan requiring Mexico to store additional water in the United States as Lake Mead elevations drop. With approval and implementation of the DCP in 2019, Mexico will join Arizona, California and Nevada in required storage contributions designed to mitigate the impacts of ongoing drought and slow the decline of Lake Mead water levels.

Effective through the year 2026, Minute 323 authorizes Mexico to defer its Colorado River water deliveries and to store water in the United States for later delivery to Mexico. The agreement will help maintain Lake Mead water levels, delay potential shortages, and create additional certainty for all water users, particularly during shortages.

Like Minute 319, Minute 323 allows for the SNWA to invest in conservation and infrastructure projects in Mexico in exchange for Bi-National ICS credits. Through Minutes 319 and 323 and the accompanying domestic agreements, SNWA has agreed to fund projects yielding a minimum of 51,025 and a maximum of 78,300 acre-feet of Bi-National ICS credits. As of late 2018, SNWA has accrued 23,750 acre-feet of Bi-National ICS credits.

FUTURE RESOURCES

For the purpose of this plan, "Future Resources" are defined as those resources expected to be available to SNWA at some point during the planning horizon. In some instances, water resources are quantified subject to water right permitting, while the availability and development of others requires further research and analysis.

Water resource conditions have changed significantly over the years for many of the western states, including Nevada. During that time, SNWA has worked to implement water resource strategies that maximize use

of permanent and temporary resources, delaying the development of costly facilities that may not be needed in the future. Development of the Future Resources discussed below will require additional environmental permitting as well as project design and construction of water delivery infrastructure.

Desalination

The SNWA is engaged with other Colorado River Basin states and water users, the U.S. Bureau of Reclamation and the country of Mexico to actively explore and investigate potential seawater and brackish water desalination projects in the state of California and the country of Mexico. One example includes ongoing exploration for operation of the Yuma Desalting Plant to treat brackish water. Other projects are being considered by a Binational Projects Work Group. These include opportunities for seawater desalination and wastewater reuse facilities in Mexico. The latter are noted as areas of interest under Minute 323.

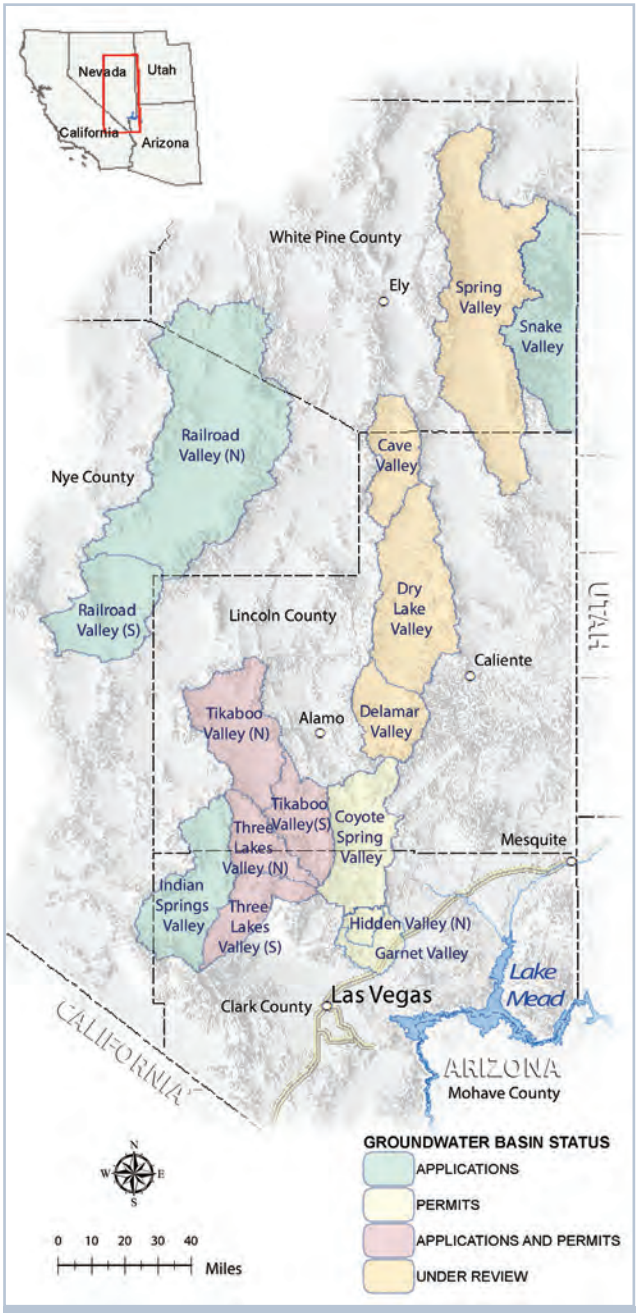


FIGURE 3.3 **In-State Groundwater Resources**

In-State Groundwater

The SNWA has a number of groundwater permits and applications in southern and eastern Nevada based on applications filed by the LVVWD in 1989. Many of these applications have been permitted by the Nevada State Engineer in accordance with Nevada Water Law, while others require further review and analysis. Figure 3.3. depicts the hydrographic areas associated with these permits/applications. Below is a summary of each resource and its current standing.

Garnet and Hidden Valleys. The SNWA has permitted rights to 2,200 AFY of groundwater in Garnet and Hidden valleys. The majority of these rights have been leased to dry-cooled power plants located in Garnet Valley. The remaining resources are anticipated to be developed as needed within these valleys.[17]

Three Lakes Valley (North and South) and Tikaboo Valley (North and South). Between 2003 and 2006, the Nevada State Engineer issued a series of rulings granting SNWA rights to 10,605 AFY of groundwater in these basins. The SNWA is working to develop options for delivery of 8,018 AFY of the groundwater rights from Three Lakes Valley North and South and Tikaboo Valley South into the northwest portion of the Las Vegas Valley.

Delamar, Dry Lake, Cave and Spring Valleys. In 2012, the Nevada State Engineer issued a ruling on SNWA's groundwater applications in Delamar, Dry Lake, Cave and Spring valleys. The ruling granted SNWA 61,127 AFY from Spring Valley and 22,861 AFY from Delamar, Dry Lake and Cave valleys.

The rulings were appealed. A District Court order affirmed several aspects of the rulings but remanded the matter back to the Nevada State Engineer for additional consideration on three primary issues. Under narrow and unprecedented requirements, the remand order specifically directed the State Engineer to recalculate the volume of water available for permitting and reconsider aspects of SNWA's monitoring, management and mitigation plan. Following a hearing in 2017, the State Engineer issued a 2018 ruling denying SNWA's applications.

The 2018 ruling makes it clear that water is available for appropriation in these basins, but the scope of the District Court remand order prevented the State Engineer from granting rights. The State Engineer did, however, approve SNWA's monitoring, management and mitigation plan, subject to the potential reinstatement of an award of the disputed groundwater rights. These resources are subject to ongoing litigation, and the SNWA and several protestants have filed petitions for judicial review of the 2018 ruling.

In the meantime, the SNWA continues to perform hydrologic and biologic monitoring to satisfy reporting requirements as set forth in the 2012 State Engineer approved monitoring plans. Additionally, SNWA holds groundwater rights to more than 8,000 AFY in Spring Valley that were acquired through the acquisition of its Great Basin Ranch Holdings (See Chapter 5).

Snake Valley. The SNWA currently holds applications for approximately 50,678 AFY in Snake Valley. The Lincoln County Conservation, Recreation, and Development Act of 2004 require the states of Nevada and Utah to reach an agreement regarding the division of water resources in Snake Valley, which is located in portions of both states. To date, an agreement has not been signed by Utah and SNWA's applications remain pending before the Nevada State Engineer. The SNWA intends to pursue development of these resources when needed to supply future demands.

Railroad Valley. The SNWA holds applications filed in 1989 for 111,496 AFY of groundwater in Railroad Valley North and South. The SNWA intends to pursue development of these resources when needed to supply future demands.

Virgin River/Colorado River Augmentation

The SNWA was permitted 113,000 AFY of Virgin River water rights in 1994. Under an agreement, SNWA transferred 5,000 AFY to the Virgin Valley Water District. In accordance with the 2007 Seven States' Agreement, the SNWA has agreed to suspend development of these Virgin River surface water rights in exchange for agreement with the other Colorado River Basin states to cooperatively pursue the development of 75,000 AFY of permanent water supplies to augment the Colorado River for Nevada.[18]

Nevada Water Law

Nevada water law is considered one of the most comprehensive water laws in the West.[19]

Unlike Colorado River water, which is managed by the U.S. Bureau of Reclamation, groundwater and surface water in Nevada (excluding the Colorado River) is administered and managed by the state. Nevada's first water law was passed in 1866 and has been amended many times since then.

The Nevada Division of Water Resources, also known as the Office of the State Engineer, regulates these supplies. The Office was created in 1903 to protect existing water rights and to bring about a better method for utilizing the state's water resources.

Today, Nevada water law serves the people of the state by providing the rules for acquiring and maintaining a water right, as well as guidelines for the State Engineer in managing the state's valuable water resources. Nevada water law follows the doctrine of prior appropriation, or "first in time, first in right"—meaning the first person to file on a water resource for beneficial use is typically considered first for a permanent right to water, subject to the Nevada State Engineer's determination of available appropriated water.

Consumptive vs. Non-Consumptive Uses

Approximately 60 percent of all water delivered by SNWA is consumed, primarily for landscape irrigation and cooling. Unlike water used indoors, water used outdoors and for cooling is lost to the system as it cannot be treated and reused. As a result, outdoor uses continue to be a primary focus area for future conservation gains.

While there are many ways to improve water efficiency, the SNWA is specifically calling on residents and businesses to take three specific actions that together will have a high impact on reducing consumptive water use. These include:

- Remove unused turf—replace water thirsty turf with water efficient landscapes.
- Change irrigation clocks—follow mandatory time-of-day and day-of-week watering restrictions.
- Report water waste—help local water agencies to identify and address water waste in the community by reporting water waste.

The SNWA is currently working with all sectors of the community to explore conservation opportunities. The organization also has expanded education, outreach and incentive programs to support water conservation and efficiency gains within the community. A full description of SNWA conservation programs is online at snwa.com.

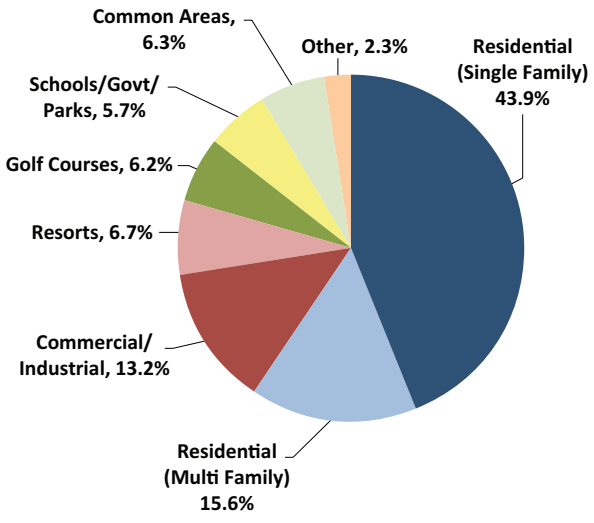


FIGURE 3.4 **Municipal Metered Use (2018)**

Transfers/Exchanges

In concept, water transfers involve moving water resources from willing sellers to willing buyers. There are a variety of ways in which this can occur: interbasin, intrastate and interstate transfers.

Full-scale transfers and exchanges among Colorado River users could involve transfers/exchanges associated with participation in desalination or agricultural fallowing projects. While Colorado River transfers and exchanges are an important future resource for Southern Nevada, they will require considerable discussion, agreements and potential regulations to implement. The SNWA continues to collaborate with other Colorado River users to evaluate the potential for future transfer and exchange projects.

WATER CONSERVATION

Water conservation is a resource. However, unlike typical "wet" resources, which are acquired and conveyed to meet demands, conservation reduces existing and future demands, and extends available supplies.

The SNWA's comprehensive five-year water conservation plan details the community's water conservation goals and progress towards those goals over time.[20] It also includes a complete description of water conservation programs and projected water savings. The following provides a brief overview of how conservation is measured and implemented in Southern Nevada.

Measuring Water Conservation and Use

Gallons Per Capita Per Day (GPCD) is a metric used by many communities to measure water uses. It is also an effective tool to measure efficiency over time. GPCD varies across communities due to several factors, including differences in climate, demographics, water-use accounting practices and economic conditions.

For the 2019 Plan, SNWA has restated its conservation progress and goal in consumptive use terms. This approach more accurately reflects the water resource implications associated with conservation progress.[21] SNWA GPCD is calculated by dividing all SNWA water sources diverted (excluding off-stream storage) less corresponding Colorado River return-flow credits by total SNWA resident population served per day (GPCD = water diverted - return- flow credits / resident population / 365 days). This approach recognizes that not all water that is delivered is consumed. This is because SNWA recycles nearly all indoor water use, either through return-flow credits or direct reuse.

Conservation Goals

Since its inception in 1991, SNWA and its member agencies have worked collaboratively to set and achieve aggressive water conservation goals. These efforts produced significant decreases in per person water use as shown in Figure 3.5. The community is working to achieve its water conservation goal of 105 GPCD by 2035. As recommended by SNWA's 2014 Integrated Resource Planning Advisory Committee, a new conservation goal will be evaluated after the current goal has been achieved. As of 2018, Southern Nevada's use is at 113 GPCD.

While future conservation gains are expected to occur over the planning horizon, these gains are likely to be realized more slowly than in previous years as higher levels of efficiency—over and above what has already occurred—become more difficult to achieve. In the long-term, there also is anticipated to be upward pressure on water use as a result of warming due to climate change.

As shown in Figure 3.5, Southern Nevada's progress towards its conservation goal has been relatively flat in recent years. This is likely the result of several factors, including strong economic conditions, unusually hot and dry weather conditions (2017 and 2018) and maturing pricing signals associated with SNWA incentive programs, which have resulted in significantly lower levels of participation than in prior years.

Conservation Tools

The SNWA uses several demand management tools to promote conservation and reduce overall water use, including water pricing, incentives, regulation and education. As described below, these measures are designed to work in conjunction with one another to promote efficient water use. Likewise, SNWA has deployed new strategies to promote continued conservation and efficiency gains. These include increased water management measures, targeted education and outreach initiatives and increases to financial incentive programs. New incentives and offerings have also been introduced.

- Education: Education is an integral element of SNWA's water conservation strategy. It includes both formal and informal education, from tips and tutorials to improve efficiency, to class offerings on water-smart landscaping practices for both residents and landscape professionals.
- Incentives: The SNWA operates one of the largest incentive programs in the nation. Since 2000, SNWA has invested more than $230

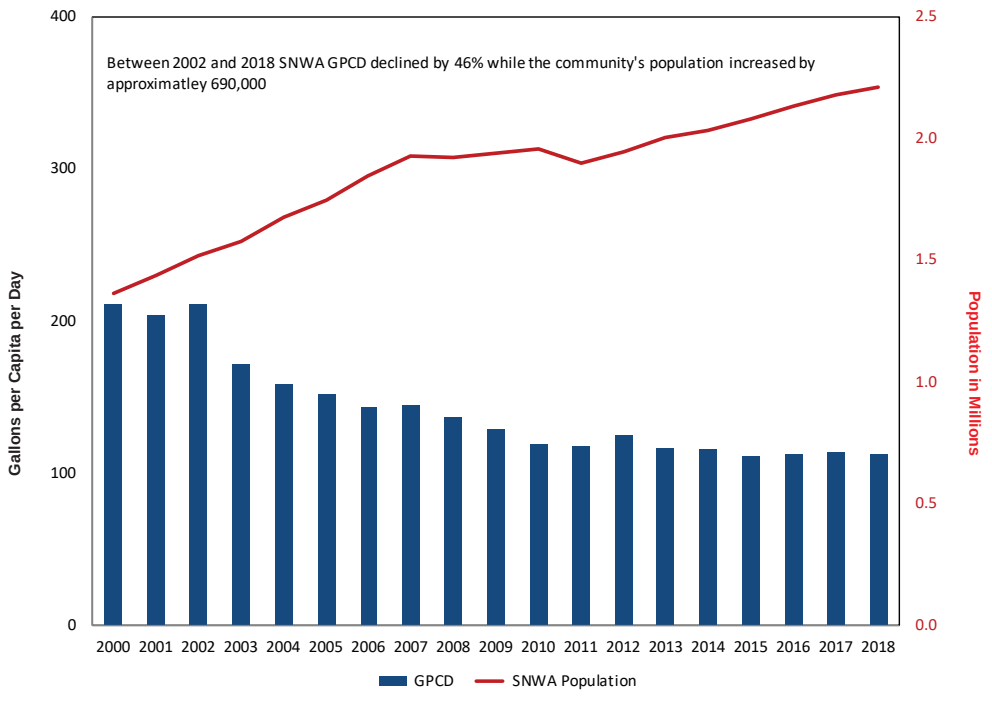
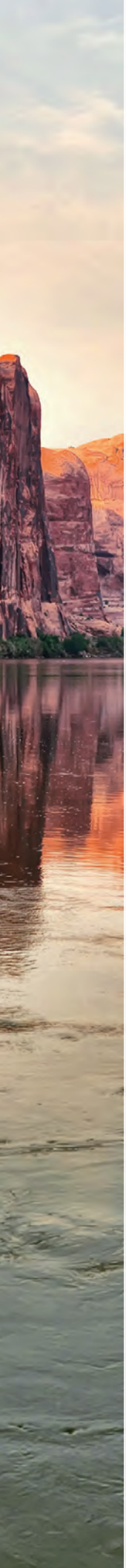


FIGURE 3.5 **Population & Per Capita Water Use**



million in incentive programs, reducing demand by more than 12.6 billion gallons annually.

- Regulation: Through collaboration, SNWA member agencies and Clark County have adopted a suite of land use codes, ordinances and water use policies to ensure more efficient use of water in Southern Nevada. These include time-of-day and day-of-week watering restrictions, water waste restrictions and limitations on the installation of new turf in residential and commercial development.
- Water Pricing: SNWA member agencies implement conservation rate structures that charge higher rates for water as use increases. These rate structures encourage efficiency, without jeopardizing water affordability for essential uses.

CHAPTER SUMMARY

A number of factors can influence the timing, use and availability of water resources. Having a diverse portfolio of resources allows SNWA to assess its overall water resource options and make appropriate decisions regarding which resources to bring online when necessary. This approach provides flexibility in adapting to changing supply and demand conditions, and helps ensure that community water demands can be met reliably.

The SNWA Water Resource Portfolio includes a mix of permanent, temporary and future resources that will be used in tandem with continued conservation efforts to meet demands over the 50-year planning horizon. Some of these resources can be used under any Colorado River operating condition, while others are subject to limitations (such as staged pumping or restrictions during shortage).

SNWA continues to make water conservation a priority and the community is currently working to achieve its 105 GPCD conservation goal by 2035. Additional targets will be evaluated once the current goal is realized. The SNWA has taken a number of steps to increase conservation gains, including enhanced education and outreach efforts, as well as increases to its conservation rebate and incentive programs.

With ongoing support from the community, conservation will maximize the use and availability of existing supplies, help protect Lake Mead water levels from continued decline, delay the need for new resources and facilities, and provide opportunities to increase temporary storage reserves.

