SOUTHERN NEVADA WATER AUTHORITY

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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.
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.
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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 2.3 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 2021 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. Today, the most significant factors affecting Southern Nevada are increased temperatures and decreased runoff in the Colorado River Basin.

Between 2000 and 2021, overall snowfall and runoff into the Basin were well below the historical average, representing the lowest 22-year period on record. The persistence of decades-long drought conditions has resulted in significant water-level declines in major system reservoirs. As of late 2021, the combined water storage in the Colorado River’s two primary reservoirs (Lake Mead and Lake Powell) was at just 32 percent of capacity.

Hydrologic modeling indicates a high probability that Lake Mead water levels will continue to decline, which has water resource implications for Lower Basin stakeholders. Nevada and Arizona made Colorado River Drought Contingency Plan (DCP) contributions in 2020 and 2021. The states will make additional contributions again in 2022 and when the elevation of Lake Mead is at or below 1,090 feet. Additionally, in 2021, the Secretary of the Interior made the first-ever shortage declaration, which will reduce the availability of Colorado River supplies to Nevada in 2022. Together, DCP contributions and shortage reductions serve to bolster Lake Mead water levels and preserve critical operations.

Projections indicate that Lake Mead water levels will continue to decline and the likelihood of shortage remains high in future years. The Secretary of the Interior and the Lower Basin states are actively engaged in consultation to establish additional plans and actions to protect against lake levels declining below elevation 1,020 feet.

Recent studies show that warming temperatures in the Colorado River Basin have significantly impacted hydrologic conditions, including the timing and magnitude of inflows to the reservoir system. These conditions are not only expected to continue but worsen. 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 an overall reduction in runoff.
The SNWA’s 2021 Resource Plan considers the water supply implications of an extended period of lower flows. Given current hydrologic conditions and consistent with prior plans, water conservation remains a critical component of the SNWA’s water resource portfolio. Ultimately, the community’s conservation performance is critical in determining how much water is needed and when. While the community has significantly reduced per capita water demands since 2000, conservation progress has stalled in recent years, and additional effort is required to balance supply and demand.

The 2021 Plan reflects the SNWA’s new conservation goal of 86 gallons per capita per day and highlights new and ongoing strategies the SNWA is pursuing to reduce demands and improve efficiency. Achieving the SNWA conservation goal will require committed support from the SNWA member agencies and the public at large, particularly with upward pressures from climate change and system age.

The SNWA is working to bolster conservation gains in Southern Nevada by focusing on consumptive water use reductions. This work includes ensuring that wastewater associated with future development is captured, treated and returned to Lake Mead for return-flow credits.

**PLANNING FOR UNCERTAINTY**

While preparing the 2021 Plan, the SNWA considered other factors related to water supply and demand conditions, including:

- The potential impact of water supply reductions and reduced runoff due to climate change, 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 2021 Plan. Key factors evaluated include reductions of Colorado River supplies, variation in future demands and the implications of conservation on water demand and water resource needs.

As part of its planning process, the SNWA considered the increasing likelihood that water supply reductions would be imposed for Colorado
River supplies over the long-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 obligation starts at 8,000 AFY when Lake Mead’s elevation is at or below 1,090 feet. Contributions increase up to 30,000 AFY as the lake level declines.

For planning purposes, the SNWA assumes a further reduction of 10,000 AFY in the event Lake Mead’s elevation declines below 1,020 feet. In 2021, Lake Mead reached an elevation of 1,065 feet, the lowest point since the lake began filling in the mid-1930s. Additional information about Colorado River water use reductions is provided in Chapter 3.

The SNWA also considered economic growth in Southern Nevada, and long-term projections indicate that the region will continue to grow. 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, the 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 the SNWA plans to meet future needs, even if conditions change significantly over time.

**ADAPTIVE MANAGEMENT**

The SNWA has implemented several adaptation strategies to respond to the drought, climate change and other factors that affect the community’s water supply. From the development of new facilities and aggressive water conservation to water banking and securing future resources, these efforts have reduced the potential for customer impacts.

The SNWA is not currently using its full Colorado River allocation, and near-term shortage declarations are not anticipated to impact current customer use. However, a return to normal or near-normal hydrologic conditions is unlikely to occur during the long-term planning horizon, and the probability of shortage is high in future years.

Meanwhile, local water demands are projected to increase.

Meeting long-term projected demands will require the SNWA to make significant and sustained progress toward its conservation goal. As demonstrated in the planning scenarios, the level of conservation achieved is a critical factor that will impact the timing and need of temporary and future resources.

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 per capita demands. It also allows the SNWA to store or “bank” these conserved supplies. This, in turn, provides the SNWA with added flexibility in responding to drought conditions and meeting future demands.

As of 2020, the SNWA has stored nearly 2.2 million acre-feet (AF) of water. This is more than eight times Nevada’s 2020 consumptive Colorado River water use.

On a larger scale, water conservation helped the SNWA meet its commitments with interstate and federal partners to store water in Lake Mead. Together, partners have bolstered Lake Mead storage through ICS, 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 more than 65 feet.

These efforts have provided the SNWA with time to complete essential infrastructure, helped to forestall a Colorado River shortage declaration, and provided water storage and recovery opportunities.

The SNWA completed construction of the Low Lake Level Pumping Station at Lake Mead in 2020. The pumping station works in conjunction with SNWA’s Lake Mead Intake No. 3 to preserve Southern Nevada’s access to Colorado River water supplies to a Lake Mead elevation of 875 feet. These infrastructure additions have helped to ensure reliable water service, even during extremely low reservoir conditions, and provide new opportunities for the SNWA to explore water resource opportunities with Colorado River partners.
Other benefits to the community include reduced pumping costs and enhanced operational flexibility.

**CURRENT PRIORITIES**
The 2021 Plan demonstrates the importance of conservation in extending the availability of Colorado River resources, minimizing the use of Temporary Resources, and delaying the timing and need for Future Resources. With ongoing community support and through adaptive use of its Water Resource Portfolio, the SNWA is prepared to meet the range of projected demands and water supply conditions presented in this plan.

Meeting the challenges that lie ahead will require significant and ongoing adaptive management efforts, which include:

- Continuing to set and achieve water conservation goals through aggressive water conservation efforts;
- Collaborating with Colorado River stakeholders for conservation and flexible use of Colorado River supplies (for example, water banking), as well as taking steps to protect Lake Mead’s elevation against future water level declines;
- Continuing to secure temporary resources to offset long-term impacts associated with shortage while working to bring other permanent resources online when needed;
- Working with Colorado River partners to explore collaborative future water resource projects;
- Addressing uncertainty by planning to a range of future supply and demand possibilities; and
- Collaborating with climate scientists and other agencies to understand and evaluate climate change, and its potential impacts on water supplies and facilities.
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, the 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, the 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 THE 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.
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 2.3 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, the 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, the 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, the 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.

As discussed in Chapter 2, the SNWA recently completed construction of a new raw water intake (Intake No. 3) and Low Lake Level Pumping Station (L3PS) at Lake Mead in response to changing hydrologic conditions in the Colorado River Basin. These facilities offset risk associated with future Lake Mead

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 more than 2.3 million in 2021, the Southern Nevada region has experienced change faster than almost any other region in the nation during this same time.

Today, Southern Nevada is home to 74 percent of Nevada’s total population. The region uses less than 5 percent of all water available for use in the state.
The SNWA is responsible for managing Southern Nevada’s long-term water resources, constructing and operating facilities and encouraging water conservation.
water level declines and preserve the community’s access to available Colorado River water supplies, even under extremely low reservoir conditions. As detailed in Chapter 3, the SNWA is pursuing water projects with Colorado River partners and will use these facilities to access current and future Colorado River supplies.

**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 SNWA adopted its first water conservation plan in 1995 and has updated the plan several times since. During this timeframe, the community has consistently set and achieved aggressive water conservation goals.

Significant and sustained conservation progress remains of critical importance for our desert community, particularly as changing hydrologic, climate and economic conditions are anticipated to impact supply and demand. To this end and to help ensure supply and demand balance, the SNWA Board of Directors adopted a new conservation goal in 2021.