Likewise, the SNWA continues to work with other Colorado River water users to pursue flexible use of Colorado River supplies, including augmentation and storage projects that are designed to increase supplies and bolster Lake Mead water levels. Together, these actions will provide flexibility in meeting demands as described in Chapter 4.

ENDNOTES

1 "Contract with the Southern Nevada Water Authority, Nevada for the Delivery of Colorado River Water," effective March 2, 1992; between Secretary of Interior, Colorado River Commission and Southern Nevada Water Authority." The contract was amended in 1994: "Amended and Restated Contract with the Southern Nevada Water Authority, Nevada for the Delivery of Colorado River Water," effective November 17, 1994.

2 Nevada Colorado River consumptive use entitlement available for SNWA and the SNWA purveyor members is estimated to be 272,205 AFY plus 4,000 AFY for Nellis Air Force Base with 23,795 AFY allocated for use by Nevada non-SNWA contractors. "Listing of Individual Water Entitlements in the State of Nevada," listing as of January 2019, U.S. Bureau of Reclamation, http://www. usbr. gov/lc/region/g4000/contracts/entitlements/NVentitlements.pdf.

3 Nevada receives credits for Colorado River return flows from the Las Vegas Wash based upon a procedure originally agreed to by the U.S. Bureau of Reclamation (BOR) and the Colorado River Commission of Nevada in 1984. This procedure has been updated periodically through consultation with the BOR, SNWA and Colorado River Commission of Nevada; the most recent update in 2007 allows full consumptive use of groundwater imported to the Las Vegas Valley.

4 The 1964 Supreme Court Decree in Arizona v. California defines "surplus" as follows: "If sufficient mainstream water is available for release as determined by the Secretary, to satisfy annual consumptive use [in the Lower Division states of Arizona, California and Nevada] in excess of 7,500,000 acre-feet, such excess consumptive use is surplus."

5 Under the Interim Guidelines, Extraordinary Conservation ICS credits accumulated in ICS accounts will be reduced by the amount of the Flood Control Surplus on an acre-foot for acre-foot basis until no Extraordinary Conservation ICS remains. The reductions to the ICS accounts will be shared on a pro-rata basis among all contractors that have accumulated Extraordinary Conservation ICS credits.

6 According to the Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations of Lake Powell and Lake Mead (Interim Guidelines), Lower Basin States of Arizona, California and Nevada can create credits for Colorado River or non-Colorado River water that has been conserved by users in the Lower Basin (known as intentionally created surplus or ICS). ICS credits can be used in the year they are created or be stored in Lake Mead and made available for release from Lake Mead at a later time, subject to Operating (Shortage) conditions at the time of release.

7 "Developed Shortage Supply ("DSS")" shall mean water available for use by a contractor under the terms and conditions of a Delivery Agreement and Section 4 of Interim Guidelines in a Shortage Condition, under Article III(B)(3) of the Consolidated Decree. During a year when the Secretary has determined a shortage condition, the Secretary shall deliver DSS available in a contractor's DSS Account at the request of the contractor, subject to the provisions of Interim Guidelines' Section 4.C.

8 Nevada Revised Statutes, Chapters 532, 533, and 534.

9 The 1944 United States-Mexico Treaty for Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande. The treaty guarantees Mexico the delivery of 1.5 million AFY of Colorado River water plus 200,000 AFY of any surplus Colorado River water. In 1974, an international agreement interpreting the 1944 Treaty guaranteed Mexico water of the same quality as that being used in the United States.

10 "In-Lieu Recharge Order," Order No. 1176, December 10, 2004,State of Nevada, Office of the Nevada State Engineer.

11 "Policy Regarding Out-of-Valley Water Reuse," 2017, SNWA.

12 "Cooperative Agreement for the Banking of Water in the Las Vegas Valley Groundwater Basin between the Southern Nevada Water Authority and the Las Vegas Valley Water District," effective February 21, 2006. The artificial recharge program in the Las Vegas Valley was initiated in 1987 by the Las Vegas Valley Water District.

13 "Third Amended Operational Agreement among the Metropolitan Water District of Southern California (Metropolitan), Colorado River Commission of Nevada and the Southern Nevada Water Authority (SNWA)," effective October 19, 2015 and "Storage and Interstate Release Agreement among the United States of America, the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, and the Colorado River Commission of Nevada," effective October 27, 2004. The amount of developed and released water stored in Metropolitan's SNWA Interstate Account to SNWA depends on timing of SNWA's request and Colorado River operating conditions at the time of such request.

14 "Third Amended and Restated Agreement for Interstate Water Banking among the Arizona Water Banking Authority and the Southern Nevada Water Authority and the Colorado River Commission of Nevada," effective May 20, 2013 and "Storage and Interstate Release Agreement among the United States of America, the Arizona Water Banking Authority, the Southern Nevada Water Authority, and the Colorado River Commission of Nevada," effective December 18, 2002.

15 "Lower Colorado River Basin Drought Contingency Plan Agreement" among the U.S., State of Arizona, Metropolitan Water District of Southern California, Coachella Valley Water District, Palo Verde Irrigation District, City of Needles, Colorado River Commission of Nevada and SNWA. May 20, 2019.

16 "Lower Basin Drought Contingency Operations, ICS Exhibit W - Southern Nevada Water Authority – Extraordinary Conservation Intentionally Created Surplus using Municipal Conservation and Offstream Storage for implementation under the Lower Basin Drought Contingency Plan," May 20, 2019.

17 SNWA has 2,200 AFY of groundwater permits in Garnet and-Hidden valleys as a combined duty. SNWA is currently leasing a maximum of 1,450 AFY, not to exceed 13,000 acre-feet over any ten year rolling period, for power generation in Garnet Valley. The leases therefore commit 1,300 AFY over a ten year rolling period. In addition, the City of North Las Vegas is permitted to divert 300 AFY from their wells in Garnet Valley, and the remaining 600 AFY is available for future uses.

18 "Agreement Concerning Colorado River Management and Operations," effective April 23, 2007; between Arizona Department of Water Resources, Colorado River Board of California, Colorado Water Conservation Board, Governor's Representative for the State of Colorado, Colorado River Commission of Nevada, Southern Nevada Water Authority, New Mexico Interstate Stream Commission, Utah Division of Water Resources, Utah Interstate Streams Commissioner, and Wyoming State Engineer.

19 Nevada Revised Statutes, Chapters 532, 533 and 534.

20 Southern Nevada Water Authority Joint Water Conservation Plan," November 2019, SNWA.

21 The 2018 Water Resource Plan presented SNWA's conservation goal and progress in "net" GPCD terms. The SNWA has changed its approach for the 2019 Plan and the SNWA's formerly noted conservation goal of 116 GPCD by 2035 has been translated to 105 Consumptive Use GPCD. This methodology reflects actual per capita SNWA consumptive use of Colorado River water excluding off-stream storage and well production including recovered storage (SNWA per capita "water resource footprint"). Historical GPCD goal progress has also been restated using the same methodology. This approach reduces the number of sources and inputs required to calculate SNWA GPCD, improving transparency and explanation. For consistency, this change is being made to other planning documents, including the SNWA's Joint Water Conservation Plan.

MEETING FUTURE DEMANDS

THIS CHAPTER ADDRESSES HOW SNWA PLANS TO RELIABLY MEET PROJECTED WATER DEMANDS UNDER A RANGE OF SUPPLY AND DEMAND CONDITIONS.

INTRODUCTION

As described in the preceding chapters, water supply conditions and demands can be influenced by several factors that can change in unpredictable ways, including changes associated with economic conditions, water conservation progress and climate variability. As SNWA prepared its 2019 Plan, the organization considered two overriding issues related to water supply and demands:

- The potential impact of continued drought and climate change on water resource availability, particularly for Colorado River supplies; and
- The potential impact of economic conditions, climate change and water use patterns on long-term water demands.

To address these uncertainties, SNWA developed a series of planning scenarios that represent Southern Nevada's future water resource needs under variable supply and demand conditions. This approach helps inform water resource planning and water resource development efforts and demonstrates how the SNWA plans to meet future needs, even if conditions change significantly over time.

In prior years, planning scenario resource volumes were presented in diversion amounts. For the 2019 Plan, water demands and resource volumes are presented in consumptive use terms. As a result, the planning scenarios more clearly correlate to the water resource descriptions in Chapter 3 and better illustrate the supply related impacts of SNWA shortage reductions and DCP contributions.

As described in the sections below, all of the planning scenarios presented in this chapter demonstrate SNWA's ability to meet the community's long-term projected water needs through adaptive use of its Water Resource Portfolio.

SUPPLY AND DEMAND

Water resource planning is based on two key factors: supply and demand. Supply refers to the amount of water that is available or that is expected to be available for use. Demand refers to the amount of water expected to be needed in a given year.

Water demand projections are based on population forecasts and include assumptions about future water use, such as expected achievements toward water conservation goals. Precise accuracy from year to year rarely occurs in projecting demands, particularly during periods of significant social and economic changes. While making assumptions is a necessary part of the planning process, assumptions are unlikely to materialize exactly as projected. Likewise, climate variations, policy changes and/or the implementation of new regulations can also influence water resource availability over time.

The scenarios presented in this chapter address these uncertainties by considering a wide range of supply and demand possibilities. Rather than considering a single forecast, the scenarios bracket the range of reasonable conditions that may be experienced over the 50-year planning horizon. Key factors evaluated include possible reductions of Colorado River supplies, as well as variation in future demands. This is a conservative approach that reflects the uncertainties presented in the current planning environment.

The following describes the water supply conditions and demand projections that were considered as part of scenario development.

Water Supply

Figure 4.1 summarizes the water resources planned for development and use as part of the SNWA's Water Resource Portfolio. As previously described, some permanent and temporary resources are subject to restrictions for use based on Lake Mead water levels (when Lake Mead is at an elevation of 1,090 feet or lower), while other resources will require the development of facilities for use.

Ultimately, the timing and need for resources will depend significantly on how supply and demand

	SUPPLY	CONSUMPTIVE USE	AVAILABLE IN SHORTAGE
PERMANENT	Colorado River (SNWA and Nellis Air Force Base) [1]	276, 205 AFY	Yes. Subject to shortage reductions
	Nevada Unused Colorado River (Non-SNWA)	13,016 (2019) to 0 AFY in 2031	Yes. Subject to availability
	Tributary Conservation ICS	28,700-36,000 AFY	Yes
	Las Vegas Valley Groundwater Rights	46,961 AFY	Yes
TEMPORARY	Southern Nevada Groundwater Bank	335,111 AF (20,000 AFY max.)	Yes
	Interstate Bank (Arizona)	613,846 AF (40,000 AFY max.)	Yes
	Interstate Bank (California)	330,225 AF (30,000 AFY max.)	Yes
	Intentionally Created Surplus (storage in Lake Mead)	695,341 AF (300,000 AFY max.)	Yes, varies by Lake Mead elevation
FUTURE	Desalination	To be determined	To be determined
	Garnet and Hidden Valleys Groundwater	2,200 AFY	Yes
	Delamar, Dry Lake, Cave and Spring Valleys Groundwater	91,988 AFY	Yes
	Tikaboo and Three Lakes Valley North and South Groundwater	10,605 AFY	Yes
	Virgin River/Colorado River Augmentation	Up to 108,000 AFY	To be determined
	Snake and Railroad Valleys Groundwater	To be determined	To be determined
	Transfers/Exchanges	To be determined	To be determined

FIGURE 4.1 **SNWA Water Resource Portfolio**

conditions materialize over the long-term planning horizon.

Water Demand Projections

The planning scenarios developed as part of this Plan include three water demand projections (Figure 4.2 and Figure 4.3). These include: an upper water demand projection, a lower water demand projection and an additional conservation demand projection. The lower water demand projection was derived from a population forecast and expected conservation achievements. The Clark County population forecast was obtained from the University of Nevada Las Vegas Center for Business and Economic Research (CBER).

This forecast is also used in local planning, including transportation planning by the Regional Transportation Commission. The forecast is based on CBER's working knowledge of the economy and the nationally recognized Regional Economic Model Incorporated (REMI).

The lower water demand projection was derived using the 2019 CBER population forecast through 2060 and trending through the year 2070. The historical share of Clark County population attributable to the SNWA service area was multiplied by 2018 water-use levels and reduced over time to represent expected achievement of the community's water conservation goal of 105 GPCD by 2035. The projection assumes a further reduction in total demand (100 GPCD) by 2055 to reflect the potential for additional conservation once the current goal has been met.

YEAR	2020	2045	2070
LOWER DEMAND	289,000	327,000	346,000
UPPER DEMAND	294,000	386,000	433,000
ADDITIONAL CONSERVATION	292,000	358,000	398,000

FIGURE 4.2
SNWA Demand Projection, (AFY)

The upper demand projection was developed for planning purposes to reflect increased uncertainties related to possible changes in demands that are associated with the economy, climate, population and water use variability.

The upper demand projection represents a 15 percent increase over the lower projection at the midpoint of the planning horizon (2039), increasing to 25 percent in the latter part of the planning horizon (2070). The SNWA also considered one variant of the upper demand projection that includes assumptions about additional levels of conservation.

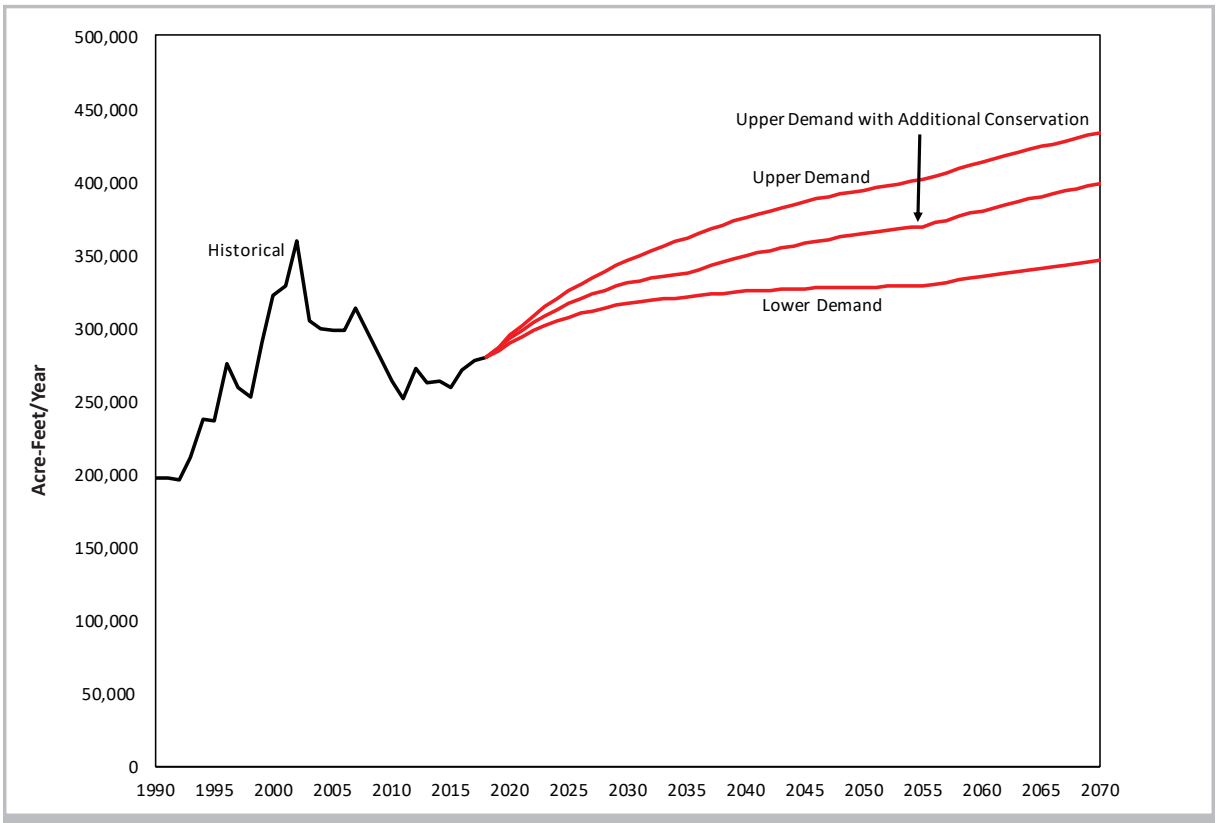


FIGURE 4.3 **SNWA Historical and Projected Water Demand**

The additional conservation demand projection was developed for planning purposes to illustrate how additional conservation might reduce water demands, extend permanent and temporary resources and delay the need for future resources. The projection assumes the community meets its conservation goal of 105 GPCD and further reduces water use to 98 GPCD by 2035 and 92 GPCD by 2055.

Water Supply Conditions

The SNWA also made assumptions about future water supply conditions as part of its long-range planning efforts. As detailed in Figure 4.4 and Figure 4.5, the SNWA evaluated four water supply conditions that are based on historic Colorado River inflows since 1906 (when record-keeping began) to 2019.

As noted earlier in this Plan, Colorado River inflows are highly variable with occasional and extended periods of extremely wet and extremely dry inflows. By incorporating historical water supply conditions into long-term planning efforts, the SNWA can make better-informed decisions about future Lake Mead water levels and associated restrictions on Colorado River supplies, as well as the timing and volume of resources needed to meet future demands.

Under the Interim Guidelines, shortage volumes are defined for Lake Mead elevations between 1,075 and

WATER SUPPLY CONDITION	SUMMARY
AVERAGE	Repeats Colorado River inflows over the combined 50-year period from 1972 to 2017 and 1906 to 1909; assumes an average annual Colorado River inflow of 14.7 million AFY. This is representative of the river's historic long-term average inflow of 14.8 million AFY.
DRY	Repeats Colorado River inflows over the 50-year period from 1924 to 1973; assumes an average annual Colorado River inflow of 14.1 million AFY.
EXTREMELY DRY	Repeats Colorado River inflows over the 50-year period from 1929 to 1978; assumes an average annual Colorado River inflow of 13.7 million AFY.
CLIMATE CHANGE	To simulate the effects of drier and hotter conditions represented in climate change projections, the Colorado River inflows over a 25-year period from 1953 to 1977 are repeated to form an average annual inflow of 12.9 million AFY. Projections of inflows under the Colorado River Basin study for climate change ranged from roughly 10 to 17 million AFY. While this does not represent the driest scenario, it is drier than approximately 70 percent of the climate scenarios (see Appendix 4).