The 2021 Plan provides greater insight into changing conditions and details the water supply and demand implications of continued conservation over the SNWA’s long-term planning horizon. It also details the planned trajectory of the community’s new conservation goal and summarizes significant efforts planned or underway to increase conservation and efficiency gains.

As noted on left and described in Chapter 3, the SNWA has identified additional actions that will support conservation goal achievement. Some actions are based on recommendations from the Integrated Resource Planning Advisory Committee (IRPAC 2020) while others were identified by the SNWA as part of ongoing strategic planning efforts. If implemented, these actions will help the SNWA to achieve its current conservation goal while countering upward pressures associated with climate change and system age.

Conservation and efficiency improvements will require committed support from the SNWA’s member agencies and from the community at large.

**2021 Water Resource Plan**

The SNWA’s 2021 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 2021 Plan incorporates the recommendations from IRPAC 2020, which were approved by the SNWA Board of Directors in September 2020. Among other things, recommendations address specific water conservation efforts needed to help the community meet its water conservation goal.

CHAPTER SUMMARY

The SNWA Water Resource Plan is an important tool designed to help the 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 setting and achieving conservation goals.

In addition, the 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 changing hydrology, climate and economic conditions are anticipated to create new uncertainties for Southern Nevada’s short- and long-term water resource needs. These challenges, as well as the 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 the 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).

ENDNOTES

6 “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

Water supply and demand conditions have changed significantly in Southern Nevada over the past century. As a result, resource strategies have needed to adapt. The community rose to these challenges time and again by developing new water resources and facilities and by significantly reducing water demands through aggressive water conservation.

Ingenuity and resolve are again required to address new challenges that emerged at the beginning of the 21st century and continue today. These include changing hydrologic, climate and economic conditions. Individually or combined, these factors significantly influence local water demands and the resources and facilities needed to support those demands over time.

This chapter provides context for the current planning environment and details the planning and response efforts taken by the SNWA, with community support, to minimize impacts. It also provides insight into current and future efforts required over the 50-year planning horizon.

As further described, changing conditions will require significant and sustained actions that conserve available resources and ongoing adaptive management. The latter requires close monitoring and proactive planning. At the time of publication, the 2021 Plan includes the latest information available. The SNWA will continue to regularly monitor and address evolving conditions as part of its water planning activities and annual resource planning process.

DROUGHT AND CLIMATE CHANGE

Colorado River water supplies are derived primarily from snowmelt and runoff from the Rocky Mountains and 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.

Between 2000 and 2021, snowfall and runoff into the Basin were well below the historical average, representing the lowest 22-year period on record (Figure 2.1). Over the last two decades, average Colorado River inflows were about 12.3 million acre-feet per year (MAFY)—about half of these years experienced flows at or below 11 MAFY.
Average annual inflows since 2000 are lower than the amount of water allocated to the Colorado River Basin states and Mexico (16.5 MAFY) and substantially lower than the 1909 - 1928 historical average flow considered in determining compact allocations (about 17.7 MAFY).

The persistence of decades-long drought and changing climate conditions has resulted in significant water level declines at major system reservoirs. As of late 2021, the combined water storage in the Colorado River’s two primary reservoirs (Lake Mead and Lake Powell) was at just 32 percent of capacity. As described below and in Chapter 4, further water-level declines are expected.

Drought has become synonymous with the Colorado River over the last 20 years. This term can be misleading, though, implying a transient condition that will end. Today, the best scientific projections available suggest that current Colorado River conditions will not only continue but worsen. Leading climate scientists warn of a permanent shift to a drier future, something known as “aridification.” In simple terms, aridification refers to drying conditions that result from warming. It is often measured by the reduction of average soil moisture content. From a timescale perspective, aridification represents long-term change rather than seasonal variation.

Recent studies show that warming temperatures within the Colorado River Basin are a major contributing factor to current conditions, including reduced streamflows. As demonstrated in recent years and when ground conditions are dry, near-normal precipitation does not equate to near-normal runoff. For example, Colorado River inflows were just 32 percent of average in 2021 despite near-normal snowpack (89 percent of average). Record warm temperatures leading into the winter season starved the soils of moisture. As a result, the dry ground soaked up more water, and less water made its way to the river.

Warming is 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. Consistent with global trends, warming has also occurred in the southwestern United States. While climate change models project that warming trends will continue (Figure 2.2), the magnitude of change at a given location will depend in part on global mitigation efforts to reduce GHG emissions.

Locally, projections indicate that Clark County will warm between 5-10°F by the end of the century. 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.

![FIGURE 2.2 Climate Change Range of Possible Future Warming in North America 2036 – 2099 (2018) National Climate Assessment](image)
As further described below, changing hydrologic and climate conditions pose two challenges for Southern Nevada: reduced Colorado River resources and potential increases to local water demands.

**Water Supply Impacts**
Lake Mead water levels have declined nearly 150 feet since 2000, and further water-level declines are expected. For the foreseeable future, there is a high probability that Southern Nevada will experience Colorado River water supply reductions.

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 (Interim Guidelines). Among other things, the Interim Guidelines established rules for implementing shortages in the Lower Basin.

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; a shortage declaration will be made if Lake Mead is forecasted to be at or below 1,075 feet on January 1 of the following year.

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 Agreement (DCP). A summary of shortage amounts/DCP contributions is provided in Appendix 5.

Nevada’s DCP contribution will be incurred when the projected elevation of Lake Mead is at or below 1,090 feet. Nevada made its first contribution (8,000 AFY) in 2020. As further described in this chapter, the DCP was approved in 2019 to help mitigate drought impacts (see also Adaptive Management). Like the Interim Guidelines, thresholds for DCP contributions are based on the Lower Basin Drought Contingency Plan Agreement (DCP). A summary of shortage amounts/DCP contributions is provided in Appendix 5.

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 the U.S. Bureau of Reclamation’s minimum probable forecast of Lake Mead elevation is projected to be at or 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 Lake Mead’s elevation from declining below 1,020 feet.

In 2021, the U.S. Bureau of Reclamation’s August 24-month study projected Lake Mead’s minimum probable elevation to drop below 1,030 feet. In accordance with the DCP, the Secretary of the Interior and the Lower Basin States are actively engaged in consultation to establish additional plans and actions through 2026 to protect Lake Mead’s elevation from declining below 1,020 feet.

The same modeling effort projected Lake Mead will fall below an elevation of 1,075 feet by January 1, 2022. This resulted in the first-ever shortage declaration by the Secretary of the Interior for 2022. As required, Nevada and Arizona will incur shortage in 2022 and also will continue making DCP contributions. In accordance with provisions of Minute 323, Mexico will also reduce deliveries. As shown in Figure 2.3, Nevada’s total obligation under the Interim Guidelines and DCP is 21,000 acre-feet for 2022.

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**FIGURE 2.3 SNWA Shortage/DCP Contribution**

The risk of shortage remains high in subsequent years. Modeling indicates an approximate 91 to 100 percent probability of shortage through 2029 and an 84 to 100 percent probability in the subsequent 10-year period. The model applies historical flows to simulate future conditions, representing both wet and dry years on the Colorado River. The likelihood for shortage within these time frames increases when factoring in drier hydrology assumptions related to climate change.

**Potential Demand Impacts**
Completed in 2012, the U.S. Bureau of Reclamation released a study that projects a median imbalance of 3.2 million acre-feet per year (AFY) between supply and demand by 2060 due to climate change and increased demands within the Basin. This study and the more recent 2020 State of the Science Report recognize the amount of water apportioned within the Colorado River Basin exceeds long-term average historic inflows, a situation that has been exacerbated by drought and climate change over the last two decades.
These studies recognize that climate change will not only affect the amount of water available for use but overall demands as well. Water evaporation and evapotranspiration rates will increase as temperatures warm, resulting in higher water demands for agricultural irrigation and landscaping uses. Reductions in use among those who share the Colorado River are needed to ensure supply and demand are balanced and that the river is managed sustainably.

In Southern Nevada, the expected impacts of climate change are similar to that of drought. These include 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.

Warmer and drier conditions are likely to increase local water demands, particularly for landscape irrigation and evaporative cooling systems. As described in Chapter 3, upward pressure from climate change and system age could increase local water demands by 10 gallons per capita per day (GPCD) or more by 2035. Among other actions, improving the efficiency of turf irrigation and air cooling uses will reduce the upward pressure of climate change and help to keep local supply and demand in balance.

LOCAL ECONOMIC CONDITIONS

Southern Nevada’s economic situation changed drastically in 2007 when the national economy began to experience its most significant decline since the 1930s. 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 2.4). For a few years following the downturn, gaming and tourism revenues declined. This was followed by a historic spike in unemployment. Most new residential and commercial development projects came to a halt, and home foreclosures flooded the real estate market.

State of the Science Report

Increasing water demand, dry conditions and warming temperatures have impacted the Colorado River in recent years, creating greater uncertainty about the basin’s future water supply availability. To more clearly understand the latest and best available science on these and related topics, the SNWA and other Colorado River Basin states and water managers pursued the creation of the Colorado River Basin Climate and Hydrology: State of the Science Report. The report integrates nearly 800 peer-reviewed studies, agency reports and other sources to assess the state of the science and the technical methods relevant to water resources in the Colorado River Basin. Further, it establishes a shared understanding of the physical setting, as well as the latest data, tools and research that underpins Colorado River water resource management.

Report findings confirm that temperature trends are increasing and precipitation, snowpack water volume and annual streamflow trends are decreasing. The SNWA and others will use the report—which identifies both challenges and opportunities—to improve the short-term and mid-term foresting and long-term projections for the Colorado River system. This information and associated work efforts will expand the SNWA’s resource management and planning capacity.
The economy has improved steadily in the region since 2012. However, conditions changed again in March 2020, when a global pandemic quickly spread within the community and throughout the world. Locally, Southern Nevada experienced a profound rise in unemployment due to non-essential business closures and the sudden halt to gaming and tourism activity.

Employment and economic activity began to recover as initial restrictions on the gaming industry eased in June 2020. From a record high unemployment rate in April 2020 (33.3 percent) to 7.4 percent in September 2021, the community’s economic recovery is ongoing. Despite a period of turbulence, the region’s population increased 2.2 percent from 2019 to 2020. Home values also increased substantially between 2019 and 2021, primarily due to low supply and growing demand.

According to the Center for Business and Economic Research (CBER) at the University of Nevada, Las Vegas, growth will likely continue. The 2021 forecast estimates a population of 3.02 million by 2035 and 3.38 million by 2060. This is a substantial increase over the prior year’s forecast, which projected slower growth due to pandemic related uncertainties and anticipated impacts to the local economy.

As demonstrated by Southern Nevada’s unpredictable past, population increases could occur faster or slower than forecasted. Significant shifts, such as the one forecasted, could affect local water demands and the resources available to meet those demands over time. As described in Chapter 3 and Chapter 4, the 2021 Plan details additional conservation actions needed to help balance supply and demand.

ADAPTIVE MANAGEMENT

Adaptive management relies on continuous assessment, flexible planning and action. As the region’s wholesale water provider, the 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 impacted water facilities, water supply availability, water quality and water demands. In addition, factors associated with Southern Nevada’s local economy and its growth rate make predicting future water demands challenging, particularly in light of the region’s previous growth history.

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

Lake Mead Facility Improvements

Lake Mead’s surface elevation is down by approximately 150 feet since 2000. In 2021, Lake Mead reached 1,065 feet, the lowest point since the lake began filling in the 1930s. Based on current and forecasted conditions, 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. Protecting Lake Mead from continued water level decline is a priority for Colorado River stakeholders. Below a Lake Mead elevation of 895 feet, Hoover Dam can no longer deliver Colorado River water to downstream users.

Until 2020, SNWA pumping facilities were limited in their operating range relative to the elevation of Lake Mead (Figure 2.5). 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 pumping station at Lake Mead.
The SNWA put its new intake (Intake No. 3) and Low Lake Level Pumping Station into service in 2015 and 2020, respectively. Together, these facilities preserve existing capacity and allow the SNWA to pump from a Lake Mead elevation of 875 feet. This elevation is approximately 20 feet below the minimum elevation that Hoover Dam can release water downstream. Major construction efforts were based, in part, on the recommendation of a prior Integrated Resource Planning Advisory Committee. The Committee 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.

These adaptive management measures help to ensure reliable water service, even during extremely low reservoir conditions, and provide new opportunities for the SNWA to explore water supply agreements with other downstream Colorado River water users.

Water Conservation
The SNWA continues to implement one of the most progressive water conservation programs in the nation, which yielded significant water savings over the last 20 years, even as the community grew. By the end of 2020, Southern Nevada’s consumptive use of Colorado River resources was 256,000 AFY. This amount is below any Colorado River water supply reduction that may occur under existing rules. DCP contributions will be met with temporary supplies.

While SNWA does not anticipate near-term customer impacts associated with a federal shortage declaration or implementation of the DCP due to community response efforts, continued water conservation will remain a critical priority in the years ahead. Meeting the community’s long-term water resource needs will require significant and sustained contributions from all community sectors on an ongoing basis.

As further described in Chapter 3, the SNWA has enhanced education, outreach and incentive programs to support continued water savings. Meanwhile, additional conservation policies and programs are planned for future implementation as Southern Nevada continues to adapt to changing supply and demand conditions.

Interstate Collaboration
The Colorado River Basin states are working collaboratively with U.S. federal partners and Mexico to augment water supplies, improve system efficiency, and protect power generation and access to water supplies. These efforts range from investing in infrastructure improvements in Mexico to system efficiency and conservation efforts that have mutual benefit to Colorado River Basin water users.
Drought Response Actions. Between 2014 and 2021, the SNWA entered into three agreements with federal, state, philanthropic organizations and other Colorado River water users to help mitigate the impacts of ongoing drought and bolster reservoir elevations. These efforts help protect against critical reservoir elevations that threaten hydropower generation at Glen Canyon and Hoover dams and preserve access to water supplies for millions of Lower Basin water users.

The SNWA and other Colorado River partners agreed to forgo off-stream banking efforts to leave water in Lake Mead as part of one agreement. Under other agreements, project partners paid for conservation projects that benefit the Colorado River system as a whole. Projects included land falling, 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 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 and 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 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 plans to meet its commitments under the Interim Guidelines and DCP with conservation savings and temporary resources as described below and in Chapter 3.

As noted previously, the Lower Basin States are in consultation with the federal government to determine what additional actions might be needed to protect a Lake Mead elevation of 1,020 feet. At the time of the 2021 Plan publication, these discussions were ongoing. Generally, the states are contemplating additional conservation and water use reductions.

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 2021, the SNWA has banked resources in the Southern Nevada Water Bank, 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, the SNWA will continue water banking efforts to build temporary reserves and help stabilize Lake Mead water levels.

As shown in Figure 2.6, water banking and other collaborative drought response actions have reduced Lake Mead’s water level decline by an estimated 65 feet in 2021.
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.

Meeting the challenges lie ahead will require significant and ongoing adaptive management efforts. Key efforts include:

- Continuing to set and achieve water conservation goals through aggressive water conservation efforts;
- Collaborating with Colorado River stakeholders for conservation and flexible use of Colorado River supplies (for example, water banking), as well as taking steps to protect Lake Mead’s elevation against future water level declines;
- Continuing to secure temporary resources to offset long-term impacts associated with shortage while working to bring other permanent resources online when needed;
- Working with Colorado River partners to explore collaborative future water resource projects;
- Addressing uncertainty by planning to a range of future supply and demand possibilities; and
- Collaborating with climate scientists and other agencies to understand and evaluate climate change, and its potential impacts on water supplies and facilities.

Applying Best Available Climate Science

The SNWA continues to work with federal, state, and local water agencies to enhance understanding of future water supply and demand uncertainty, and improve short and mid-term forecasts and long-term projections. A key accomplishment of these efforts is the creation of the Colorado River Basin Climate and Hydrology: State of the Science report (see page 16).

Likewise, to better understand and adapt to climate change effects on water-related infrastructure and water resources, the 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. 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). 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.