FIGURE 4.4 **Water Supply Conditions Summary**

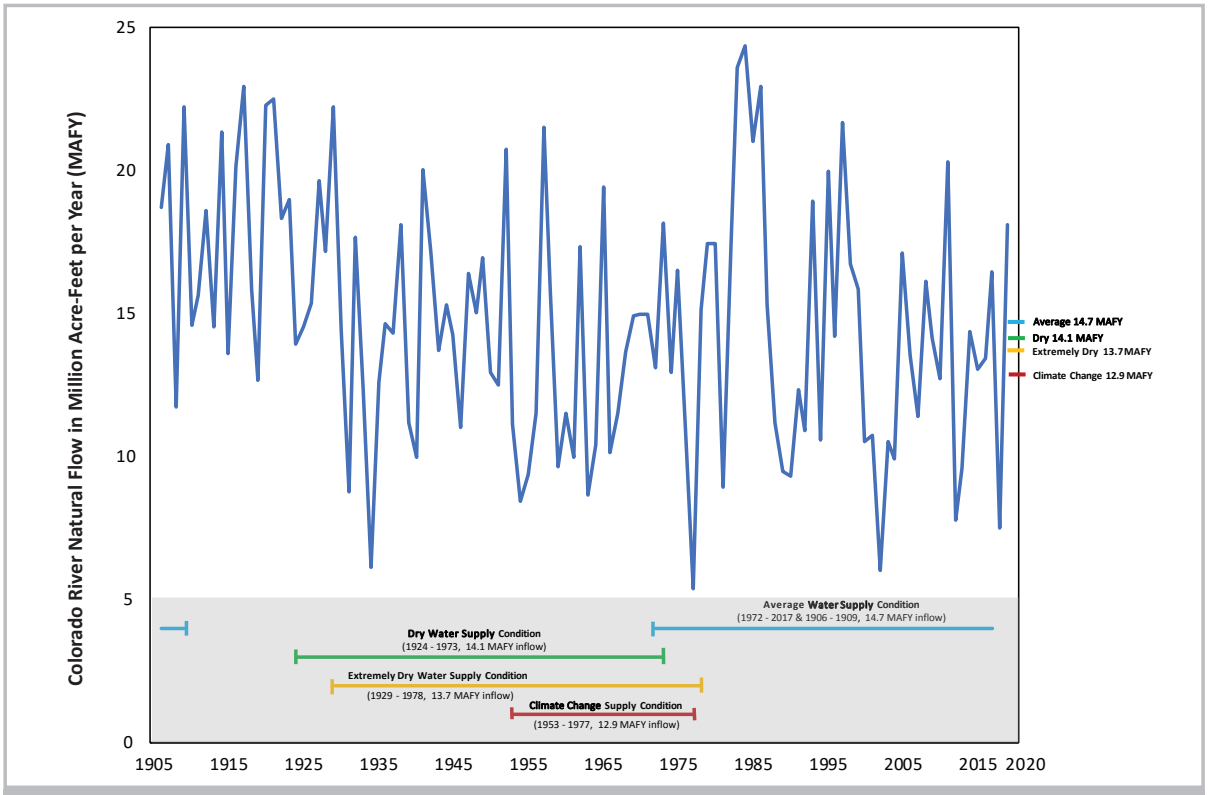


FIGURE 4.5 **Water Supply Conditions Evaluated in Planning Scenarios 1906 - 2019**

1,025 feet. Likewise, the DCP defines Lower Basin contributions when Lake Mead is at or below 1,090 feet. Both agreements expire in 2026. While some provisions extend further, operational certainty decreases with time.

If Lake Mead is projected to be at or below 1,030 feet, the U.S. Secretary of the Interior will consult with the Colorado River Basin States to determine what additional measures are needed to avoid and protect against the potential for Lake Mead to decline to below 1,020 feet. If this were to occur, future negotiations and consultation with the U.S. Secretary of the Interior may establish additional shortage volumes and/or DCP contribution amounts. As a result, Nevada may be required to assume reductions greater than 30,000 AFY (Nevada's combined maximum shortage and contribution volume under the Interim Guidelines and DCP). This Plan assumes a maximum reduction of 40,000 AFY as described later in this chapter.

Colorado River modeling performed by the Bureau of Reclamation in 2019 projects an approximate 4-43 percent probability that Lake Mead will reach an elevation of 1,075 feet or lower in the years 2021 to 2024, triggering a federal shortage declaration. The probability of shortage ranges between approximately 47–82 percent in the years following.

SUPPLY AND DEMAND SCENARIOS

The water supply conditions and demand projections on pages 39 and 40 have been combined into a series of planning scenarios (Figure 4.6 through Figure 4.21) that depict the volume and type of resources planned for use to meet the range of possible future supply and demand conditions discussed in this chapter. Each set of planning scenarios is accompanied by a more detailed description of water supply conditions, as well as assumptions about resource availability and use.

The 2019 Plan assumes the Interim Guidelines and DCP continue through the planning horizon. Resource volumes may vary within scenario groupings based on assumptions for how SNWA DCP commitments are met. The SNWA can meet this obligation by reducing the use of Colorado River supplies, by utilizing other resources, or converting eligible forms of ICS to meet DCP contributions.

All planning scenarios consider combinations of permanent, temporary and future resources as described in Chapter 3. Having a portfolio of resource options provides the SNWA with the flexibility to adjust the use of some resources if the development of other resources is delayed or revised, or if changes in demands occur. If other options become available sooner, the priority and use of resources may change.

Hoover Dam

The Interim Guidelines and Lower Basin DCP work to reduce the decline of Lake Mead water levels and protect Colorado River operations. If modeling projects Lake Mead to be at or below 1,030 feet, the U.S. Secretary of the Interior will work with Lower Basin states to determine what additional actions may be needed to avoid and protect against the potential for Lake Mead to decline below 1,020 feet.

AVERAGE HYDROLOGY SCENARIOS
(14.7 Million AFY Natural Flow)

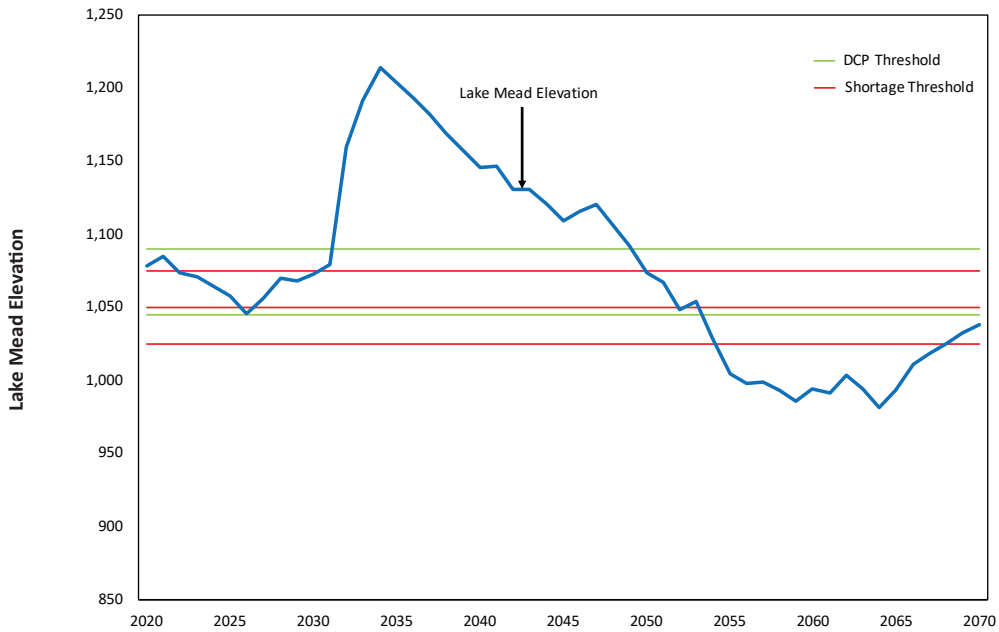


FIGURE 4.6 **Lake Mead Elevation, Average Hydrology**

Figure 4.6 depicts the projected Lake Mead elevation if Colorado River hydrology over the combined 50-year period from 1972 to 2017 and 1906 to 1909 is repeated through 2070.

This forecast assumes the surface elevation of Lake Mead will decline intermittently over the long-term planning horizon, triggering defined shortage reductions and DCP contributions between 2020 and 2032 and 2051 and 2070; increased reductions up to 40,000 AFY are assumed in later years based on demand and when Lake Mead water levels are below 1,020 feet.

Figure 4.7 - Figure 4.9 reflect SNWA planning adjustments and water resources available to meet the three water demand projections with average hydrology.

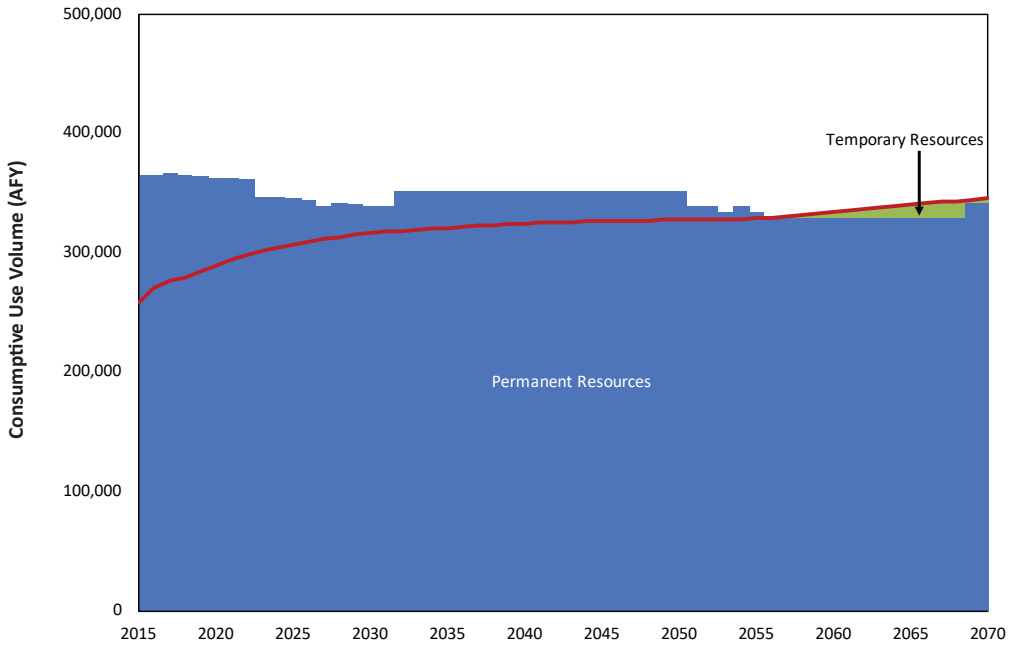


FIGURE 4.7 **Average Hydrology, Lower Demand**

As shown in Figure 4.7, permanent and temporary resources are sufficient to meet demands through 2070. Under this scenario, temporary resources are needed beginning in 2056.

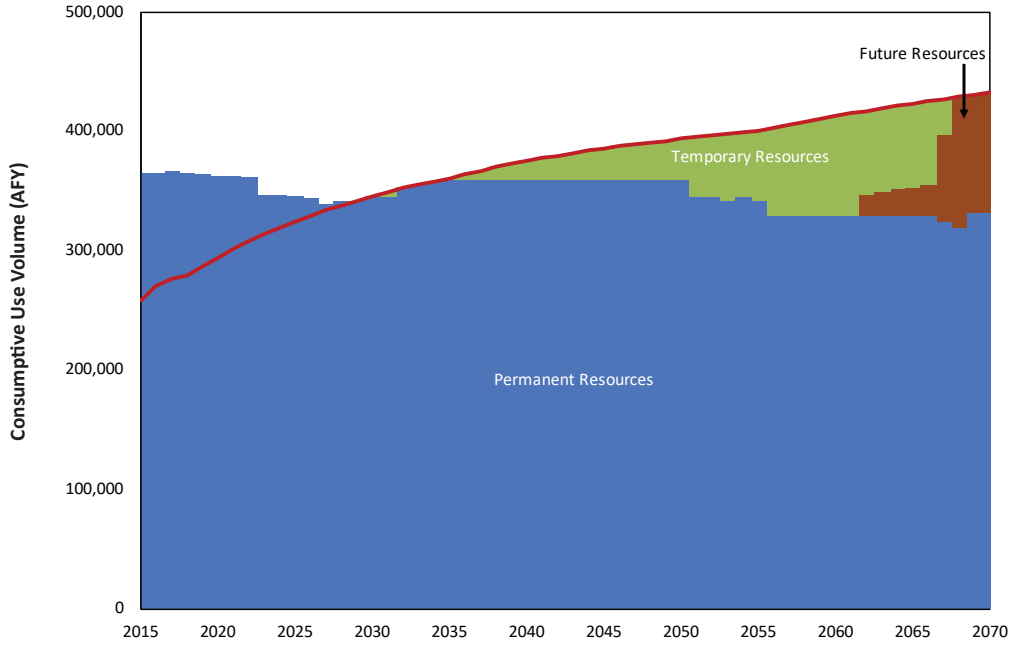


FIGURE 4.8 **Average Hydrology, Upper Demand**

As shown in Figure 4.8, permanent, temporary and future resources are needed to meet demands through the 50-year planning horizon. Under this scenario, temporary and future resources are utilized beginning in 2031 and 2062, respectively. The volume of future resources needed in 2070 is estimated at 101,000 AFY.

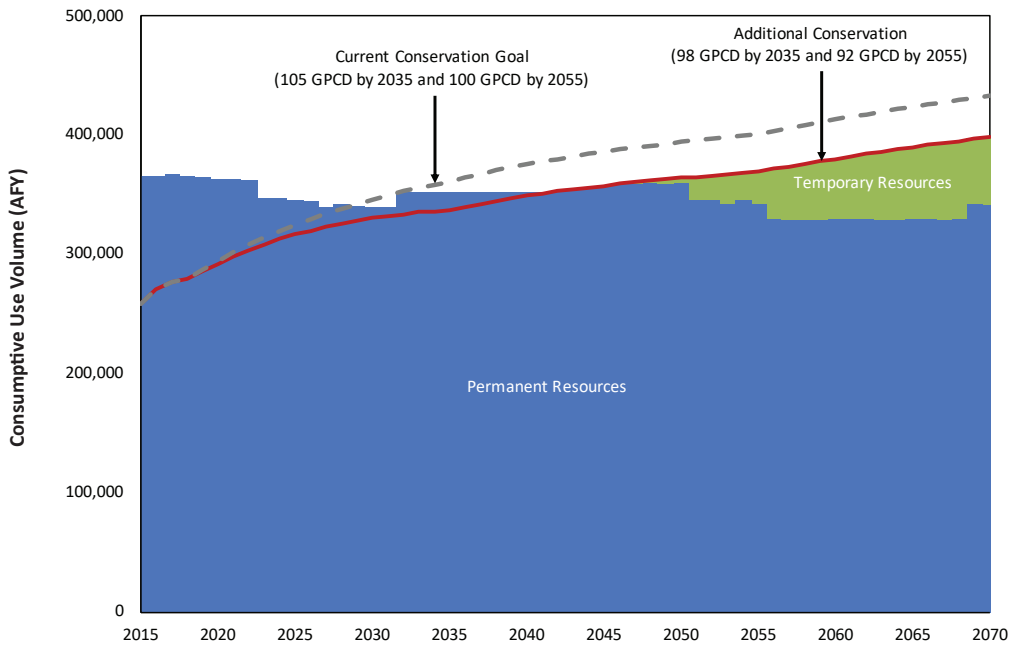


FIGURE 4.9 **Average Hydrology, Additional Conservation**

Figure 4.9 illustrates the impact of additional conservation on the timing and need of temporary and future resources. This scenario assumes future water use at 98 GPCD by 2035 and 92 GPCD by 2055. Under this scenario, permanent and temporary resources are sufficient to meet water demands through 2070. Temporary resources are needed to meet projected water demands beginning in 2047.

DRY HYDROLOGY SCENARIOS
(14.1 Million AFY Natural Flow)

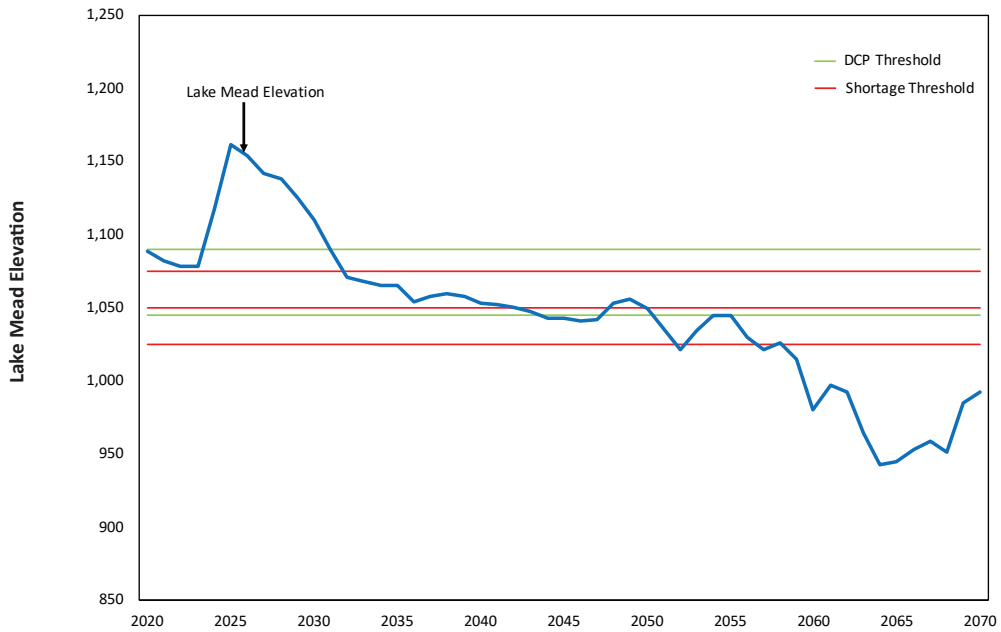


FIGURE 4.10 **Lake Mead Elevation, Dry Hydrology**

Figure 4.10 illustrates the projected elevation of Lake Mead if Colorado River hydrology experienced between 1924 and 1973 is repeated through 2070.

This forecast assumes the surface elevation of Lake Mead will briefly recover above 1,090 feet between 2025 and 2031 and then experience sustained decline over the long-term planning horizon, triggering defined shortage reductions and DCP contributions. A maximum annual reduction of 40,000 AFY is assumed in later years based on demand and when Lake Mead water levels are below 1,020 feet.

Figure 4.11 – Figure 4.13 reflect SNWA planning adjustments and water resources available to meet the three water demand projections with dry hydrology.

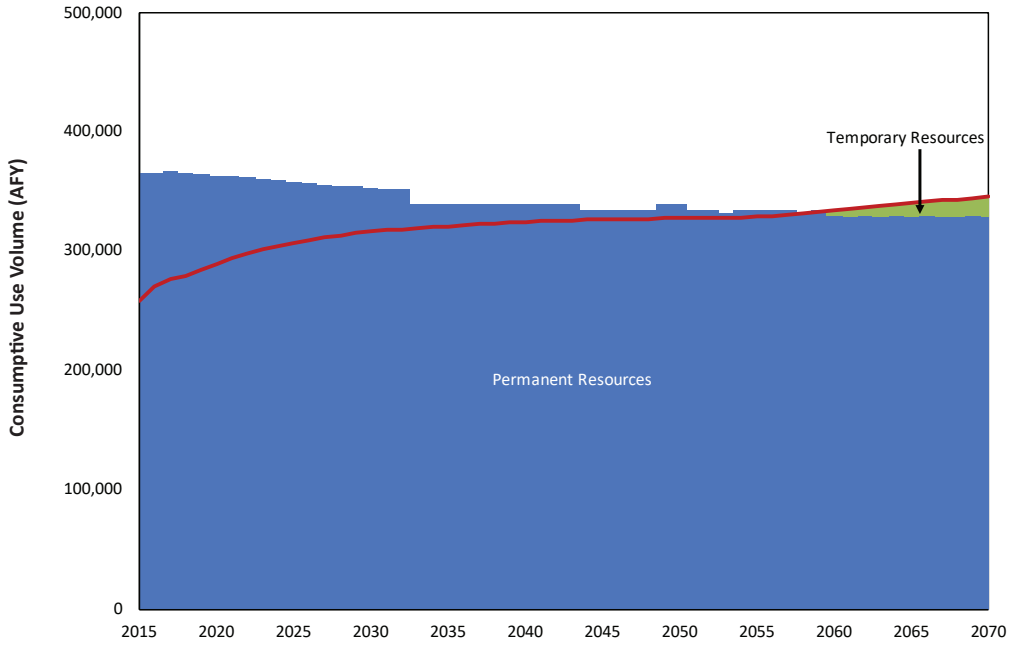


FIGURE 4.11 **Dry Hydrology, Lower Demand**

As shown in Figure 4.11, permanent and temporary resources are sufficient to meet demands through 2070. Under this scenario, temporary resources are needed beginning in 2060.