Supply and Demand Forecasting

As in prior years, the SNWA has taken a scenario-based planning approach with its 2021 Plan to address possible changes to water supply availability and demands. This is a conservative approach that considers various water demand and supply conditions, including impacts of declared shortage and climate change.
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 2019 are official, while estimates for the period 2020 and 2021 are provisional, August 2021, U.S. Bureau of Reclamation.


15. Clark County Population data 1970-1980 are decadal counts from the U.S. Census Bureau. Clark County Population data 1990-2019 are annual estimates prepared by the Clark County Comprehensive Planning Department.


17. Ibid

THE 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

The SNWA has worked since 1991 to establish and manage a flexible portfolio of water resources, an approach commonly used in resource planning. Having a portfolio of resources allows the SNWA to assess its overall water resource options and make appropriate decisions regarding which resources to develop and use when necessary. Key factors considered in determining acquisition, the priority of development, and resource use include availability, accessibility, cost and need.

The SNWA’s water resource portfolio and associated facility planning and permitting efforts provide the SNWA with flexibility in adapting to changing supply and demand conditions. As detailed in Chapter 2, water resource conditions have changed significantly over the years for many western states, including Nevada.

During that time, the SNWA has worked to implement innovative water conservation and resource strategies that have increased the efficiency of Colorado River water use, bolstering the elevation of Lake Mead and maximizing the availability of this critical water supply. The organization has also created new temporary resources that provide flexibility in meeting current and future demands. These efforts have helped delay the need to develop costly water projects.

Adaptive management has played an increasingly significant role in the SNWA’s water resource and facility planning efforts, helping reduce demands, bolster supplies and minimize risk associated with drought and climate change in the Colorado River Basin. These efforts have led to the development of new Lake Mead intake and pumping facilities and collaborative partnerships that significantly enhance the reliability of and access to Southern Nevada’s Colorado River water supplies.

This chapter discusses the diverse set of water resource options acquired by the SNWA to reliably meet the community’s current and future water needs. Resources in the SNWA water resource portfolio are described in consumptive use volumes and are organized into the following categories:

- Permanent Resources
- Temporary Resources
- Future Resources

Consistent with prior plans, water conservation is a critical component of the SNWA’s water resource management strategy and reducing per capita water use remains a top priority. This chapter highlights new and ongoing strategies the SNWA is pursuing to balance supply and demand, building upon the community’s conservation success over the last two decades.

PERMANENT RESOURCES

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, Tributary Conservation Intentionally Created Surplus (ICS), permitted groundwater rights in the Las Vegas Valley and reuse, primarily through return-flow credits. The section below describes these resources and provides details about their availability and use.

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.
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.¹

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 develop sustainable solutions that balance supply and demand.

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, the 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

The SNWA’s total estimated Colorado River entitlement is 276,205 AFY of Nevada’s 300,000 AFY allocation. This volume includes 272,205 AFY for use by SNWA member agencies and 4,000 AFY that the SNWA delivers to Nellis Air Force Base. Nevada’s remaining apportionment is contracted to other users.² The 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 it if and when it is available.

The SNWA’s use of Colorado River resources has declined 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 reduce the potential for 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 water diversions minus any Colorado River water returned to the Colorado River. These returns are also called “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.⁴
Return-flow credits constitute a significant portion of Southern Nevada’s Colorado River resource, expanding the SNWA’s Colorado River supply. Nevada’s Colorado River return-flows consist mostly of highly-treated wastewater 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 designation 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.5

Based on current Lake Mead water levels and climate variability in the Colorado River Basin, the SNWA does not assume that flood control surplus water will be available during the planning horizon. However, the SNWA will utilize this resource as a priority when it is available.6

**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,” the SNWA can consumptively use up to 400,000 AFY of Colorado River water when Lake Mead is above 1,145 feet. The 2021 Plan does not assume the availability or use of domestic surplus water during the planning horizon. However, the SNWA will utilize this resource as a priority when it is available.6

**Intentionally Created Surplus**

In 2007, as part of the Interim Guidelines, the SNWA entered into a series of agreements that ensure the availability and delivery of water resources developed under provisions for ICS.7 As discussed below, Tributary Conservation ICS and Imported ICS enable the SNWA to develop some of its surface and groundwater rights located in Nevada, near the Colorado River. The SNWA may develop these rights as needed by conveying them to Lake Mead in exchange for Tributary Conservation ICS and Imported ICS credits.

The SNWA can use its Tributary Conservation and Imported ICS credits during the year created and under any operating condition, including shortage (taken as Developed Shortage Supply or “DSS” during a declared shortage).8 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.

Water not used in the year it is created may be converted to Extraordinary Conservation ICS. As discussed in the “Temporary Resources” section on the following pages, the credits will be withdrawn as Colorado River water through SNWA facilities when needed 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 with 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, the SNWA has acquired approximately 16,500 AFY of permanent rights. In addition to these permanent rights, the SNWA also leases approximately 17,600 AFY of rights, with remaining terms through 2026. The SNWA anticipates developing 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 stem of the Colorado River.

The SNWA has 9,000 AFY of permitted non-Colorado River groundwater rights in Coyote Spring Valley that would qualify as Imported ICS. However, these and other groundwater rights within the Lower White River Flow System are under review, subject to an ongoing process initiated by the State Engineer in 2018 to evaluate the amount of water that can be pumped sustainably. For the 2021 Plan, the SNWA assumes no use of this resource.

**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.9

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. Las Vegas Valley
TEMPORARY RESOURCES

Beginning in the early 1990s and continuing today, the SNWA has worked closely with other basin states to maximize opportunities for flexible use of Colorado River water. Through local and interstate arrangements, the 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 and to meet DCP contributions. The SNWA will carefully consider future resource availability and the lead time for future resource development when accessing temporary resources.

Temporary resources are defined as banked resources. As part of its overall water resource strategy, the SNWA has reserved water in years when Nevada’s Colorado River allocation exceeds the community’s demands. To the extent possible, 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, the SNWA stores banked resources locally, as well as through banking agreements with other states.

Southern Nevada Water Bank

The SNWA has stored more than 345,000 acre-feet of water in the Southern Nevada Water Bank through 2020 for future use under an agreement with LVVWD. The SNWA may recover water banked under this agreement in any water supply condition. This plan assumes a maximum recovery rate of 20,000 AFY.

California Water Bank

Between 2004 and 2012, the SNWA entered into various agreements that allow for the storage of Nevada’s unused Colorado River water in California. As of 2020, Nevada has banked more than 330,000 acre-feet of water in California. This plan assumes a maximum recovery of up to 30,000 AFY during normal and shortage conditions, subject to agreement terms.

Arizona Water Bank

In 2013, the SNWA approved an amendment to the 2001 water banking agreement with the Arizona Water Banking Authority. Through 2020, the SNWA stored approximately 614,000 acre-feet of Colorado River water underground in Arizona’s aquifers for the SNWA’s future use. The SNWA can bank additional water on a pay-as-you-go basis up to 1.25 million acre-feet.

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 through treatment and releases 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 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 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, prioritizing the return of treated wastewater to Lake Mead for return-flow credits. IRPAC 2020 further recommended that the SNWA require out-of-valley development to return wastewater to Lake Mead and further limit consumptive uses of water outside the Las Vegas Valley. The 2021 Plan assumes new non-consumptive water deliveries are treated and returned to the system for return-flow credits.

groundwater rights remain a critical component of SNWA’s Resource Portfolio.
For the SNWA to recover this stored water, Arizona will utilize the banked water and forego a like amount of Colorado River water. The SNWA will then divert the water from facilities at Lake Mead. The SNWA can recover up to 40,000 AFY during any water supply condition and 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.

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. Bi-National ICS is an additional form of ICS created in 2012 as part of an international pilot program. Provisions for Bi-National ICS were extended through 2026 with 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 provide an incentive for additional water storage in Lake Mead and, in turn, to help slow the decline of Lake Mead water levels. The SNWA can use its DCP ICS credits without repayment obligations when Lake Mead is above an elevation of 1,110 feet. The SNWA can access up to 300,000 AFY of its combined System Efficiency ICS, Extraordinary Conservation ICS, Bi-National 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 anticipated for use throughout the planning horizon and are further described below.

**System Efficiency ICS.** In 2007, the 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 and are 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. The SNWA’s share of 3,050 acre-feet is stored temporarily 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. Using an established methodology to determine water savings, the SNWA will accrue Extraordinary Conservation ICS credits through 2026 when it stores these water savings in Lake Mead as ICS. Water conservation initiatives have reduced Nevada’s Colorado River water use below the state’s apportionment and created the opportunity for the SNWA to store conserved water in one of its off-stream water banks. Tributary Conservation and Imported ICS credits are also converted to Extraordinary Conservation ICS credits if 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 2020, the SNWA has stored approximately 399,000 acre-feet of Extraordinary Conservation ICS.

DCP Contributions and ICS. DCP 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.

The Bureau of Reclamation’s August 2019 forecast projected Lake Mead’s elevation at or below 1,090 feet by January 1, 2020. This triggered first-tier DCP contributions by the Lower Basin states in 2020. Nevada’s contribution was 8,000 AFY. Subject to the DCP agreement and storage limitations, Nevada’s DCP ICS account will be credited each time the state makes a DCP contribution. The SNWA can utilize its DCP ICS credits with no penalty or repayment obligations when Lake Mead is above 1,110 feet. Below this elevation, the SNWA can access or borrow credits, subject to repayment.

As shown in Figure 3.2, access to DCP ICS credits is 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.
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. 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 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.

**Bi-National ICS.** The United States and Mexico finalized Minute 323 to the 1944 U.S./Mexico water treaty in 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 high- and low-reservoir conditions. In addition, Minute 323 contains Mexico’s commitment to a Water Scarcity Plan that requires Mexico to store additional water in the United States as Lake Mead elevations drop. With approval and implementation of the DCP, 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 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 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, the 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 2020, the SNWA has accrued 32,842 acre-feet of Bi-National ICS credits.

The DCP and associated agreements limit the maximum amount of Extraordinary Conservation ICS, Biinational ICS and DCP ICS each Lower Basin state can store. California is limited to 1.7 million acre-feet of storage, and Nevada and Arizona are each limited to 500,000 acre-feet of storage. As allowed by the DCP, Lower Basin stakeholders—including SNWA, Arizona Department of Water Resources, Colorado River Commission of Nevada and Metropolitan Water District of Southern California—entered into an Additional

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**FIGURE 3.2 Availability of DCP ICS Credits**

*2021 Water Resource Plan assumes availability through 2072.*
Sharing Agreement in 2021. The agreement establishes a mechanism and framework that allows the parties to pool their ICS storage capacity for possible use among Lower Basin states, subject to storage availability and ongoing coordination. The agreement provides enhanced flexibility for Lower Basin stakeholders, including Nevada.

**FUTURE RESOURCES**

Future resources are resources expected to be available to the 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 require further research, analysis and agreement.

The development of most future resource options described in this Plan will require additional environmental permitting, as well as construction of water delivery infrastructure. Likewise, implementing some Colorado River options may require changes to the Law of the River to provide increased flexibility.

**Colorado River 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 water users could involve transfers/exchanges associated with participation in desalination or agricultural fallowing projects or participation in other conservation and reuse initiatives. As part of Colorado River negotiations that began in 2021, the SNWA will work with other Colorado River Basin states to create a more concrete framework for these types of exchanges.

**Desalination.** The SNWA is engaged with other Colorado River Basin states and water users, the U.S. Bureau of Reclamation and Mexico to actively explore and investigate potential seawater and brackish water desalination projects in the state of California and the country of Mexico.

The Binational Projects Work Group is considering other projects such as opportunities for seawater desalination and wastewater reuse facilities in
Mexico. The latter are noted as areas of interest under Minute 323. To support these efforts, the SNWA and Basin State partners funded a feasibility study to examine desalination opportunities along the Sonoran coast of the Sea of Cortez. The study was completed in 2020 and is available online.17

**Colorado River Partnerships.** The SNWA and other Lower Basin stakeholders are actively exploring future resource options that may involve financial participation in major capital projects under development in other states. For example, the SNWA, Central Arizona Project and the Arizona Department of Water Resources are exploring participation in a major reuse project by the Metropolitan Water District of Southern California (MWD).

MWD is planning for a full-scale regional recycled water program that would produce up to 150 million gallons of water daily (or about 168,000 AFY). An initial pilot project is currently underway to support planning and research efforts. While the project is still in an early development phase, the SNWA and MWD are collaborating to identify a path for the SNWA’s participation and determine what approvals might be needed to implement the partnership. The SNWA anticipates that 20,000 - 40,000 AFY will be available to the SNWA in exchange for funding participation.

The SNWA has contributed funding to support environmental planning for the project and will continue to collaborate with MWD and other Colorado River water users to evaluate the potential for participation in this and other collaborative Colorado River partnerships of mutual benefit.

**Colorado River Augmentation**

The SNWA was permitted 113,000 AFY of Virgin River water rights in 1994. Under an agreement, the 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.19

**In State Groundwater**

The SNWA has permits and applications in southern and eastern Nevada based on applications filed by the LVVWD in 1989. As further described below, some of these applications have been permitted by the Nevada State
Engineer in accordance with Nevada Water Law, while others require further review and analysis.

**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 are leased to dry-cooled power plants located in Garnet Valley. As noted earlier in this chapter, these and other groundwater rights within the Lower White River Flow System are subject to an ongoing process initiated by the State Engineer in 2018 to evaluate the amount of water that can be sustainably pumped from the system.

**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 the 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. In 2020, the SNWA withdrew the remaining applications for groundwater not acted upon by the Nevada State Engineer.

**WATER CONSERVATION**

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

Gallons Per Capita Per Day (GPCD) is a metric used by many communities to measure water use. It also is 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.

The SNWA’s conservation progress and goal is stated in consumptive use terms. This approach reflects water resource implications associated with conservation progress. 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 the SNWA recycles nearly all indoor water use, primarily through return-flow credits.

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

**Conservation Goals**

As further described in Chapter 4, conservation progress underpins the community’s long-term water resource planning efforts. Ultimately, the community’s performance determines how much more or less water is needed and when.

Since its inception in 1991, the SNWA and its member agencies have worked collaboratively to set and achieve aggressive water conservation goals. Per capita water use in Southern Nevada decreased by 47 percent between 2002 and 2020, even as the population within the SNWA service area increased by approximately 52 percent during the same timeframe (Figure 3.5). However, the most significant conservation gains occurred between 2000 and 2010; per capita water use has remained relatively flat in the years since. Stalled progress has significant implications for Southern Nevada, which faces two immediate and compounding challenges: upward pressure on water demands and water supply reductions.

Beyond projected population increases, which are expected to continue throughout the planning horizon, the SNWA anticipates that the upward pressures due to climate change and system age could increase demands by 10 GPCD or more by 2035. Meanwhile, supply reductions under the Interim Guidelines and DCP could reduce the availability of Colorado River resources and other temporary supplies by up to 30,000 AFY. Chapter 4 contemplates even higher supply reductions.
Recognizing the paramount importance of the community’s water supply security, the SNWA Board of Directors established a new conservation goal of 86 GPCD by 2035. The new goal addresses changing conditions and recognizes that additional progress is needed to maximize available supplies. Achieving the goal will require significant and sustained conservation effort from all sectors of the community.

While the SNWA has expanded education, outreach and incentive programs to support water conservation and efficiency gains, meeting higher levels of efficiency will require the implementation of new strategies and tactics. The following sections detail conservation efforts currently underway and new initiatives that are now in planning to support continued water conservation and efficiency gains.

**Key Focus Areas**

Above and beyond the continued implementation of existing measures (see sidebar on Page 34), the SNWA has identified additional actions that will support conservation goal achievement. Some actions are based on recommendations from IRPAC 2020 (see Appendix 3), while the SNWA identified others as part of ongoing strategic planning efforts. If implemented, these actions will help the SNWA achieve its current conservation goal while countering upward pressures associated with climate change and system age. Implementation will require committed support from the SNWA’s member agencies.