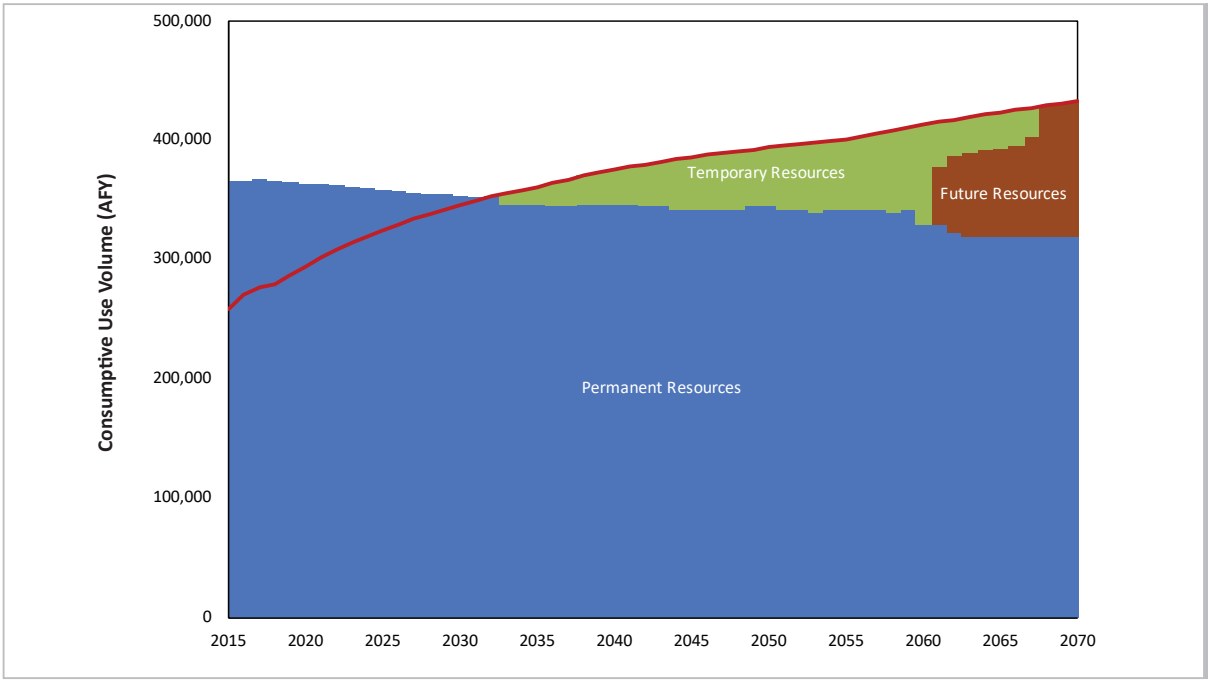


FIGURE 4.12 **Dry Hydrology, Upper Demand**

As shown in Figure 4.12, permanent, temporary and future resources are needed to meet demands through the 50-year planning horizon. Under this scenario, temporary and future resources are needed beginning in 2033 and 2061, respectively. The volume of future resources needed in 2070 is estimated at 114,000 AFY.

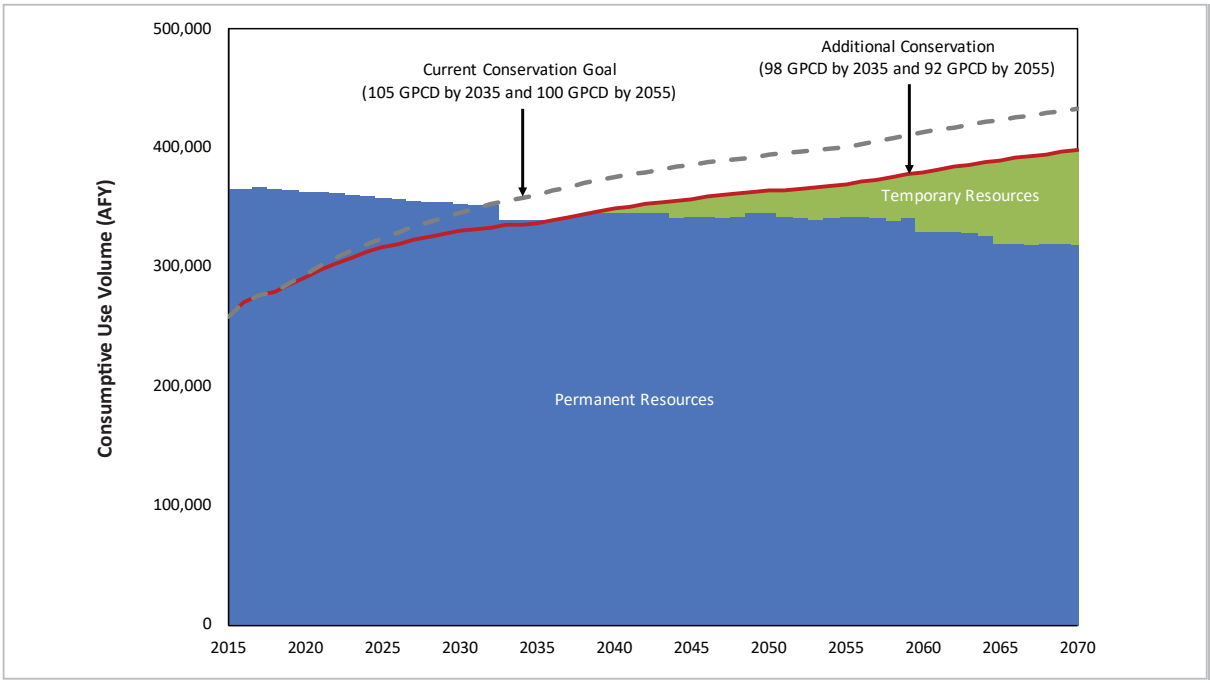


FIGURE 4.13 **Dry Hydrology, AdditionalConservation**

Figure 4.13 illustrates the impact of additional conservation on the timing and need for temporary and future resources. This scenario assumes future water use at 98 GPCD by 2035 and 92 GPCD by 2055. Under this scenario, permanent and temporary resources are sufficient to meet water demands through 2070. Temporary resources are needed beginning in 2039.

EXTREMELY DRY HYDROLOGY SCENARIOS
(13.7 Million AFY Natural Flow)

FIGURE 4.14 **Lake Mead Elevation, Extremely Dry Hydrology**

Figure 4.14 illustrates the projected elevation of Lake Mead if Colorado River hydrology experienced between 1929 and 1978 is repeated through 2070.

This forecast assumes the surface elevation of Lake Mead will briefly recover above 1,090 feet between 2021 and 2024 and then experience periods of intermittent and sustained decline over the long-term planning horizon, triggering defined shortage reductions and DCP contributions. Increased reductions up to 40,000 AFY are assumed in later years based on demands and when Lake Mead water levels are below 1,020 feet.

Figure 4.15 – Figure 4.17 reflect SNWA planning adjustments and water resources available to meet the three water demand projections with extremely dry hydrology.

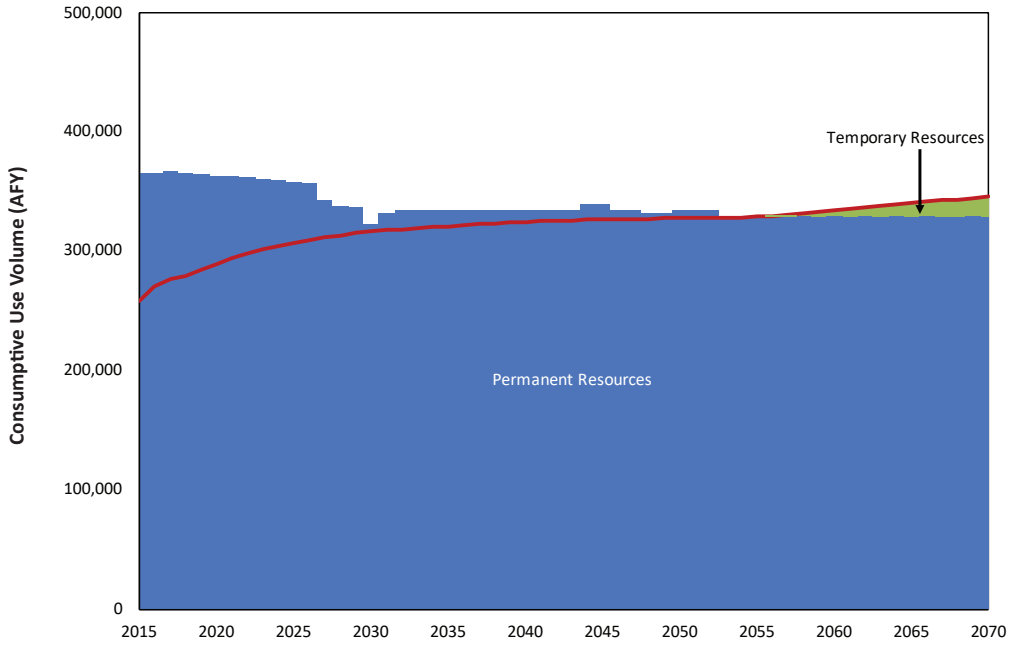


FIGURE 4.15 **Extremely Dry Hydrology, Lower Demand**

As shown in Figure 4.15, permanent and temporary resources are sufficient to meet demands through 2070. Under this scenario, temporary resources are needed beginning in 2056.

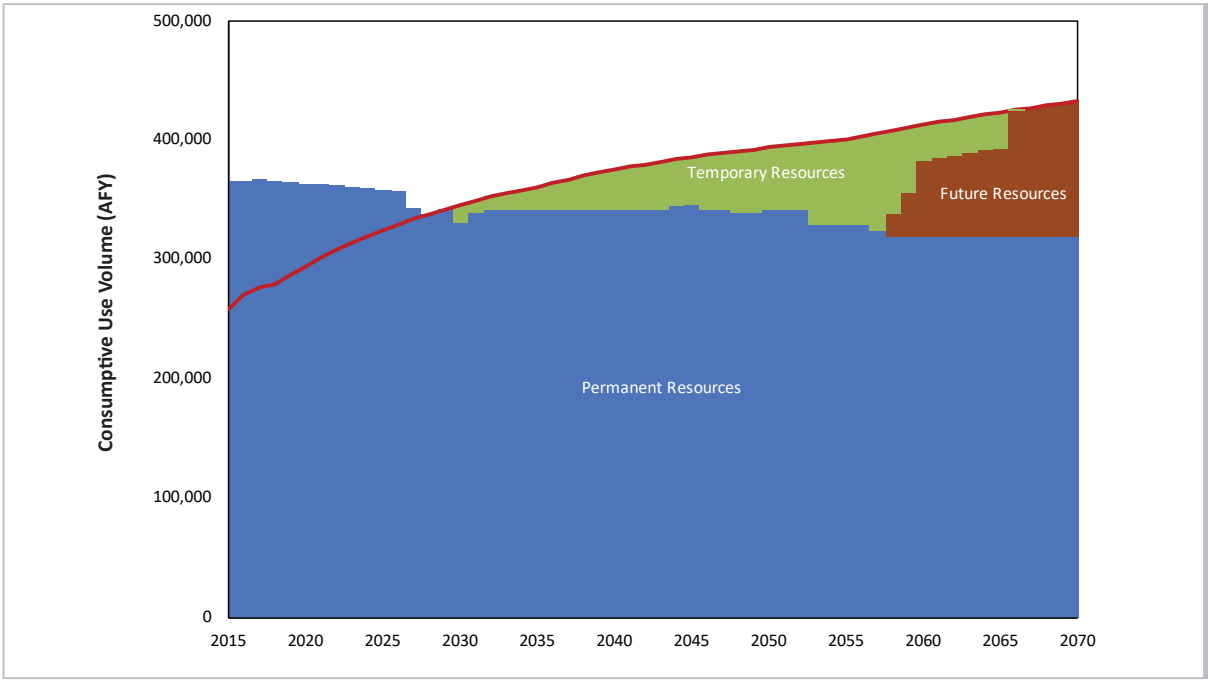


FIGURE 4.16 **Extremely Dry Hydrology, Upper Demand**

As shown in Figure 4.16, permanent, temporary and future resources are needed to meet demands through the 50-year planning horizon. Under this scenario, temporary and future resources are needed beginning in 2030 and 2058, respectively. The volume of future resources needed in 2070 is estimated at 114,000 AFY.

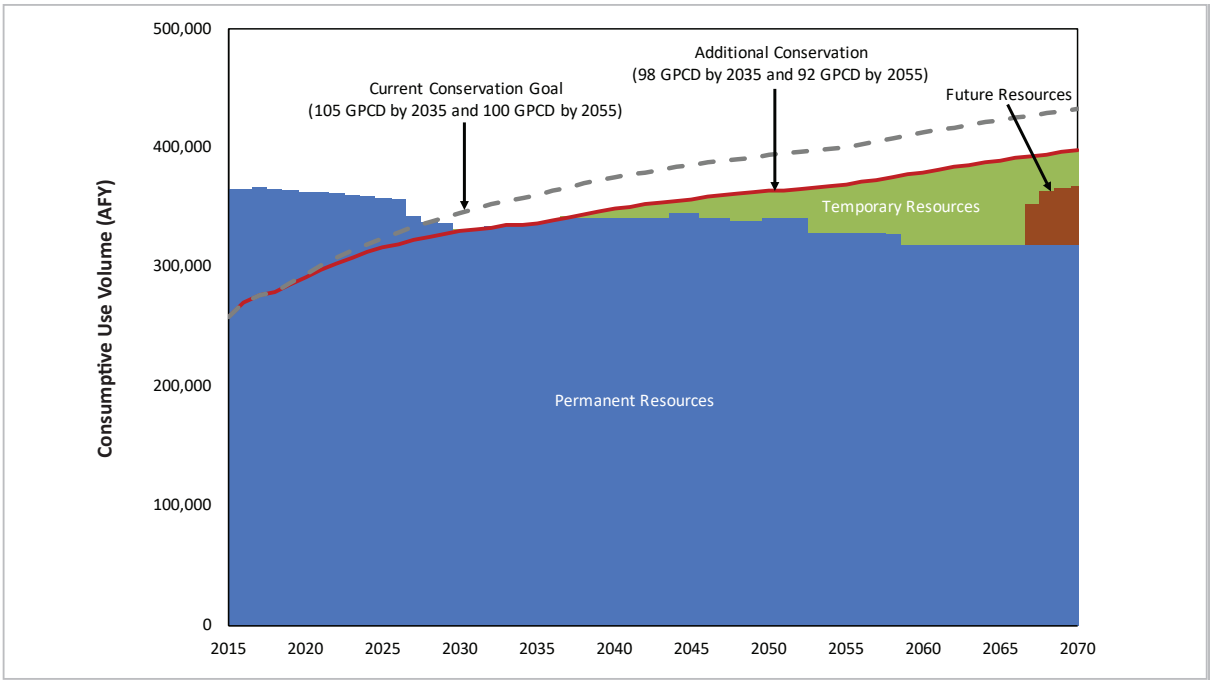


FIGURE 4.17 **Extremely Dry Hydrology, Additional Conservation**

Figure 4.17 illustrates the impact of additional conservation on the timing and need for temporary and future resources. This scenario assumes future water use at 98 GPCD by 2035 and 92 GPCD by 2055. Under this scenario, permanent, temporary and future resources are needed to meet water demands through 2070. Temporary and future resources are needed beginning in 2037 and 2067, respectively. The volume of future resources needed in 2070 is estimated at 49,000 AFY.

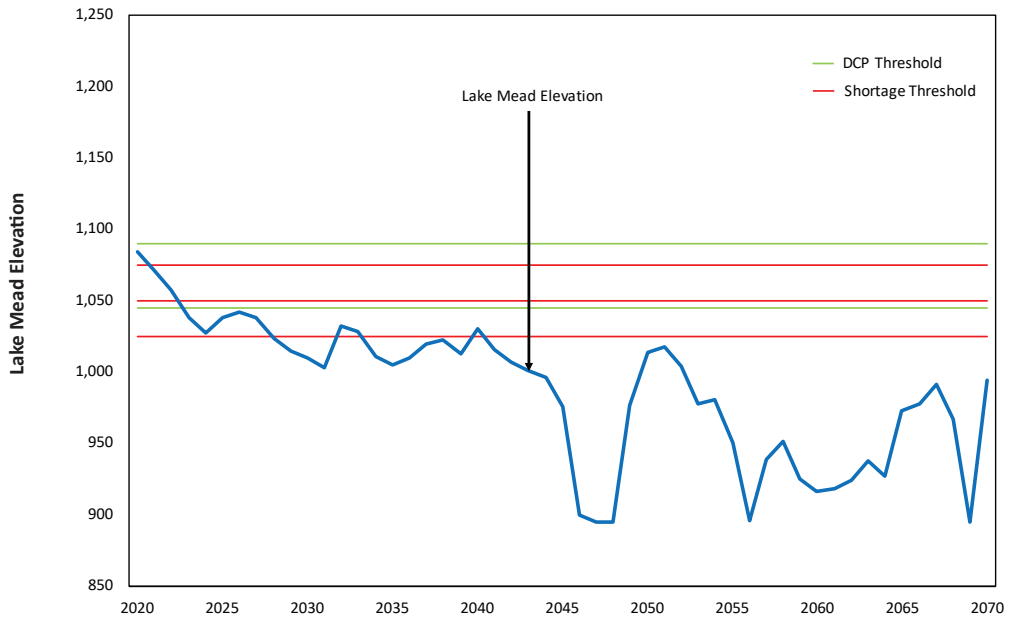


FIGURE 4.18 **Lake Mead Elevation, Climate Change Hydrology**

Figure 4.18 illustrates the projected elevation of Lake Mead if Colorado River hydrology experienced between 1953 and 1977 is repeated through 2070.

This forecast assumes the surface elevation of Lake Mead will remain below 1,090 feet over the long-term planning horizon, intermittently reaching a Lake Mead elevation of 895 feet, the point at which Hoover Dam can no longer deliver water to downstream users.

Shortage reductions and DCP contributions are assumed throughout the planning horizon. Increased reductions up to 40,000 AFY are assumed based on demands and when Lake Mead water levels are below 1,020 feet.

Figure 4.19 – Figure 4.21 reflect SNWA planning adjustments and water resources available to meet the three water demand projections under climate change hydrology.

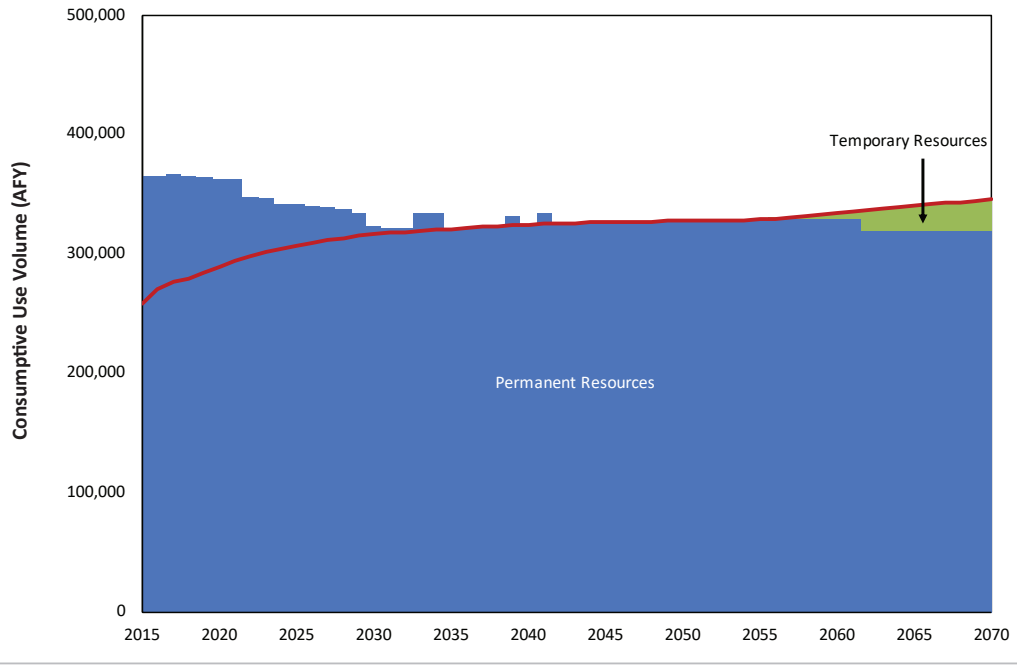


FIGURE 4.19 **Climate Change Hydrology, Lower Demand**

As shown in Figure 4.19, permanent and temporary resources are sufficient to meet demands through 2070.

Under this scenario, temporary resources are needed beginning in 2056.

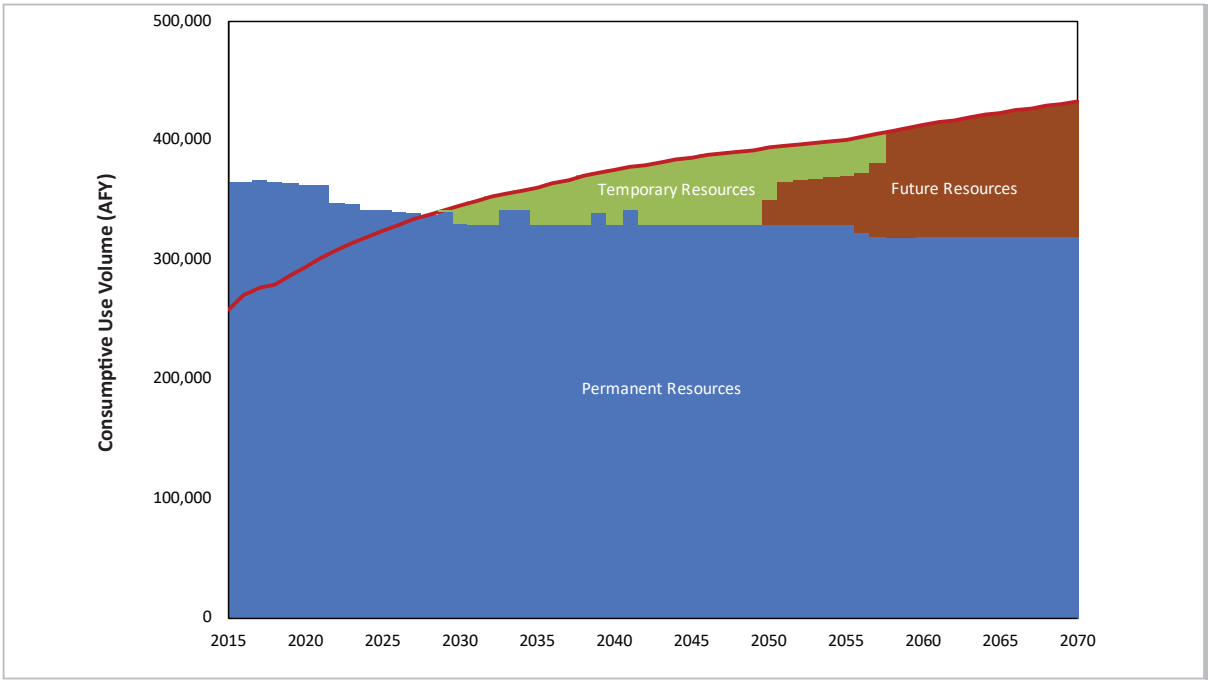


FIGURE 4.20 **Climate Change Hydrology, Upper Demand**

As shown in Figure 4.20, permanent, temporary and future resources are needed to meet demands through the 50-year planning horizon. Under this scenario, temporary and future resources are needed beginning in 2029 and 2050, respectively. The volume of future resources needed in 2070 is estimated at 114,000 AFY.

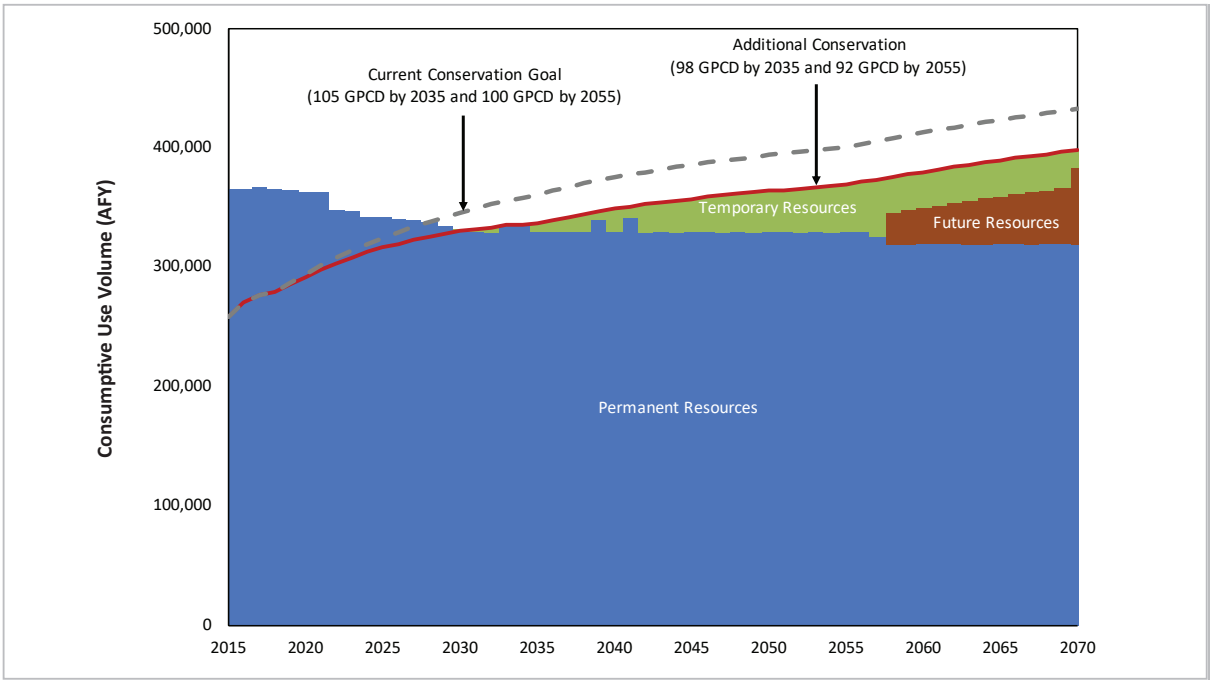


FIGURE 4.21 **Climate Change Hydrology, Additional Conservation**

Figure 4.21 illustrates the impact of additional conservation on the timing and need for temporary and future resources. This scenario assumes future water use at 98 GPCD by 2035 and 92 GPCD by 2055. Under this scenario, permanent, temporary and future resources are needed to meet water demands through 2070. Temporary and future resources are needed beginning in 2030 and 2058, respectively. The volume of future resources needed in 2070 is estimated at 64,000 AFY.

CHAPTER SUMMARY

Water supply and demand conditions are influenced by a number of factors, including economic conditions, water use patterns, conservation progress and climate variability. To account for these variables, SNWA's 2019 Plan considers several water supply and demand scenarios that bracket the range of plausible conditions to be experienced over the 50-year planning horizon.

The scenarios assume that Southern Nevada will continue to make progress towards its current water conservation goal, as well as achieve increased levels of efficiency over the long-term planning horizon. Likewise, the scenarios assume that unused Nevada Colorado River water will continue to be stored for future use and that this and other temporary resources will be used to meet demands until future resources are needed and developed.

Colorado River modeling performed by the Bureau of Reclamation in 2019 projects an approximate 4-82 percent probability that Lake Mead will reach an elevation of 1,075 or lower over the 50-year planning horizon. This would trigger a federal shortage declaration. Under the Interim Guidelines and DCP, the maximum supply reduction prescribed to Nevada is 30,000 AFY; however, this amount could potentially increase. If modeling projects Lake Mead to be at or below 1,030 feet, the U.S. Secretary of the Interior will work with Lower Basin states to determine what additional actions may be needed to avoid and protect against the potential for Lake Mead to decline below 1,020 feet.

The SNWA is not currently using its full Colorado River allocation and near-term shortage declarations are not anticipated to impact current customer use. Additionally, and as illustrated in the planning scenarios, SNWA is prepared to meet long-term demands and future Colorado River supply limitations by adaptively managing its resource portfolio and by bringing future resources online when needed.

Subject to necessary authorizations, the amount of resources available for use as described in the SNWA Water Resource Portfolio is more than sufficient to meet the range of projected demands through the planning horizon. Maintaining this portfolio provides flexibility and enables SNWA to use an appropriate mix of resources as needed to meet demands. Through this and other adaptive management strategies, SNWA is better prepared to address factors that can influence resource availability over time such as permitting, policy changes, climate variability and/or new regulations.

As part of its long-term water planning efforts, the SNWA will:

- Continue to assess factors influencing water demands and the outlook for future demands;
- Continue to assess its overall water resource options and make informed decisions on which resources to use when needed;
- Consider the factors of availability, accessibility, cost, need and supply diversification when determining priority of resources for use;
- Maintain a diverse water resource portfolio to ensure future resources are available to meet projected long-term demands and to replace temporary supplies such as banked resources; and
- Work proactively with other Colorado River water users on efforts that increase Lake Mead's elevation to preserve system operations.

ENDNOTES

1 The U.S. Bureau of Reclamation developed the Colorado River Simulation System (CRSS), a long-term planning and operations model. The probabilities of shortage correspond with August 2019 CRSS results, applying historical Colorado River flows, provided by U.S. Bureau of Reclamation to Southern Nevada Water Authority, August, 2019.

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PROTECTING THE ENVIRONMENT

THE SNWA'S ENVIRONMENTAL STEWARDSHIP EFFORTS HELP CONSERVE AND PRESERVE NATURAL RESOURCES FOR FUTURE GENERATIONS WHILE MINIMIZING CONFLICTS WITH WATER RESOURCE MANAGEMENT.

The SNWA works cooperatively with federal, state and local agencies as part of its long-term water resource management and planning efforts. This work helps to ensure avoidance, mitigation or minimization of impacts during development and delivery of water resources, including the construction, operation and maintenance of regional water facilities. In addition to the organization's proactive efforts, SNWA adheres to strict environmental laws and regulations that govern its use and development of resources and facilities. These include the Endangered Species Act, National Environmental Policy Act (NEPA) and Clean Water Act.

By complying with environmental laws and regulations, working cooperatively with others, and by implementing the latest best management practices, SNWA minimizes its footprint and protects valuable environmental resources for generations to come.

The SNWA participates in several environmental programs that contribute to species recovery and habitat conservation and protection in areas where its facilities or resources are located. The following summarizes specific activities that are currently planned or underway:

COLORADO RIVER

Human alterations on the Colorado River, including changes to riparian, wetland and aquatic habitats, have affected the river's ecosystem, both in the United States and in Mexico. Today, there are several native fish, birds and other wildlife species listed as threatened or endangered under the ESA.

Lower Colorado River Multi-Species Conservation Program

Environmental issues are being addressed cooperatively by Colorado River water users, primarily through the Lower Colorado River Multi-Species Conservation Program (LCRMSCP).

Finalized in 2005, the LCRMSCP provides ESA coverage for federal and non-federal operations in the Lower Colorado River under a Biological Opinion and a Habitat Conservation Plan.[1]

The SNWA is a non-federal partner in the LCRMSCP, which is being implemented by the Bureau of Reclamation over a 50-year period. The program area extends more than 400 miles along the lower Colorado River, from Lake Mead to the southernmost point of the U.S./Mexico border. Lakes Mead, Mohave and Havasu, as well as the historical 100-year floodplain along the main stem of the lower Colorado River, are all included. The program area also supports implementation of conservation activities in the lower Muddy, Virgin, Bill Williams and Gila rivers. The plan will benefit at least 26 species, most of which are state or federally listed endangered, threatened or sensitive species.

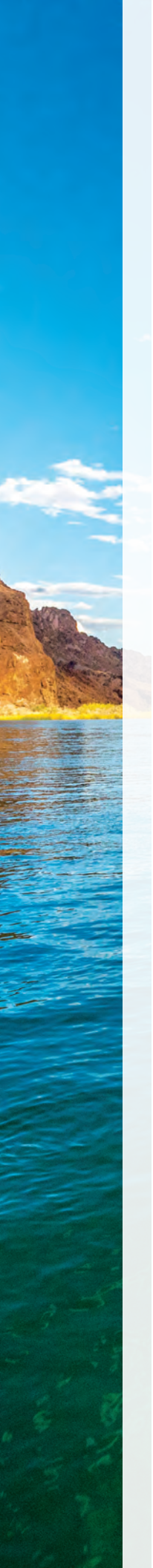
Some of the LCRMSCP projects being conducted in Nevada include razorback sucker studies in Lake Mead, southwestern willow flycatcher surveys and habitat protection at the Big Bend Conservation Area.

In 2005, SNWA purchased the 15-acre Big Bend Conservation Area site along the Colorado River to protect backwater habitat for native fish. In 2008, the LCRMSCP and the U.S. Fish and Wildlife Service (USFWS) funded wildlife habitat improvements on the property. The SNWA continues to maintain the property and habitat.

By taking a proactive role in the health of the river and its native species, SNWA and other Colorado River users are working to help ensure the long-term sustainability of this critical resource.

Colorado River Basin Water Supply and Demand Study

An Environmental and Recreational Flows Workgroup was one of three workgroups established following completion of the Colorado River Basin Water Supply



and Demand Study.[2] The SNWA is a member of this workgroup, which identified opportunities that would provide multiple benefits to improve flow and water-dependent ecological systems, power generation and recreation.

Binational Collaboration

Through interpretive minutes to the 1944 Treaty for the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, the United States and Mexico have established a framework for cooperation on environmental issues in Mexico. This includes studies related to the riparian and estuarine ecology of the Colorado River limitrophe and Delta.

The SNWA is a member of the Environmental Work Group that was established in 2010. The work group provides a forum where the two countries can explore and evaluate potential areas of cooperation. SNWA continues to collaborate with the work group to consider opportunities for environmental improvements such as those identified in minutes 319 and 323 regarding environmental flow deliveries in the limitrophe and Delta.

Adaptive Management Work Group

The SNWA participates in the Adaptive Management Work Group (AMWG) for the operations of Glen Canyon Dam. This multi-agency work group helps balance the needs and interests of the endangered humpback chub, recreational interests, Native American perspectives, hydropower generation, water deliveries and downstream water quality. Active participation in the AMWG and its subcommittees helps ensure SNWA's interests in protecting water deliveries, downstream water quality and the endangered humpback chub are adequately addressed.

MUDDY RIVER

The Muddy River and its tributaries and springs provide habitat for a unique array of rare species, including the federally endangered Moapa dace (*Moapa coriacea*), southwestern willow flycatcher (*Empidonax trailii extimus*), and Yuma Ridgway's rail (*Rallus obsoletus yumanensis*) (formerly Yuma clapper rail), and the federally threatened western yellow-billed cuckoo (*Coccyzus americanus occidentalis*). It is also habitat for the Virgin River chub (*Gila seminuda*), which although not listed on the Muddy River is listed as endangered on the Virgin River.

The SNWA has conducted and supported environmental studies on the Muddy River since 2004, including population and habitat surveys for these and other native, sensitive species. The SNWA is also working with federal and state agencies, environmental organizations and local stakeholders to implement conservation and recovery actions.

Warm Springs Natural Area

Located approximately 7 miles northwest of the town of Moapa, the Warm Springs Natural Area contains more than two dozen warm water springs that form the headwaters of the Muddy River. The springs and river provide habitat for the federally endangered Moapa dace, a small fish that is endemic to the area. The river and surrounding riparian areas also provide habitat for 27 other listed and sensitive species, including fish, birds, bats, invertebrates and amphibians.

In 2007, SNWA purchased the former 1,220-acre "Warm Springs Ranch," using funding secured under the Southern Nevada Public Lands Management Act. Working with federal, state and local stakeholders, SNWA completed a Stewardship Plan for the Warm Springs Natural Area in 2011.[3] The Stewardship Plan provides a framework for use and management of the property that preserves the integrity of natural resources and allows for management of water resources.

Since acquisition of the property, SNWA has focused on restoration of aquatic fish habitat, control and eradication of invasive species, fire prevention and general property maintenance. A public use trail system with interpretive signage also was developed to allow for low-impact public use of the property. These conservation actions help to provide mitigation benefits for water development. The Warm Springs Natural Area is now open to the public six days a week, from Labor Day to Memorial Day. For more information, visit warmspringsnv.org.

VIRGIN RIVER

The Virgin River is one of the largest riparian corridors in the desert southwest; within Nevada, the lower Virgin River is home to the federally

endangered woundfin, Virgin River chub, southwestern willow flycatcher, and Ridgway's rail and the federally threatened western yellow-billed cuckoo. Since 1993, SNWA has conducted and supported environmental studies on the Virgin River, including population and habitat surveys for these species.

In addition, the SNWA participates on the Lower Virgin River Recovery Implementation Team, which is working to develop a conservation action plan for the woundfin and Virgin River chub.

CLARK COUNTY

The SNWA participates in a number of environmental initiatives in Clark County to help protect and restore the environment, including the Clark County Multiple Species Habitat Conservation Plan and Las Vegas Wash Comprehensive Adaptive Management Plan. These efforts directly affect the SNWA's ability to operate facilities in Clark County and deliver high quality water to the community.