**Prohibit New Golf Course Development.** Existing codes and policies make the development of new golf courses in Southern Nevada less practical. In some jurisdictions, new courses are currently limited to 45 acres per 18-hole course, plus 5 acres for a driving range. Restricting new course development will further reduce per capita consumptive water use. The Las Vegas Valley Water District approved service rule changes in 2021 that restrict the use of Colorado River water to irrigate new golf course developments. Future efforts to prohibit the development of new course construction may include changes to service rules, codes and ordinances.

**Reduce Golf Course Water Budgets.** Golf courses are subject to mandatory water budgets that allow 6.3 acre-feet of water annually per irrigated acre. Future efforts to reduce existing golf course water budgets to 4.0 acre-feet of water per irrigated acre annually may include changes to service rules, codes and ordinances. The average course in Southern Nevada uses about 4.1 acre-feet of water per irrigated acre. Many local courses have participated in SNWA incentive programs to replace turf with water-efficient landscaping.
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, the 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 the 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 $275 million in incentive programs, reducing demand by more than 13.7 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 use of 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.

Some courses have identified turf areas not used during play through the use of GPS technology, a service offered by the SNWA.

**Convert Cool Season Turf.** Limiting future installations of cool-season turf and expediting the conversions to warm-season turf at existing public facilities will help reduce consumptive use associated with turf irrigation while preserving functional turf in recreational spaces. The SNWA is working with its member agencies to identify conversion opportunities and provides support through its incentive programs. Future efforts to limit new cool-season turf installations may include changes to service rules, codes and ordinances. The estimated water savings is 21 gallons per square foot of turf converted.

**Implement Large Water User Policy.** While Southern Nevada has some of the nation’s most progressive water efficiency standards, the implementation of additional policies, products and practices can significantly reduce consumptive water use in new development. Meaningful opportunities for efficiency gains exist within the commercial and industrial sectors, particularly for new development.

As recommended by IRPAC 2020, the SNWA has worked with its member agencies to embed the principles of the SNWA’s Non-Functional Turf Resolution in municipal codes and service rules. Efforts include requiring out-of-valley development to return wastewater to Lake Mead for return-flow credits, and further limiting consumptive uses of water in out-of-valley areas.

Meanwhile, the SNWA continues to work with its member agencies to establish an efficiency review policy and process for new large water users that encourages efficient development and disincentivizes consumptive uses. In concept, the policy targets the top 2 percent of water users and encourages them to take actions that will reduce consumptive water use by 10 percent per year over initial planned usage.

**Implement AB356 (Non-Functional Turf Removal).** The Nevada Legislature passed AB356 in 2021, restricting the use of Colorado River water to irrigate non-functional turf in non-single family residential applications by the end of 2026.

The new law targets turf found in streetscapes, medians, parking lots, traffic circles and other areas not used for recreation and play. There are approximately 5,000 acres of non-functional turf in the SNWA member agency service area. The legislation targets approximately 3,900 acres for removal. Conversion of non-functional turf...
Associated with AB356 implementation will reduce consumptive water demands by an estimated 10 percent, saving about 9.5 billion gallons of water annually (or 29,000 AFY).

As required by the legislation, the SNWA convened an advisory committee to define functional and non-functional turf. The committee is expected to advance its recommendations to the SNWA Board of Directors in early 2022. In the meantime, the SNWA is working to enhance capabilities to accommodate increased demand under its Water Smart Landscapes program. The program provides incentives for commercial and residential turf conversions.

Implement Pool Development Standards. Some private pools exceed 3,000 square feet and evaporate more than 145,000 gallons of water per year. Future efforts to limit the allowable pool size in new development may include changes to service rules, codes and ordinances. This measure will help reduce consumptive water use associated with evaporative water loss, targeting savings from the top 25 percent of new pools constructed.

Enhance Leak Resolution. Customers are responsible for repairing leaks occurring on their property and the customer side of the utility’s water meter. Residential leaks are typically due to damaged irrigation systems, cracked supply lines or faulty fixtures (such as faucets, toilets, appliances and water heaters). Slow leaks are not always visible and can generate significant water loss.

As recommended by IRPAC 2020, SNWA member agencies, including the Las Vegas Valley Water District, City of Henderson and City of North Las Vegas, are working to deploy advanced metering infrastructure (AMI). This technology will significantly enhance the ability of local water providers to notify their customers of suspected leaks for faster leak resolution. The Big Bend Water District is currently using this technology. AMI provides high-resolution data in near real-time. Other efforts may include the development of new programs and services, as well as the deployment of other new technologies that can help customers to identify and resolve leaks faster.

Implement Park Efficiency Improvements. Parks provide significant recreational value for our community’s residents, offering active and programmed turf areas for a wide variety of uses. While turf is the predominant feature in most parks, other amenities may include playgrounds,
sewer-connected splash pads, sports courts and group use facilities. Water use per irrigated acre varies markedly within this sector, and many parks appear to be using significantly more water than needed. High water use could be the result of unaddressed leaks, inefficient irrigation practices or other factors.

The SNWA offers incentives to public parks to convert cool-season turf, install sewer-connected splash pads and develop alternate amenities (such as basketball courts, tennis courts and other turfless play areas). Future efforts may include creating awareness and tools for parks to manage water use consistent with their property features.

**Implement Cooling Efficiency Standards:** Evaporative cooling is the second-largest consumptive water use in Southern Nevada, predominantly used to cool commercial and industrial buildings. Deployment of alternative cooling technology represents a significant opportunity for water savings. Water consumption primarily occurs through evaporation and drift loss, which comprise about 70 percent of total cooling water demand.

As recommended by IRPAC 2020, the SNWA is evaluating changes necessary to reduce current and future consumptive water losses associated with evaporative cooling technology. Near-term efforts include research and pilot projects to inform best management practices, incentive programs and other policy changes. The SNWA also offers incentives to commercial and multifamily property owners who install water-efficient devices and technologies, including cooling system upgrades.

Near-term efforts include code changes that require high efficiency systems for new development. Future code changes may require property owners to replace evaporative cooling systems with water efficient models when existing equipment reaches the end of it’s useful life.

**Enhance Landscape Watering Compliance.** Improving compliance with landscape watering restrictions and preventing water waste is a high priority for reducing consumptive water use in Southern Nevada. Current rules allow customers to water on three assigned days per week in spring and fall, one assigned day per week in winter and six assigned days per week in summer. Sunday watering is prohibited year-round.

The SNWA maintains an active information and outreach campaign to promote landscape watering compliance, and SNWA’s member agencies conduct water waste enforcement. Other strategies to improve compliance include enhanced water waste investigations and more direct outreach to violators. Future efforts may include changes to service rules that allow for the implementation of seasonal excess use charges. This measure would specifically target those customers that are not compliant with mandatory watering restrictions by providing a strong pricing signal.
**Make Asset Management Investments.** IRPAC 2020 recommended that water agencies continue making investments to maintain and improve the current water loss rate among wholesale and retail water purveyors. Non-revenue water losses are typically associated with leaks in transmission or distribution pipelines, variations in meter accuracy and water theft. The SNWA and its member agencies implement several strategies to minimize water loss within their water distribution systems, but ongoing investment will be required as systems age. Other related efforts include deploying and testing innovative technologies that can improve leak detection and speed leak repairs, prioritizing system optimization and making proactive retrofits and repairs to system facilities.

**Limit New Turf Installations.** Southern Nevada has some of the most progressive development standards for new turf installation. Turf is currently prohibited in new residential front yards and limited in backyard applications. While rules vary slightly by jurisdiction, turf is also prohibited in multifamily and non-residential developments, except for parks and other community-use recreational turf areas (upon approval). Near-term efforts include changes to service rules, codes and ordinances that restrict turf installations in all new development except for parks and schools. Implementation will yield significant water savings over the long-term planning horizon.

**Implement Pricing Changes.** While the SNWA’s member agencies set water rates independently, they use similar conservation rate principles to manage water demand. Over the years, SNWA water purveyors have compressed tier thresholds and significantly increased upper-tier water rates. To maintain a strong pricing signal, the SNWA adopted the recommendation of a citizens committee in 2015 to promote water rates that sustain and advance conservation achievements by ensuring rates keep pace with inflation. Future efforts may include changes that further incentivize conservation among top water users. Actions under consideration by some agencies include implementation of seasonal rates, excessive use surcharges, new tiers and tier compression.