Clark County Multiple Species Habitat Conservation Plan

The Clark County Multiple Species Habitat Conservation Plan (MSHCP)[4] was approved in 2001, and provides ESA coverage for 78 species, including the threatened desert tortoise (*Gopherus agassizii*). The key purpose of the MSHCP is to achieve a balance between the conservation and recovery of listed and sensitive species in Clark County and the orderly beneficial use of land to meet the needs of the growing population in Clark County. The SNWA actively participates in the MSHCP, which provides ESA coverage for its projects and facilities located on non-federal lands within the county.

Las Vegas Wash

The Las Vegas Wash is the primary channel through which the SNWA member agencies return water to Lake Mead for return-flow credits. These flows account for less than two percent of the water in Lake Mead and consist of urban runoff, shallow groundwater, storm-water and highly treated wastewater from the valley's four water reclamation facilities. Decades ago, the flows of the Wash created more than 2,000 acres of wetlands, but by the 1990s, only about 200 acres of wetlands remained. The dramatic loss of vegetation reduced both the Wash's ability to support wildlife and serve as a natural water filter.

In 1998 at the request of its citizen's advisory committee, SNWA reached out to the community in an effort to develop solutions to the problems affecting the Wash. This led to the formation of the Las Vegas Wash Coordination Committee (LVWCC), a panel representing more than two dozen local, state and federal agencies, businesses, an environmental group, the University of Nevada Las Vegas and private citizens. The committee quickly developed a Comprehensive Adaptive Management Plan for the Wash.[5]

Over nearly 20 years of working together, the LVWCC and its member agencies have taken significant strides toward improving the Las Vegas Wash. Early efforts focused on reducing the channelization of the Wash, reducing erosion and increasing the number of wetlands. Accomplishments to date include:

- Completed construction of 21 identified erosion control structures or weirs.
- Stabilized more than 13 miles of the Wash's banks

Mature Vegetation Along the Wash

Dace on the Rise

The Moapa dace is endemic to the Muddy River.

The Moapa dace only occurs in the warm springs, tributaries and upper main stem of the Muddy River, and was listed as an endangered species in 1967. The USFWS recovery plan for the Moapa dace set a goal to delist the fish when the adult population reaches 6,000 in five spring systems for five consecutive years.[6]

The SNWA has worked with its partners to implement a number of activities to benefit the Moapa dace, including installation of non-native fish barriers, eradication of invasive fish species, restoring natural stream flow dynamics and riparian vegetation, and improving connectivity between springs and streams. These actions have helped the overall Moapa dace population to increase substantially. The population increased from a low of 459 individuals in 2008 to more than 1,500 in 2018.

Despite significant progress, additional actions will likely be needed to protect the dace, including limiting the amount of water produced from the surrounding aquifer that affects dace habitat.

- Removed more than 550 acres of non-native tamarisk
- Revegetated more than 500 acres with native plants
- Removed more than 500,000 pounds of trash from adjacent areas
- Organized more than 15,000 volunteers
- Completed extensive wildlife and water quality monitoring programs
- Built or improved more than two miles of trails
- Implemented an invasive species management program

Today, the Wash carries about 200 million gallons of water a day to Lake Mead. The efforts to stabilize the Wash have resulted in a greater than 60 percent reduction in the amount of total suspended solids in the water, and the removal of the Wash from Nevada Division of Environmental Protection's list of impaired waters.

NORTHERN NEVADA GROUNDWATER RESOURCES

As described in Chapter 3, In-State Groundwater is a future resource in SNWA's water resource portfolio. The SNWA is working to complete the environmental compliance and permitting that will allow these resources to be developed and conveyed to Southern Nevada when they are needed.

In 2006 and 2008, SNWA and U.S. Department of the Interior agencies, including the Bureau of Indian Affairs, Bureau of Land Management (BLM), USFWS and the National Park Service, entered into stipulations for withdrawal of protests for water right applications in Spring, Delamar, Dry Lake and Cave valleys.

Technical teams representing the agencies developed biological and hydrological monitoring plans pursuant to the obligations of the stipulated agreements. Hydrologic monitoring is ongoing, in accordance with the Hydrologic Monitoring and Mitigation Plan for Spring Valley[7] and the Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake and Cave valleys.[8]

Two years of baseline biologic monitoring were conducted in 2009 and 2010[9] in accordance with the Biological Monitoring Plan for Spring Valley with ongoing biological monitoring focusing on specific species and small studies to further understand the ecosystems and biota.

Groundwater Development Project

After completion of an Environmental Impact Statement[10] and Record of Decision,[11] the BLM issued a right-of-way to SNWA for the Clark, Lincoln and White Pine Counties Groundwater Development Project in 2013.

The right-of-way grant is for the first phase of the Groundwater Development Project; additional tiered NEPA compliance and rights-of-way will be necessary when specific well sites and collector pipeline routes are identified.

Great Basin Ranch

Beginning in 2006, SNWA began acquiring ranch properties in Spring Valley from landowners who approached SNWA desiring to sell their properties. Since then, the SNWA has continued to operate the properties, collectively named the Great Basin Ranch, to ensure water rights associated with the properties are maintained in good standing through beneficial use and to ensure land resources remain productive. The land and water rights associated with Great Basin Ranch provide SNWA with an opportunity to integrate adaptive management with environmental mitigation during future development activities.

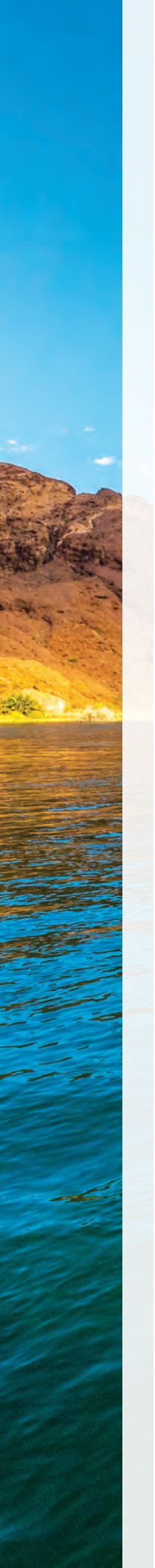
The seven properties acquired by the SNWA include the El Tejon, Robison, Huntsman, Harbecke, Wahoo, Phillips and Bransford ranches. As part of its ranch purchases, the SNWA has:[12]

- More than 23,000 acres of private land
- More than 56,000 AFY of surface water rights
- More than 11,000 acre-feet of groundwater rights
- On average, 8,900 head of livestock (depending upon time of year and season)

The SNWA also holds roughly 900,000 acres in grazing allotment permits from the BLM and the U.S. Forest Service. There are a total of 15 grazing allotments that span Spring, Dry Lake, Cave, Lake, Tippett, Hamlin, Pahroc, Steptoe and Patterson valleys. SNWA-owned cattle and sheep graze these allotments under a program designed to maintain rangeland health standards.

The Great Basin Ranch provides opportunities for SNWA to better understand and manage hydrologic and biological resources of Spring Valley while continuing the historic agricultural and livestock operations. The SNWA accomplishes this by employing best management practices, such

Great Basin Ranch



as adaptive grazing, water- and energy-efficient agricultural technologies, GPS tracking of livestock and invasive weed-control treatments. Technical staff and contractors perform range monitoring and rangeland-condition analyses, among a variety of monitoring and reporting programs. Through these management efforts, the SNWA is creating a sustainable ranch operation.

SUSTAINABILITY

Sustainability transcends resource boundaries, but it is inseparably linked to the conservation of vital resources such as water and energy. This concept forms the framework for SNWA's sustainability initiatives, which focus on four main areas:

- Water
- Energy
- Environment
- Personal responsibility

As a water provider and educator in one of the region's driest communities, living a conservation ethic is an essential part the organization's work practices. The SNWA strives to provide sufficient water to the community while promoting conservation, utilizing reliable, renewable water resources and maintaining water quality with minimal impact on the environment.

The SNWA has undertaken a broad range of initiatives to help ensure conservation and preservation of water resources. The SNWA's Water Smart Landscape program has averted more than 40,000 metric tons of carbon dioxide discharge (more than 1.6 billion pounds). On an annual basis, program participants reduce our carbon dioxide footprint by 709 metric tons.

As the state's largest energy user, the SNWA strives to reduce energy consumption and reduce environmental pollution through efficient energy use and incorporating use of renewable resources such as solar energy and hydropower. Following the passage of new renewable energy standards by the Nevada Legislature in 2019, the SNWA is working to achieve 20 percent renewable energy by 2019 and 50 percent by 2030. The SNWA's current energy portfolio consists of approximately 18 percent derived from renewable resources.

The SNWA's solar and small hydropower facilities generate more than 44 million kilowatt hours of clean energy, enough to power nearly 3,500 average Southern Nevada homes annually. The SNWA's fleet is nearing its goal of becoming 100 percent alternative fueled, replacing standard-fueled vehicles with alternative-fueled models when appropriate.

The SNWA continues to identify ways to minimize the environmental impacts of operations and create a greener way of working. Reducing, reusing and recycling are key components of waste reduction efforts. SNWA facilities are designed to be environmentally conscious, including certification under U.S. Leadership in Energy and Environmental Design green building program.

CHAPTER SUMMARY

The SNWA adheres to strict environmental laws and regulations that govern its use and development of resources and facilities. In addition, the SNWA proactively integrates environmental stewardship into facility operations and resource management. To support its long-term water resource planning and development efforts, the SNWA will:

- Continue its environmental planning, monitoring and mitigation efforts to minimize its footprint and protect community water supplies;
- Participate in environmental programs to enhance regulatory certainty for the flexible and adaptive use of resources;
- Work with partners to conserve habitat and work towards the recovery of threatened and endangered species, as well as reducing the likelihood of additional species listings; and
- Meet the community's current and long-term water resource needs while promoting conservation, utilizing reliable, renewable water resources and maintaining water quality with minimal impact on the environment.

ENDNOTES

1 Lower Colorado River Multi-Species Conservation Program, 2004. Lower Colorado River Multi-Species Conservation Program, Volume II: Habitat Conservation Plan. December 17, 2004.

2 "Colorado River Basin Water Supply and Demand Study," December 2012, U.S. Bureau of Reclamation.

3 SNWA, 2011. "Warm Springs Natural Area Stewardship Plan," June 2011, SNWA.

4 Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada, September, 2000, Clark County Department of Comprehensive Planning and U.S. Fish and Wildlife Service.

5 "Las Vegas Wash Comprehensive Adaptive Management Plan," December 1999, Las Vegas Wash Coordination Committee.

6 "Recovery Plan for the Rare Aquatic Species of the Muddy River Ecosystem," May 16, 1996, U.S. Fish and Wildlife Service Region 1, Portland, Oregon.

7 "Hydrologic Monitoring and Mitigation Plan for Spring Valley (Hydrographic Area 184)," 2011 SNWA (Doc. No. WRD-ED-0012).

8 "Hydrologic Monitoring and Mitigation Plan for Delamar, Dry Lake, and Cave Valleys," 2011, SNWA (Doc. No. WRD-ED-0011).

9 Biological Monitoring Plan for the Spring Valley Stipulation, 2011 Biological Working Group.

10 Biological Monitoring Plan for Delamar, Dry Lake, and Cave Valley Stipulation, January, 2011, Biological Resource Team.

11 "Clark, Lincoln, and White Pine Counties Groundwater Development Project Record of Decision," 2012, U.S. Bureau of Land Management.

12 Supplemental rights are included in groundwater and surface water totals. These rights are subordinate to primary, stand alone rights and have restrictions on use that primary rights do not.

Water Smart streetscape

APPENDIX 1

CLARK COUNTY POPULATION FORECAST AND ASSUMPTIONS USED IN 2019 WATER RESOURCE PLAN DEMAND PROJECTIONS

Year	Lower Demand Population	Upper Demand Population
2019	2,330,000	2,350,000
2020	2,382,000	2,423,000
2025	2,583,000	2,731,000
2030	2,719,000	2,974,000
2035	2,817,000	3,173,000
2040	2,888,000	3,337,000
2045	2,940,000	3,471,000
2050	2,986,000	3,590,000
2055	3,033,000	3,700,000
2060	3,086,000	3,808,000
2065	3,139,000	3,906,000
2070	3,192,000	3,993,000

Endnotes:

1 "Population Forecasts: Long-Term Projections for Clark County, Nevada 2019–2060," June 2019, Center for Business and Economic Research at the University of Nevada, Las Vegas (projected through 2070).

2 Adjusted "Population Forecasts: Long-Term Projections for Clark County, Nevada 2019–2060," June 2019, Center for Business and Economic Research at the University of Nevada, Las Vegas (projected through 2070 with a 15 percent increase by 2039 and a 25 percent increase by 2070).

APPENDIX 2

Year	Lower Demand (105 GPCD Conservation goal)	Upper Demand (105 GPCD Conservation goal)	Upper Demand (Add'l Conservation Scenario)
2019	284,000	287,000	286,000
2020	289,000	294,000	292,000
2025	307,000	325,000	316,000
2030	317,000	346,000	330,000
2035	321,000	361,000	337,000
2040	325,000	375,000	349,000
2045	327,000	386,000	358,000
2050	328,000	394,000	364,000
2055	329,000	401,000	369,000
2060	335,000	413,000	380,000
2065	340,000	424,000	390,000
2070	346,000	433,000	398,000

APPENDIX 3

POLICY REGARDING OUT-OF-VALLEY WATER USE

Managing Southern Nevada's water resources responsibly is critical to the continued vitality of the region. The ongoing risk of supply reductions underscores the need for responsible and sustainable management of Southern Nevada Water Authority (SNWA) water resources. This policy is designed to maximize the productivity of all SNWA water resources. To provide for the long-term sustainable development of resources and reduce demand impacts to Colorado River resources, the SNWA Board of Directors agrees to support the following principles for the use of Colorado River water and other SNWA water resources outside areas that are currently served by SNWA members' wastewater systems.

- Adoption of service rules and development codes by SNWS Purveyor Members that rely on industry best practices to minimize consumptive use of water resources.

- Returning treated wastewater to Lake Mead to receive return-flow credits should be accomplished whenever feasible.

- If returning treated wastewater to Lake Mead is not feasible, Colorado River water and other SNWA water resources should be reused either through direct or indirect reuse to achieve full beneficial use of recycled water similar to existing practices within the Las Vegas Valley.

- Wastewater will be treated to levels sufficient to allow the water to be reused.

- Implementation of localized, beneficial direct reuse within the development area for industrial and commercial uses, and school and community parks where feasible should displace the need for SNWA water resources.

- Implementation of aquifer storage and recovery programs, where possible.

- Limitation on the use of evaporative coolers.

Introduced and passed on May 18, 2017.

APPENDIX 4

SCENARIO DETAIL

Figure A-1 from the Colorado River Basin Study illustrates the range of Colorado River inflows considered under observed hydrology and climate change projections, providing useful detail to compare the water supply conditions presented in Chapter 4.2 The graph on the left was developed using observed resampled average annual Colorado River natural flow at Lees Ferry. It shows the variability of future hydrology based on observed records, with a range of Colorado River inflow between approximately 13.7 MAFY and 16.3 MAFY. Mean inflow is approximately 15 MAFY.

The graph on the right considers how climate change might impact Colorado River inflows and flow variability. It was developed using Downscaled General Circulation Model (Downscaled GCM) projections and simulated hydrology, which project the climate will continue to warm in the future. The range of inflow for the Downscaled GCM projection is between approximately 10 MAFY and 17 MAFY. The mean inflow is approximately 13.7 MAFY.

The water supply conditions presented in Chapter 4 are within range of the average and below average observed natural flow, and within mid-range of the Downscaled GCM projections.

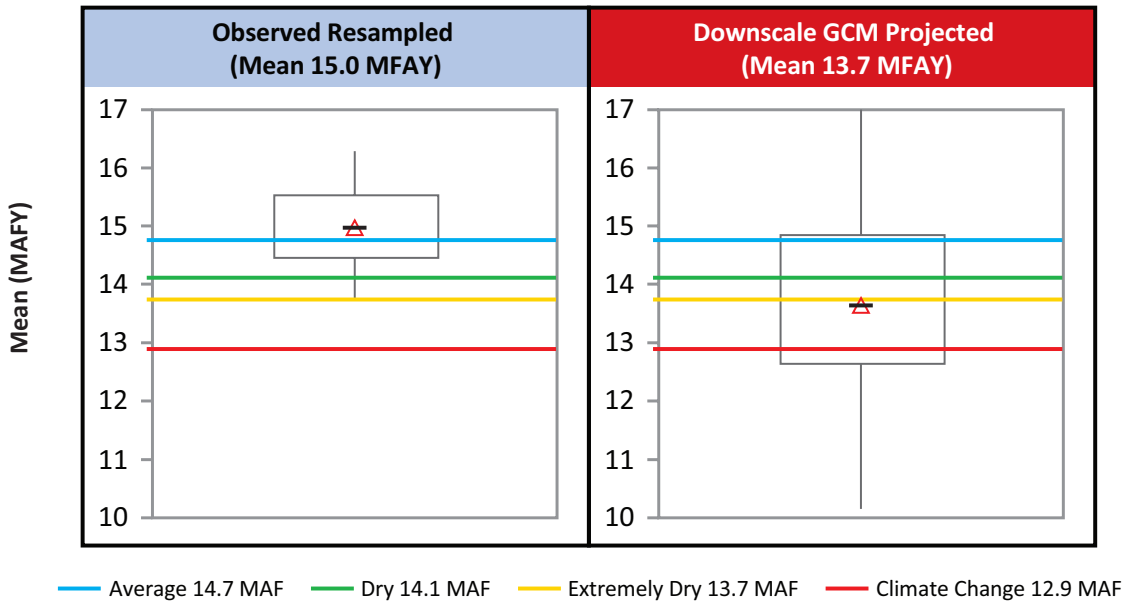


FIGURE A-1 **Average Annual Colorado River Natural Flows at Lees Ferry in Million Acre-Feet per Year (MAFY)**

ENDNOTES

1 "Colorado River Basin Water Supply and Demand Study Technical Report B – Water Supply Assessment," December 2012, U.S. Bureau of Reclamation.

2 The lower and upper borders of each box in the graph represent the 25th and 75th percentile values (lower quartile Q1 and upper quartile Q3). The band within each box denotes the median (dash) and the mean (triangle) values. The value Q3-Q1 is the interquartile range or IQR. Thus, 50 percent of the values reside within the box and the IQR is the height of the box. The upper and lower vertical lines, or whiskers, cover the points outside of the box. Each of the whiskers covers 25 percent of the values. The colored lines in the graphs represent average annual flow for the water supply conditions used in Chapter 4.

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Appendix C Invoices and Estimates

Franklin Electric Turf Boss 160 GPM 5 HP Self-Priming Cast Iron Sprinkler Pump

Click to Enlarge Image

Our Price | Shipping Info

Model: 92980050

A+

★★★★★ (5)

Write A Review

$1,749.00

PayPal CREDIT Make 24 payments of $81.34/mo
Learn more

In-Stock Ships in 4-7 Days

Free Shipping

Add-Ons

☐ Add Lift Gate Service +$50.00
Learn More

Qty. 1 Add To Cart

For Irrigation Pump

HOT BOX

27" x 13" x 23" Fiberglass Valve Enclosure, Unheated

Item # **6CHK0** Mfr. Model # **LF013027023** Catalog Page # **2907** UNSPSC # **40141616**

Web Price

$792.00 / each

1 Add to Cart

+ Add to List |

Shipping Pick

Expected to arrive **Thu. Jul 30**

Ship To 89040 (Change)

Shipping Weight **36.0 lbs.**

Country of Origin **Varies** | *Country of Origin is subject to change.*

Note: Product availability is real-time updated and adjusted continuously. The product will be reserved for you when you complete your order. *More*

How can we improve our Product Images?

Compare

Product Details

You can help protect backflow protection devices, valves, and pumps from freezing with this HOT BOX valve enclosure. Unit features a hinged,
View More

Technical Specs

Item	**Valve Enclosure**	Color	**Beige**
Heated/Unheated	**Unheated**	Body Material	**Fiberglass**
Height	**23"**	Pipe Size	**1"**
Width	**13"**	Insulation Class	**R8**
Length	**27"**	Standards	**ASSE1060**
Mounting Pad Size	**36 x 22"**		

Quote for Equipment Rental - Excavator

Robert Shakespear contacted Jim Morwood (LVVWD Fleet Services) on 7/13/20 and requested a quote for a mid-sized excavator. That same day, Jim forwarded the following verbal quote from Coastline Equipment company in Las Vegas, Nevada to Robert:

- John Deere 135G, $4,240 per month plus $500 delivery each way.

Quote for Equipment and Operators

Von Winkel contacted Bob McCormick from L.J. McCormick Enterprises on 7/6/20 and received a verbal quote for the following:

- Mid-sized Caterpillar Excavator and operator per hour: $150
- Dump truck and driver per hour: $75

Las Vegas Nursery Order Form

Plant Characteristics Sheet

Please call or e-mail the nursery to verify availability.

Information Video on NDF's State nurseries

LANT PRICES:

- Supercell $2.50
- D-Pot container $5.00
- 1-gallon container $7.00
- T-Pot container $9.00
- 2 or 3 gallon container $14.00
- 5-gallon container $19.00
- 15-gallon container $27.00

Note: ***Payment must be by cash, check, or purchase order. We do not accept credit cards.***

Help us conserve resources as well as hold prices down by returning your empty growing containers to the nursery or to the Las Vegas NDF Office at 4747 West Vegas Drive. Please no 6-packs or flats/trays.

All sizes are limited quantity.

Prices subject to change.

Local Resources for Plants in Southern Nevada:

- Mountain States Nursery Plant Sheets – This website provides many descriptions and photos of plants grown at the Las Vegas State Tree Nursery.
- Drip irrigation for the Mojave Desert – A complete guide to designing, installing, scheduling, and maintaining a drip system. Developed by the Conservation District of Southern Nevada.

PO # 3306906

Invoice

Mountain States Wholesale Nursery
13803 W Northern Ave
Glendale, AZ 85307
Phone: (623) 247-8509
Fax: (623) 247-6354
www.mswn.com

Invoice Number: SBI-24413
Invoice Date: 3/9/2020

Bill To:
SOUTHERN NV WATER AUTHORITY
ATTN: JASON ECKBERG
PO BOX 99956
LAS VEGAS, NV 89193-9956

Ship To:
WARM SPRINGS NATURAL AREA
4225 N. HIGHWAY 168
MOAPA, NV 89025

VON (725) 221-0930 OR (702) 379-1247

CUSTOMER	CUSTOMER PO	Terms	Ship Via
SOUTHERN NV WATER AUTHORITY	WARM SPRINGS	30	Zone 3

Salesperson	ENTERED BY	Job Name	SHIP DATE	DUE DATE
JC	jean cote		3/9/2020	4/8/2020

QUANTITY ORDERED	QUANTITY SHIPPED	DESCRIPTION	SIZE	Landed Price	EXT. PRICE
522	522	ATRIPLEX POLYCARPA	#1	2.24	1,169.28
578	578	ATRIPLEX POLYCARPA	#1	2.24	1,294.72
250	250	ISOCOMA ACRADENIA	#1	2.65	662.50
200	200	DISTICHLIS SPICATA	#1	2.65	530.00
200	200	SPOROBOLUS AIROIDES	#1	2.65	530.00

Name:	Von Winkel
Invoice Date:	March 9, 2020
Date to Bella:	March 13, 2020
Blanket #:	B865500278
GL String:	01.3632.19100.045.0500.R8509
Justification:	Funds available in the Authority's FY19/20 Operating Budget. This work supports Goal 3, Strategy 4 of the Strategic Plan. Invoice for native plants that are needed to restore wildlife habitat at Restoration Site 71 at WSNA.

OK KC 3/16/20

Subtotal:	4,186.50
Sales Tax	0.00
Surcharges:	0.00
Other:	0.00
Amount Due:	**4,186.50**

SIGNATURE_____ **DATE**_____

WSNA

P-Card

LOWE'S

LOWE'S HOME CENTERS, LLC
4625 W. CHARLESTON BLVD.
LAS VEGAS, NV 89102 (702) 258-4136

- SALE -

SALES#: S1639JG1 2494592 TRANS#: 2297861 11-20-19

492408 BH 3-FTX25-FT 19-GA HARDW	321.58
7 @ 45.94	
492435 BH 2-FT X 25-FT 19-GA HDW	57.70
2 @ 28.85	
493051 BH 3-FT 14-GA U-POST	100.20
30 @ 3.34	
493052 BH 4-FT 14-GA U-POST	225.60
60 @ 3.76	
47574 12-1/2 GAUGE HOG RINGS 40	12.46
7 @ 1.78	
SUBTOTAL:	717.54
TOTAL TAX:	0.00
INVOICE 02238 TOTAL:	717.54
VISA:	717.54

VISA:XXXXXXXXXXXX3652 AMOUNT:717.54 AUTHCD:036948
CHIP REFID:163902340259 11/20/19 16:58:23
*PIN Verified
APL: VISA CREDIT TVR: 0080048000
AID: A0000000031010 TSI: E800
STORE: 1639 TERMINAL: 02 11/20/19 16:58:52

 # OF ITEMS PURCHASED: 106

EXCLUDES FEES, SERVICES AND SPECIAL ORDER ITEMS

THANK YOU FOR SHOPPING LOWE'S.
SEE REVERSE SIDE FOR RETURN POLICY.
STORE MANAGER: JENNIFER PHILLIPS

LOWE'S PRICE MATCH GUARANTEE
FOR MORE DETAILS, VISIT LOWES.COM/PRICEMATCH

****
* SHARE YOUR FEEDBACK! *
* **ENTER FOR A CHANCE TO BE** *
* **ONE OF FIVE $500 WINNERS DRAWN MONTHLY!** *
* ¡ENTRE EN EL SORTEO MENSUAL *
* PARA SER UNO DE LOS CINCO GANADORES DE $500! *
* *
* ENTER BY COMPLETING A SHORT SURVEY *
* **WITHIN ONE WEEK AT: www.lowes.com/survey** *
* Y O U R I D # 022381 163933 243411 *
* *
* NO PURCHASE NECESSARY TO ENTER OR WIN. *
* VOID WHERE PROHIBITED. MUST BE 18 OR OLDER TO ENTER. *
* OFFICIAL RULES & WINNERS AT: www.lowes.com/survey *

HDSUPPLY
CONSTRUCTION & INDUSTRIAL
WHITE CAP

ON ACCOUNT

038 - No. Las Vegas
4171 Distribution Circle, Suite #107
North Las Vegas, NV, 89030
(702) 639-0380

PICK TICKET
REPRINT

35004917

Sold To: 116495
LAS VEGAS VALLEY WATER
DISTRICT// A/P MS 340
LAS VEGAS, NV, 89153
702-258-3221

Ship To: LVVWD OFFICE, 10000376679
1001 S VALLEY VIEW BLVD
LAS VEGAS, NV, 89107
Job Site Contact:
Job Site Phone:
Map #:

ADA: 4225 W HIGHWAY 168
MOAPA,NV 89025

Sales Order Header Changes:

- Printer has been changed from P019 to P510
- Pick ticket last printed by Kurt B on 10/08/2019 11:10:46 AM PACIFIC

Delivery :
Printed By : KURT B
Printed Date : 10/08/2019 12:09 PM PACIFIC Ordered By : BELLA CASTRO Contact Ph# : 702-8223311

Order Number	Order Date	Request Date	Customer PO	Terms	Ship via/Routing	Sales Person	Created By
35004917	10/08/2019	10/10/2019	CREDIT CARD	N30D	2. Our Truck	Harrison, L	Kurt B

LN / Bin	Part# / H/M	Description / LOT / S/N	Quantity ORD	SHP	BKO	U/M / Unit WT	Price / COO	Amount / Applied
		DELIVER TO ALTERNATE ADDRESS CALL PRIOR TO DELIVERY AND ADVISE CUSTOMER JOBSITE CONTACT:VON 725-221-0930 **********						
3	SHIPPING VPN: MFGEXEMPT	SHIPPING AND HANDLING OH 0 ATT 0	1	1	0	EA 0 LBS	$120.00	$120.00
2 1-J0502	437WS1218 VPN: 1218FSK	1"X2"X18" WOOD STAKE 50/BUNDLE OH 46 ATT 46	3	3	0	BDL 20.625 LBS	$22.99	$68.97
1 1-YARDWAL	262SCRS825 VPN: 4000-4200	8"X25' RICE STRAW WATTLE FIBER ROLL OH 207 ATT 207	40	40	0	RL 35 LBS	$25.49	$1,019.60

AMOUNT PAID BY 3629 $1208.57

CARDMEMBER ACKNOWLEDGES RECEIPT OF GOODS AND/OR SERVICES IN THE AMOUNT OF THE TOTAL SHOW HEREON

Shipped amount $1,208.57
Delivery charges $0.00

WARNING: These products contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Download any needed Safety Data Sheets (SDS) online today at sds.hdsupply.com

HDSUPPLY
CONSTRUCTION & INDUSTRIAL
WHITE CAP

ON ACCOUNT

038 - No. Las Vegas
4171 Distribution Circle, Suite #107
North Las Vegas, NV, 89030
(702) 639-0380

PICK TICKET
REPRINT

35004917

Sold To: 116495
LAS VEGAS VALLEY WATER
DISTRICT// A/P MS 340
LAS VEGAS, NV, 89153
702-258-3221

Ship To: LVVWD OFFICE, 10000376679
1001 S VALLEY VIEW BLVD
LAS VEGAS, NV, 89107
Job Site Contact:
Job Site Phone:
Map #:

ADA: 4225 W HIGHWAY 168
MOAPA,NV 89025

Delivery :
Printed By : KURT B
Printed Date : 10/08/2019 12:09 PM PACIFIC Ordered By : BELLA CASTRO Contact Ph# : 702-8223311

Order Number	Order Date	Request Date	Customer PO	Terms	Ship via/Routing	Sales Person	Created By
35004917	10/08/2019	10/10/2019	CREDIT CARD	N30D	2. Our Truck	Harrison, L	Kurt B

LN	Part#	Description	Quantity			U/M	Price	Amount
Bin	H/M	LOT / S/N	ORD	SHP	BKO	Unit WT	COO	Applied

AND AGREES TO PERFORM THE OBLIGATIONS SET FORTH BY THE CARDMEMBER'S AGREEMENT WITH ISSUER.

Tax amount		$0.00
Lumber Tax rate/amount	1.00%	$0.00
Order total		$1,208.57
Deposit/funds tendered		$1,208.57
Balance due		$0.00

PRINT: PHONE PAYMENT SIGN : _____

**********PICK TICKET ONLY**********

SHIPPED WEIGHT: 1,461.88 LBS PULLED BY: _____ CHECKED BY: _____ LOADED BY: _____

HD SUPPLY WHITE CAP #0
4171 DISTRIBUTION CIRCL
NORTH LAS VEG, NV 89030
10/08/2019 11:04:18
MID: XXXXXXXXXXX108 TID: XXXXV867

CREDIT CARD
VISA SALE

Card # Token XXXXXXXXXXX3629
SEQ #: 6
Batch #: 987
INVOICE 35004917
Approval Code: 046261
Entry Method: Manual
Mode: Online
Tax Amount: $0.00
Cust Code:
Avs Code: NYZ
Card Code: M

SALE AMOUNT $1208.57

I agree to pay above total amount according to card issuer agreement.
(Merchant agreement if Credit Voucher)

PHONE PAYMENT

MERCHANT COPY

WARNING: These products contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Download any needed Safety Data Sheets (SDS) online today at sds.hdsupply.com

HDSUPPLY
CONSTRUCTION & INDUSTRIAL
WHITE CAP

ON ACCOUNT

038 - No. Las Vegas
4171 Distribution Circle, Suite #107
North Las Vegas, NV, 89030
(702) 639-0380

QUOTE

34848877

Sold To: 116495
LAS VEGAS VALLEY WATER
DISTRICT// A/P MS 340
LAS VEGAS, NV, 89153
702-258-3221

Ship To : LVVWD OFFICE,10000376679
1001 S VALLEY VIEW BLVD
LAS VEGAS, NV, 89107
Job Site Contact:
Job Site Phone:
Map #:

03:25 PM **Ordered By:** VON WINKEL **Contact Phone:** 725-2210930

Quote Number	Quote Date	Valid Until	Request Date	Sales Person
			09/26/2019	Harrison, L
Terms	**Shipping Method**	**Quote Name**	**Customer PO**	**Created By**
N30D	2. Our Truck		NEED PO	Franco, D

LN	Part# / H/M	Description	Ord Quantity	U/M / Unit WT	Price / COO	Amount
1.1	262SCRS825	8"X25' RICE STRAW WATTLE FIBER ROLL	40	RL 35 LBS	$25.49	$1,019.60
2.1	437WS1218	1"X2"X18" WOOD STAKE 50/BUNDLE	3	BDL 20.625 LBS	$22.99	$68.97
3.1	FREIGHT	INBOUND FREIGHT	1	USD	$120.00	$120.00

Name:	Von Winkel
Date:	September 26, 2019
Blanket #:	
GL String:	01.3632.19100.045.0500.R8509
Justification:	Wattles and snakes are needed to stabilize North Fork of the Muddy River banks.

Shipped amount		**$1,208.57**
Order charges		**$0.00**
Tax amount		**$0.00**
Lumber Tax rate/amount	**1.00%**	**$0.00**
Quote total		**$1,208.57**

Shipped Weight: **1,461.88** Customer acceptance signature:_____Date : _____

ALL ITEMS AND QUANTITIES REQUIRE CUSTOMER REVIEW AND APPROVAL
AVAILABILITY AND LEAD TIMES ARE SUBJECT TO CHANGE
SPECIAL ORDERED ITEMS ARE SUBJECT TO MANUFACTURER APPROVAL PRIOR TO RETURN.
QUOTE IS SUBJECT TO EXPIRATION AS INDICATED IN THE ABOVE DATE.

*** CASH * SALE *** 200 EWING, N LAS VEGAS ORDER NUMBER 1146740-A-AD
* ORDER CONFIRMED * 3521 N RANCHO DR PAGE 1-
LAS VEGAS 891303123 ORDERED 10/17/19 2:41PM
PHN (702)839-9530 FAX (702)839-9540 REQUESTED 10/17/19

SOLD TO: LAS VEGAS VALLEY WATER DIST SHIP TO: _____
0030053 1001 S VALLEY VIEW BLVD #340
LAS VEGAS NV 89153
(702)258-3798

SPECIAL INSTRUCTIONS: _____

PO#:P-CARD BUYER: _____ PH#: _____ VIA:W/C
JOB NAME: VON WINKLE EIP#: 00001 BY: SAUL B QUOTE#: 3274964

QTY ORDER	SUG SHIP	QTY SHIP	QTY B/O	ITEM	DESCRIPTION	LIST	NET	EXTENSION	LIN #
2		2		24020340	6 X 300 295POLYSPUN L/S FABRIC	190.30	114.180	228.36	2
100		100		12003224	930CCCT 3/4X3/4X1/2 TEE COMP	3.57	2.142	214.20	3
15		15		04437131	1 X 3/4 PVC RED BUSHING SS	2.51	.502	7.53	4
1		1		54010210	STAPLES 6IN 11GA 500/BOX	59.30	47.440	47.44	5
1		1		24020320	4 X 300 295POLYSPUN L/S FABRIC	126.98	76.188	76.19	6
3		3		04401030	3 PVC TEE SSS	45.43	9.086	27.26	7
2		2		08010404	PT CHRISTY RED HOT BLUE GLUE	27.55	15.704	31.41	8

NO CASH REFUNDS
Any Credit for Material Returned will be Applied
against Future Purchases or Account Balance

SUB TOTAL 632.39

PAYMENTS: TYPE REFERENCE AMOUNT
VISA 14 632.39

TAX
FREIGHT
LABOR
HANDLING
TOTAL $632.39

FIRM _____

BY _____

FILLED BY _____
DATE _____

#CARTONS	TOTAL LBS.	TRACKING NUMBER
	118.408	

DEL BY _____
DATE _____

11/22/2019 14:42:36

P-Card

EWING
Irrigation & Landscape Supply

Home Office
3441 E. Harbour Drive, Phoenix, AZ 85034
602.437.9530
EwingIrrigation.com

RECEIPT

CHARGE ACCT
* 30053 *

200 Ewing North Las Vegas
3521 N Rancho Dr
Las Vegas, NV 89108
PHN 702-839-9530 FAX 702-839-9540

ORDER # 2710444
REFERENCE # 11109140
PAGE 1 of 2
ORDERED 3/3/2020

SOLD TO: LAS VEGAS VALLEY WATER DIST
109823 1001 S VALLEY VIEW BLVD #340
LAS VEGAS, NV 89153
PH 702-258-3798

SHIP TO: LAS VEGAS VALLEY WATER DIST
1001 S VALLEY VIEW BLVD #340
LAS VEGAS, NV 89153
PH 702-258-3798

DELIVERY INSTRUCTIONS: _____

PO#: P-CARD BUYER: ACCOUNTS PAYABLE PH:

P21 JOB: _____ EIP#: _____ BY: AGUSTIN M QUOTE#: _____

EWING JOB: _____ JOB REF: WARM SPRINGS

QTY ORDER	QTY SHIP	QTY B/O	ITEM DESCRIPTION		NET	EXTENDED	LINE#
6,000	6,000	0	12001010	LP710 500FT PE RED 1/2 TUBING	7.4333	446.00	1
100	100	0	12003220	930C3T 3 WAY COMPRESSION TEE	1.8144	181.44	2
65	65	0	12003224	930CCCT 3/4X3/4X1/2 TEE COMP	1.9278	125.31	3

Visa: xxxxxxxxxxxx3652 xx/xx
Transaction Type: Final Sale
Entry Method: Chip
Merchant ID: ****2999
Reference Number: 1014923
Name: VON WINKEL
AID: A0000000031010
Application: VISA CREDIT

Retrieval Number: 2057254131
Host Response: APPROVED
Authorization Number: 044728
Authorization Date: 3 Mar 2020 1:54 PM
Authorized Amount: 752.75
Cryptogram: TC D1E675324C14F169

I agree to pay above total amount according to card issuer agreement

ORIGINAL

EWING
Irrigation & Landscape Supply

Home Office
3441 E. Harbour Drive, Phoenix, AZ 85034
602.437.9530
EwingIrrigation.com

RECEIPT

CHARGE ACCT	200	Ewing North Las Vegas	ORDER #	2710444
* 30053 *		3521 N Rancho Dr	REFERENCE #	11109140
		Las Vegas, NV 89108	PAGE	2 of 2
	PHN	702-839-9530 FAX 702-839-9540	ORDERED	3/3/2020

DELIVERY INSTRUCTIONS: _____

PO#: P-CARD BUYER: ACCOUNTS PAYABLE PH:

P21 JOB: _____ EIP#: _____ BY: AGUSTIN M QUOTE#: _____

EWING JOB: _____ JOB REF: WARM SPRINGS

QTY ORDER	QTY SHIP	QTY B/O	ITEM DESCRIPTION	NET	EXTENDED	LINE#

SUB-TOTAL:	752.75
TAX :	0.00
Visa :	752.75
AMOUNT DUE:	**0.00**

CARTONS

FILLED BY _____
DATE _____

SIGNATURE _____ DELIVERED BY _____

Acknowledgement of receipt of goods listed above.