**Optimize Return-Flow Credit.** There are approximately 14,500 commercial and residential septic systems in the greater Las Vegas Valley. Many of the associated properties rely on Colorado River water that is delivered by municipal water providers. Water discharged to septic systems is lost as it cannot be recovered. The SNWA developed a Septic Conversion Pilot Program in 2021 that offers grant funding for septic users to abandon their septic systems and connect to the municipal wastewater system. Water discharged to the municipal wastewater system is collected, treated and released to the Las Vegas Wash for return-flow credit. Future code changes may limit the development of new septic systems.

Figure 3.7 illustrates the estimated trajectory of conservation gains if all actions are implemented.
Chapter 4 provides additional information by illustrating how conservation goal achievement affects the timing and need of temporary and future resources.

CHAPTER SUMMARY
Several factors can influence the timing, use and availability of water resources. Having a diverse portfolio of resources allows the 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 the SNWA can reliably meet community water demands.

The SNWA Water Resource Portfolio includes a mix of 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.

The SNWA continues to make water conservation a priority, and the community is currently working to achieve its 86 GPCD conservation goal by 2035. The SNWA has taken several steps to increase conservation gains and is aggressively pursuing implementation of recommendations identified by the SNWA’s 2020 Integrated Resource Planning Advisory Committee. The SNWA has identified additional actions that complement these efforts. Figure 3.7 illustrates the estimated trajectory of conservation gains if all actions are implemented.

Implementation of these measures will put the community on a path to achieving its conservation goal. Moving from a projected 123 GPCD (which accounts for current per capita water use and upward pressure due to climate change and system age) to 86 GPCD by 2035 will require significant and sustained investments from all community sectors.

From a supply perspective, the SNWA continues to work with other Colorado River water users to pursue flexible use of Colorado River supplies. Efforts include augmentation and storage projects designed to increase supplies and bolster Lake Mead water levels. The SNWA also continues to pursue other water resource initiatives that could provide permanent supply benefits to Southern Nevada.

ENDNOTES


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 May 2020, U.S. Bureau of Reclamation, http://www.usbr.gov/lc/g4000/contracts/entitlements/NVentitlements.pdf. 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 water imported to the Las Vegas Valley.

3 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.

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

Mea (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.

8 “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.

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


11 “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.

12 “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.


18 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.


22 “Agreement for Additional Interim Sharing of Intentionally Created Surplus Accumulation Limits,” among Arizona Department of Water Resources, Metropolitan Water District of Southern California, U.S. Bureau of Reclamation, SNWA, and Colorado River Commission of Nevada, 2021. This agreement governs joint sharing of Lake Mead ICS storage of up to 2.7 million acre-feet and provides SNWA greater flexibility to store additional water in Lake Mead.

23 Estimated GPCD water savings in 2035 based on a population served of 2.9 million. Projected GPCD reflects the upward pressure of climate change and system age.
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 the SNWA prepared its 2021 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, the 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 development efforts and demonstrates how the SNWA plans to meet future needs, even if conditions change significantly over time.

Water demands and resource volumes are presented in consumptive use terms, consistent with the water resource descriptions in Chapter 3 and illustrating the supply-related impacts of SNWA shortage reductions and DCP contributions. As described in the following sections, all of the planning scenarios presented in this chapter demonstrate the SNWA’s ability to meet the community’s long-term projected water needs with additional conservation and 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 available or 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 change. 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 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). Other resources are subject to future agreements or will require the development of facilities for use.

Ultimately, the timing and need for resources will depend significantly on how supply and demand 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 and lower water demand projection that assumes expected conservation and an upper demand projection that assumes lower levels of conservation achievement. 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).

### Figure 4.1 SNWA Water Resource Portfolio

<table>
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<th>SUPPLY</th>
<th>CONSUMPTIVE USE</th>
<th>AVAILABLE IN SHORTAGE</th>
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<td><strong>PERMANENT</strong></td>
<td></td>
<td></td>
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<tr>
<td>Colorado River</td>
<td>(SNWA and Nellis Air Force Base) 1</td>
<td>276,205 AFY</td>
<td>Yes. Subject to shortage reductions</td>
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<tr>
<td>Nevada Unused Colorado River</td>
<td>(Non-SNWA)</td>
<td>13,938 (2021) to 0 AFY in 2031</td>
<td>Yes. Subject to availability</td>
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<td>Tributary Conservation ICS</td>
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<td>30,690-36,000 AFY</td>
<td>Yes</td>
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<td>Las Vegas Valley Groundwater Rights</td>
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<td>46,961 AFY</td>
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<td><strong>TEMPORARY</strong></td>
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<td>Southern Nevada Groundwater Bank</td>
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<td>345,206 AF (20,000 AFY max.)</td>
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<td>Interstate Bank (Arizona)</td>
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<td>613,846 AF (40,000 AFY max.)</td>
<td>Yes</td>
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<td>Interstate Bank (California)</td>
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<td>330,225 AF (30,000 AFY max.)</td>
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<td>Intentionally Created Surplus</td>
<td>(storage in Lake Mead)</td>
<td>865,741 AF (300,000 AFY max.)</td>
<td>Yes, varies by Lake Mead elevation</td>
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<td><strong>FUTURE</strong></td>
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<td>Colorado River Transfers/Exchanges Permanent Future Supply (Desalination and Colorado River Partnerships)</td>
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<td>20,000-40,000 AFY</td>
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<td>Colorado River Transfers/Exchanges Virgin River/Colorado River Augmentation</td>
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<td>Up to 108,000 AFY</td>
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<td>Garnet and Hidden Valleys Groundwater</td>
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<td>2,200 AFY</td>
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<td>Tikaboo and Three Lakes Valley North and South Groundwater</td>
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<td>10,605 AFY</td>
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### Figure 4.2 SNWA Demand Projection, (AFY)

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<th>2021</th>
<th>2045</th>
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<td>LOWER DEMAND 86 GPCD IN 2035</td>
<td>291,000</td>
<td>301,000</td>
<td>324,000</td>
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<tr>
<td>UPPER DEMAND 86 GPCD IN 2035</td>
<td>294,000</td>
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<td>405,000</td>
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<tr>
<td>UPPER DEMAND 98 GPCD IN 2035</td>
<td>296,000</td>
<td>389,000</td>
<td>434,000</td>
</tr>
</tbody>
</table>
The CBER 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 2021 CBER population forecast through 2060 and trending through 2072. The historical share of Clark County population attributable to the SNWA service area was multiplied by 2020 water-use levels and reduced over time to represent expected achievement of the community’s water conservation goal of 86 GPCD by 2035.

The upper demand projection was developed for planning purposes to reflect increased uncertainties related to possible changes in demands associated with the economy, climate, population and water use variability. It also reflects expected achievement of the community’s water conservation goal of 86 GPCD by 2035.

The upper demand projection represents an approximate 15 percent increase over the lower projection at the midpoint of the planning horizon (2041), increasing to 25 percent in the latter part of the planning horizon (2072). The SNWA also considered one variant of the upper demand projection to illustrate how falling short of the current conservation goal will impact the anticipated timing and need for permanent, temporary and future resources. The projection assumes the community only reduces demands 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 three water supply conditions based on historic Colorado River inflows since 1906 (when record-keeping began) to 2021. While one of the planning scenarios presented in this Plan considers historical average flows for Colorado River supplies (14.7 MAFY inflow), drier hydrology is expected based on current trends and forecasted conditions (see Chapter 2). As a result, the two lower inflow volumes as shown on right provide a more prudent range for planning purposes, with inflows ranging from 12.9 to 11.0 million acre-feet per year (MAFY).

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.

The Interim Guidelines define shortage volumes for Lake Mead elevations between 1,075 and 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 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. In 2021, the U.S. Bureau of Reclamation’s August 24-month study projected Lake Mead’s minimum probable elevation to decline below 1,030 feet. In accordance with the DCP, the Secretary of the Interior and the Lower Basin States are actively engaged in consultation to establish additional plans and actions to protect against Lake Mead declining below an elevation of 1,020 in the next two years and for the remainder of the interim period. Nevada may be required to assume reductions and contributions greater than 30,000 AFY or take reductions sooner than currently called for. This Plan assumes a maximum reduction of 40,000 AFY.