DATE _____

PRINT NAME _____

NO CASH REFUNDS. Sale subject to terms and conditions on reverse

No recommendation has been made by, or provided to, the seller concerning the use of the pesticide covered by this invoice.

PROPOSITION 65 WARNING: Some of the products on your order may expose you to chemicals that are known to the State of California to cause cancer, birth defects and reproductive harm. Learn more at https://www.p65warnings.ca.gov/

ORIGINAL

P-Card

EWING Irrigation & Landscape Supply

Home Office
3441 E. Harbour Drive, Phoenix, AZ 85034
602.437.9530
EwingIrrigation.com

RECEIPT

CHARGE ACCT
* 30053 *

200 Ewing North Las Vegas
3521 N Rancho Dr
Las Vegas, NV 89108
PHN 702-839-9530 FAX 702-839-9540

ORDER # 2674382
REFERENCE # 11081532
PAGE 1 of 2
ORDERED 2/26/2020

SOLD TO: LAS VEGAS VALLEY WATER DIST
109823 1001 S VALLEY VIEW BLVD #340
LAS VEGAS, NV 89153
PH 702-258-3798

SHIP TO: LAS VEGAS VALLEY WATER DIST
1001 S VALLEY VIEW VALLEY VIEW & ALTA
LAS VEGAS, NV

DELIVERY INSTRUCTIONS:

PO#: P-CARD BUYER: ACCOUNTS PAYABLE PH:
P21 JOB: EIP#: 1 BY: SAUL B QUOTE#:
EWING JOB: STOCK JOB REF: P-CARD

QTY ORDER	QTY SHIP	QTY B/O	ITEM DESCRIPTION		NET	EXTENDED	LINE#
4,000	4,000	0	12001010	LP710 500FT PE RED 1/2 TUBING	7.4333	297.33	1
700	700	0	12008120	HE-20-B-100 2 GPH BARB EMITTR	0.1908	133.56	2
3	3	0	54010210	STAPLES 6IN 11GA 500/BOX	47.4400	142.32	3
2,500	2,500	0	12001020	LP940 500FT PE RED 3/4 TUBING	10.5000	262.50	4
1	1	0	28002740	5 TINE MANURE FORK WOOD HANDLE	45.0000	45.00	5

Visa: xxxxxxxxxxxx3652 xx/xx
Transaction Type: Final Sale
Entry Method: Chip
Merchant ID: ****2999
Reference Number: 978789
Name: VON WINKEL
AID: A0000000031010
Application: VISA CREDIT

Retrieval Number: 1990498764
Host Response: APPROVED
Authorization Number: 047463
Authorization Date: 26 Feb 2020 2:24 PM
Authorized Amount: 880.71
Cryptogram: TC 61850723557D6169

I agree to pay above total amount according to card issuer agreement

ORIGINAL

EWING
Irrigation & Landscape Supply

Home Office
3441 E. Harbour Drive, Phoenix, AZ 85034
602.437.9530
EwingIrrigation.com

RECEIPT

CHARGE ACCT
* 30053 *

200 Ewing North Las Vegas
3521 N Rancho Dr
Las Vegas, NV 89108
PHN 702-839-9530 FAX 702-839-9540

ORDER # 2674382
REFERENCE # 11081532
PAGE 2 of 2
ORDERED 2/26/2020

DELIVERY INSTRUCTIONS: _____

PO#: P-CARD BUYER: ACCOUNTS PAYABLE PH:

P21 JOB: _____ EIP#: 1 BY: SAUL B QUOTE#: _____

EWING JOB: STOCK JOB REF: P-CARD

QTY ORDER	QTY SHIP	QTY B/O	ITEM DESCRIPTION	NET	EXTENDED	LINE#

SUB-TOTAL:	880.71
TAX :	0.00
Visa :	880.71
AMOUNT DUE:	**0.00**

CARTONS

FILLED BY _____
DATE _____

SIGNATURE _____
Acknowledgement of receipt of goods listed above.

DELIVERED BY _____
DATE _____

PRINT NAME _____

NO CASH REFUNDS. Sale subject to terms and conditions on reverse

No recommendation has been made by, or provided to, the seller concerning the use of the pesticide covered by this invoice.

PROPOSITION 65 WARNING: Some of the products on your order may expose you to chemicals that are known to the State of California to cause cancer, birth defects and reproductive harm. Learn more at https://www.p65warnings.ca.gov/

ORIGINAL

BRIDGESTONE HOSEPOWER

** BRANCH **
3630 NORTH 5TH ST
NORTH LAS VEGAS, NV 89032
Ph: (702)731-1100 Fax: ((00)0) -000-

** CORPORATE **
50 INDUSTRIAL LOOP NORTH
ORANGE PARK, FL 32073
Ph: (904) 264-1267 Fax: (904) 264-7797
accounting@hosepower.com

INVOICE
73094088-00

TRACKING #

CUST # 9647	ORDER DATE 03/04/20	TAKEN BY RL	P.O.# VON WINKEL	SOR: 7300	DATE
INSTRUCTIONS 725-221-0930		SHIP VIA Default			PAGE 1

Bill To: LAS VEGAS VALLEY WATER DIST.
1001 SOUTH VALLEY VIEW BLVD
MAILSTOP 340
LAS VEGAS, NV 89153

Ship To: LAS VEGAS VALLEY WATER DIST.
1001 SOUTH VALLEY VIEW BLVD.#3
LAS VEGAS, NV 891530000

LINE	ITEM NUMBER	DESCRIPTION / COMMENTS	U/M	ORDERED	B.O./RET	SHIPPED	UNIT PRICE	AMOUNT
1	AL-A300	MALE CAM X FP 3TAX300,CF100013	EA	4			$ 9.575	$ 38.30
2	ASYIH300	48" WA50-300, FCAM E/E	EA	1			$ 106.13	$ 106.13
3	ASYIH300	72" WA50-300, FCAM E/E	EA	1			$ 123.33	$ 123.33

VISA CenPos Amount: $ 267.76
03/09/20 Card: **********3652
Auth: 057997
Credit Card Signature

SUB TOTAL $ 267.76	SHOP SUPPLY	FREIGHT IN	FREIGHT OUT	SALES TAX

TERMS: Customer agrees to pay a service charge of 1-1/2% per month, a true rate of 18% per annum on any amount past due and to pay reasonable attorney's fees if it becomes Necessary to file suit to enforce collection. Accounts past due may be placed on a COD basis without notice. A $35 fee will be charged for returned checks. Special orders may not be returned or payment refunded. No items will be accepted for return without authorization. All returns are subject to a restocking charge plus any freight charges incurred. Orders below minimum level are subject to a delivery charge. All sales are FOB / SHIPPING POINT.
Payments can be made on-line at HTTPS://www.e-billexpress.com/ebpp/HosePower/

TERMS: **1% 10 NET 30**

TOTAL DUE **$ 0.00**

Payment Received: **$ 267.76**

Retain This Portion For Your Records

^ Detach Here ^

CUST # 9647	INVOICE # 73094088-00	DATE	TOTAL DUE $ 0.00	PAYMENT $

Bill To: LAS VEGAS VALLEY WATER DIST.
1001 SOUTH VALLEY VIEW BLVD
MAILSTOP 340
LAS VEGAS, NV 89153

Remit To: BRIDGESTONE HOSEPOWER LLC
PO BOX 861777
ORLANDO, FL 32886-1777

Detach and Return This Portion With Your Remittance

SOUTHERN NEVADA WATER AUTHORITY™
1001 South Valley View Boulevard • Las Vegas, NV 89153
702-258-3939 • snwa.com

July 23, 2018

Soil Tech
Attn: Robby Jay
6420 S. Cameron St.
Ste. 207
Las Vegas, NV 89118

SUBJECT: NOTICE OF AWARD – Bid No. SNWA 2376-18, SNWA Revegetation and Restoration Programs

Dear Mr. Jay:

On July 19, 2018, the Authorized Representative for the Southern Nevada Water Authority (SNWA) Board of Directors approved the award of Bid No. SNWA 2376-18, SNWA Revegetation and Restoration Programs to your firm, in the amount not to exceed $1,073,091.00 per contract year, with the base year budget not to exceed $980,944.00. The period of performance is from August 2, 2018 through August 1, 2023, unless sooner terminated in accordance with the terms of the bid.

Your primary points of contact for these programs are as follows:

Bend Water Conservation Area and Las Vegas Wash
Jason Eckberg — jason.eckberg@lvvwd.com
Environmental Biologist II — 702-822-3389

Warms Springs Natural Area
Dr. Von Winkel — von.winkel@lvvwd.com
Preserve Restoration Ecologist — 702-822-7730

Please contact me at 702-258-2465 or via email at veronica.kammler@lvvwd.com should you have any questions or need any additional clarification.

Sincerely,

Veronica "Ronni" Kammler
Purchasing Analyst

cc: Keiba Crear, Stewardship & Sustainability
Jason Eckberg, Stewardship & Sustainability
Dr. Von Winkel, Stewardship & Sustainability

SOUTHERN NEVADA WATER AUTHORITY

AGREEMENT
BID NO. 2376-18
SNWA REVEGETATION AND RESTORATION PROGRAMS

THIS AGREEMENT, made and entered into, by and between the Southern Nevada Water Authority (Owner) and Soil-Tech, Inc. (Contractor).

The Parties do mutually agree as follows:

1. Owner has awarded Bid No. 2367-18 to Contractor pursuant to an administrative approval document signed by the General Manager.

2. Owner agrees to purchase and Contractor agrees to provide the specified products, supplies, services, or materials, as well as necessary equipment and labor, to properly perform and complete the contractual obligations in strict accordance with the Contract Documents and throughout the term of the contract.

3. Contractor certifies that Contractor has read and understands every provision contained in the Contract Documents. Contractor shall be bound and shall comply with each term, condition, and covenant set forth in the Contract Documents.

4. For providing or performing all products, supplies, services, or materials, as well as necessary equipment and labor to properly form and complete the contractual obligations, Owner will pay the Contract Price, in the manner and upon the conditions set forth in the Contract Documents.

5. Contract Documents which comprise the entire Agreement between the Owner and Contractor for the performance of Work consist of the following (as applicable):
   Amendments
   Bid Addenda
   Technical Specifications, Statement of Work or Specifications
   Special Conditions
   General Conditions
   Agreement
   Drawings
   Bid Submission
   General Provisions

Blanket Purchase Order No. 2376084477

IN WITNESS WHEREOF, Contractor has caused this Agreement to be executed this 19th day of July, 2018.

SOIL-TECH, INC.	SOUTHERN NEVADA WATER AUTHORTY
By: _____	By: _____
Name: Robby Jay	Name: John J. Entsminger
Title: VP of Sales & Estimating	Title: General Manager

Bid Request Number SNWA 2376-18 Addendum 1

Specification Responses

Soil Tech

Line	Description	Mfgr	MfgNo	UOM	QTY	Unit
1	General Labor (hourly rate)- (see Statement of Work, Seciton 9.A.i.)			Hours	20000	**$18.00**
2	Equipment Operator(hourly rate)-(see Statement of Work, Seciton 9.A.i.)			Hours	7000	**$22.00**
3	Field Supervisor(hourly rate)- (see Statement of Work, Seciton 9.A.i.)			HRS	4000	**$30.00**
4	Markup Applied to Purchased Materials (see Statement of Work section 9.A.ii.)			Dollars	150000	**$1.12**
5	Overhead Markup Applied to Total Direct Labor (see Statement of Work, Section 9.A.iii.)			Lump Sum	1	**$126,800.00**

SHOPPING CART

‹ CONTINUE SHOPPING

Proceed To Checkout

Item	Price	Quantity	Total
PRO-MIX BX BIOFUNGICIDE + MYCORRHIZAE Item No.: SO-PMBIO-28 View | Delete	$ 41.95	19 Each	$ 797.05
 BLACK FORM TRAYS Item No.: CN-TRV-1836 View | Delete	$ 72.70	1 Case	$ 72.70
 SQUARE BLACK FORM POTS Item No.: CN-SQV-035D View | Delete	$ 56.00	1 Case	$ 56.00
SHIPPING (QUOTED)	$ 258.00		$ 258.00
FREE SHIPPING UPGRADE (QUOTED)	$ -258.00		$ -258.00

Empty shopping cart Update

Subtotal	$	925.75

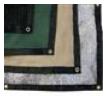
+ Enter Promo code

Total	$	925.75
Total incl. tax	$	925.75

‹ CONTINUE SHOPPING

Proceed To Checkout

Checkout Offers



Custom Shade Cloth

Item No. SC-CUST

$20.00

View Options

Hot Dawg Heater Package

Item No. HD-PKG

$786.00

View Options

Row Cover Deluxe

Item No. GR-RC05

$21.50

View Options

Standard Clear Greenhouse Film, 6 mil

Item No. GF-6MC

$49.56

View Options

Store Links

Customer Service
Technical FAQ
Homeowner Financing
Our Blog
Our Locations
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BTU Calculator
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Southern Nevada Fish and Wildlife Office
4701 North Torrey Pines Drive
Las Vegas, Nevada 89130

July 27, 2020

Memorandum

To: Darion Mayhorn
Water Resources and Planning Office
United States Bureau of Reclamation, Denver, Colorado

From: Field Supervisor GLEN KNOWLES Digitally signed by GLEN KNOWLES Date: 2020.07.27 12:51:25 -07'00'
Southern Nevada Fish and Wildlife Office
Las Vegas, Nevada

Subject: Memorandum of Support for the Southern Nevada Water Authority grant application to restore riparian habitat of the Muddy River

This memorandum is provided on behalf of the Southern Nevada Water Authority (SNWA), in support of their grant application to restore riparian habitat along the Muddy River in Clark County, Nevada. The habitat of significant restoration need occurs along the banks of the upper Muddy River (e.g., South Fork, North Fork, among other areas) where thermal, headwater springs support a suite of endemic water–dependent invertebrate and vertebrate taxa, including the endangered Moapa dace (*Moapa coriacea*) and Southwestern willow flycatcher (*Empidonax traillii extimus*). Significant and similar restoration of habitat has already occurred on adjacent lands managed by the USFWS on the Moapa Valley National Wildlife Refuge. Recent acquisitions of riparian habitats by SNWA affords an excellent opportunity to restore, almost completely, the headwaters of the Muddy River. Riparian restoration in this system is especially important given the extreme local endemism, and the importance of riparian vegetation in maintaining ecological interactions and suitable water quality parameters associated with the thermal streams.

The Southern Nevada Water Authority's proposal plans to focus on habitat restoration of mesquite bosque and ash tree habitat along both the North Fork and South Fork Muddy River, an area of significant need in which invasive vegetation poorly supports native species, and limits recovery of listed species. We believe the project would accelerate recovery of the Muddy River species by expanding the previously restored habitats on the Moapa Valley National Wildlife Refuge.

We fully support the subject proposal and look forward to coordinating with the Southern Nevada Water Authority, a longstanding partner, on these critical recovery efforts. Please contact Michael Schwemm of our office if you have questions or need additional information at (702) 515-5079 or via email at Michael_Schwemm@fws.gov.

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Southern Nevada District Office
Las Vegas Field Office
4701 N. Torrey Pines Drive
Las Vegas, Nevada 89130
http://www.blm.gov/nevada

In Reply Refer To:
6840 (LLNVS01000)

Mr. Darion Mayhorn
Water Resources and Planning Office
Bureau of Reclamation
Mail Code 86-69200
P.O. Box 25007
Denver CO, 80225

Dear Mr. Mayhorn:

I am pleased to provide this letter of support for the Southern Nevada Water Authority's Drought Resiliency Project grant application to the Bureau of Reclamation to fund riparian and mesquite bosque habitat restoration at the Warm Springs Natural Area (WSNA).

The BLM Southern Nevada District is an active participant in recovery actions on the Muddy River and associated riparian habitat for the endangered Moapa dace, Southwestern Willow Flycatcher and the threatened Yellow-billed Cuckoo. All restorations actions implemented in the WSNA, which at this time has all there species on-site, will benefit the other agencies that are actively implementing restoration projects downstream from the WSNA on habitat they manage.

BLM is currently working on a 3.2-million-dollar restoration project a few miles downstream from the WSNA. This project is restoring 35 acres of floodplain for the federally listed birds. BLM will create another habitat patch in the hopes that the nesting birds on the WSNA will establish a nesting territory on the 35 acres in the future, thus expanding their nesting habitat. It is critical that the WSNA continues active restoration of those habitats to ensure BLM's restoration project will be successful as well.

Sincerely,

Shonna Dooman
Field Manager
Las Vegas Field Office

DES
DEPARTMENT OF ENVIRONMENT AND SUSTAINABILITY
air quality · desert conservation program · sustainability

4701 W. Russell Road 2nd Floor
Las Vegas, NV 89118-2231
Phone: (702) 455-5942 • Fax: (702) 383-9994
Marci Henson, Director

July 22, 2020

Attn: Mr. Darion Mayhorn
Water Resources and Planning Office
Bureau of Reclamation
Mail Code: 86-69200
P.O. Box 25007
Denver, CO 80225

Re: Southern Nevada Water Authority Restoration Grant Application

Dear Mr. Mayhorn:

I am pleased to provide this letter to express our support for the Southern Nevada Water Authority's (SNWA) restoration grant application to conduct riparian and mesquite bosque habitat restoration at the Warm Springs Natural Area.

The Warm Springs Natural Area is located along the Muddy River in southern Nevada, a very rare riparian ecosystem that provides an oasis for species amidst an otherwise harsh desert environment. Native trees along the Muddy River provide important nesting habitat for birds including the endangered southwestern willow flycatcher and the threatened yellow-billed cuckoo, while providing shade and mitigating water temperatures for native stream and river species. However, riparian habitat along the Muddy River has been significantly reduced over the last century due to development, agriculture, fire, and the lowering of the regional aquifer. This loss of desert riparian habitat has impacted many bird and fish species native to the region.

SNWA, Clark County, and the Bureau of Land Management all administer lands along the Muddy River and management of these lands is for the benefit of native bird and fish species. SNWA's proposed restoration efforts would complement ongoing work conducted by SNWA, Clark County, and the Bureau of Land Management. These agencies have a history of working together to collaboratively restore habitat along the Muddy River and enhance conditions for native species and the SNWA's proposed restoration work would expand on and further enhance these efforts.

Clark County encourages you to move this proposal forward for funding. Please feel free to contact me at 702-455-3118 should you have any questions or need additional information.

Sincerely,

Marci Henson

Marci Henson, Director