Colorado River modeling performed by the U.S. Bureau of Reclamation in August 2021 projected Lake Mead to fall below an elevation of 1,075 feet by January 1, 2022, resulting in the first-ever shortage declaration by the Secretary of the Interior for 2022. The risk of shortage remains high in subsequent years. Modeling indicates an approximate 91 to 100 percent probability of shortage through 2029 and an 84 to 100 percent probability in the subsequent 10-year period.

SUPPLY AND DEMAND SCENARIOS

Water supply conditions and demand projections are combined into a series of planning scenarios (Figure 4.6 through Figure 4.19) 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 and assumptions about resource availability and use.

The 2021 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, 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.
Figure 4.6 depicts the projected Lake Mead elevation with average inflows of 14.7 MAFY. This hydrology is based on a 50-year sequence of inflows using the period of 1977 to 2019 and 1906 to 1912.

This forecast assumes Lake Mead will decline intermittently over the long-term planning horizon, triggering shortage reductions and DCP contributions from 2022 through 2029. This is followed by a return to normal water supply conditions and recurring shortage after 2049.

Figures 4.7 - 4.9 reflect water resources available to meet projected demands with average inflows of 14.7 MAFY.

As shown in Figure 4.7, permanent resources are sufficient to meet demands through 2072. Permanent future supplies (25,000 AFY) are available in 2032 but not needed under this scenario.

Temporary, permanent future supply and other future resources are not anticipated for use during the planning horizon.
As shown in Figure 4.8, permanent, temporary and future resources are needed to meet demands through 2072. Under this scenario, permanent future supply (25,000 AFY) is available in 2032, with deliveries beginning in 2048. Temporary resources are needed in 2052. Other future resources are not anticipated for use during the planning horizon.

Figure 4.9 illustrates how falling short of the conservation goal impacts the timing and need for temporary and future resources. This scenario assumes upper demands at 98 GPCD by 2035 and 92 GPCD by 2055. Permanent, temporary and future resources are needed to meet water demands through 2072. Permanent future supply (25,000 AFY) is available in 2032, with deliveries beginning in 2036. Temporary resources are needed in 2043. Other future resources are not anticipated for use during the planning horizon.
12.9 MAFY NATURAL FLOW PLANNING SCENARIOS

Figure 4.10 illustrates the projected elevation of Lake Mead with average inflows of 12.9 MAFY. This hydrology was derived from a 25-year period from 1953 to 1977 and repeated twice to form the basis for the 50-year water supply condition.

Under this scenario, Lake Mead consistently falls below 1,050 feet (reaching a low elevation of 931 feet) with intermittent elevations above and below 1,025 feet.

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.

Figures 4.11 – 4.13 reflect water resources available to meet demands with average inflows of 12.9 MAFY.

As shown in Figure 4.11, permanent resources are sufficient to meet demands through 2072. Permanent future supplies (25,000 AFY) are available in 2032 but not needed under this scenario.

Temporary, permanent future supply and other future resources are not anticipated for use during the planning horizon.
As shown in Figure 4.12, permanent, temporary and future resources are needed to meet demands through 2072. Permanent future supply (25,000 AFY) is available in 2032, with deliveries beginning in 2042.

Temporary resources are needed in 2049. Other future resources are needed prior to 2072 (31,000 AFY in 2072).

Figure 4.13 illustrates how falling short of the conservation goal impacts 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. Permanent, temporary and future resources are needed to meet water demands through 2072.

Temporary resources are first needed in 2030, prior to permanent future supply, which is available and needed in 2032. Other future resources are needed prior to 2063 (89,000 AFY in 2072).
Figure 4.14 illustrates the projected elevation of Lake Mead with average inflows of 11.0 MAFY. This hydrology is based on inflows between 1931 and 1980 adjusted to 11.0 MAFY. Under this scenario, Lake Mead falls below elevation 1,050 feet in 2023 and rapidly declines below 1,000 feet in 2025. Lake Mead periodically reaches elevation 895 feet thereafter.

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.

Figures 4.15 – 4.17 reflect the water resources available to meet water demand projections with average inflows of 11.0 MAFY.

As shown in Figure 4.15, permanent resources are sufficient to meet demands through 2072. Permanent future supplies (25,000 AFY) are available in 2032 but not needed under this scenario. Temporary and future resources are not anticipated for use during the planning horizon.
As shown in Figure 4.16, permanent, temporary and future resources are needed to meet demands through 2072. This scenario assumes permanent future supply (25,000 AFY) is available in 2032 and needed in 2039.

Temporary resources are needed in 2046. Other future resources are needed prior to 2070 (31,000 AFY in 2072).

Figure 4.17 illustrates how falling short of the conservation goal impacts 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. Permanent, temporary and future resources are needed to meet water demands through 2072.

Temporary resources are first needed in 2028, prior to permanent future supply (25,000 AFY), which is available and needed in 2032. Other future resources are needed prior to 2055 (89,000 AFY in 2072).
Figures 4.18 and 4.19 illustrate how the availability of future permanent supply impacts the timing and need for temporary resources and other future resources.

As shown in Figure 4.18, permanent, temporary and future resources are needed to meet demands through 2072. This planning scenario considers delayed timing for permanent future supply (25,000 AFY), which is available and needed in 2039.

Temporary resources are needed in 2046. Other future resources are needed prior to 2070 (31,000 AFY in 2072).

Figure 4.19 illustrates how falling short of the conservation goal impacts 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. It also assumes temporary resources are needed in 2028 as a bridge until future permanent supply (25,000 AFY) is available in 2039. Other future resources are needed prior to 2053 (89,000 AFY in 2072).
CHAPTER SUMMARY

Water supply and demand conditions are influenced by several of factors, including economic conditions, water use patterns, conservation progress and climate variability. To account for these variables, the SNWA’s 2021 Plan considers three 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 new water conservation goal of 86 GPCD. They also demonstrate how falling short of the goal could impact water resource timing and need over the planning horizon. Likewise, the scenarios assume that conserved Nevada Colorado River water will continue to be stored for future use when available and that this and other temporary resources will be used to meet demands until future resources are needed and developed. Meanwhile, the SNWA continues to work with its Colorado River partners to explore emerging resource development opportunities, including participation in desalination projects in the U.S. and Mexico, and/or conservation and reuse projects in the state of California.

Colorado River modeling performed by the U.S. Bureau of Reclamation in 2021 projected that Lake Mead will reach an elevation of 1,075 or lower in 2022, triggering the first federal shortage declaration. The risk of shortage remains high in subsequent years. Modeling indicates an approximate 91 to 100 percent probability of shortage through 2029 and an 84 to 100 percent probability in the subsequent 10-year period. Under the Interim Guidelines and DCP, the maximum supply reduction prescribed to Nevada is 30,000 AFY; however, this amount could potentially increase.

The 2021 modeling effort also projected Lake Mead’s minimum probable elevation to decline below 1,030 feet during 2023. In accordance with the DCP, the Secretary of the Interior and the Lower Basin States are actively engaged in consultation to establish additional plans and actions to protect against lake level decline below elevation 1,020 in the next two years and through the remainder of the interim period.

The SNWA is not currently using its full Colorado River allocation, and near-term shortage declarations are not anticipated to impact current customer use. However, a return to normal or near-normal hydrology is unlikely to occur during the long-term planning horizon, and the probability of shortage is high. Meanwhile, local water demands are projected to increase.

Meeting long-term projected demands will require the SNWA to make significant and sustained progress toward its conservation goal. As demonstrated in the planning scenarios, lower levels of conservation achievement will impact the timing and need of temporary and future resources.

The 2021 Plan demonstrates the importance of conservation in extending the availability of Colorado River resources, minimizing the use of temporary resources, and delaying the timing and need for future resources. With ongoing community support and through adaptive use of its Water Resource Portfolio, the SNWA is prepared to meet the range of projected demands and water supply conditions presented in this plan.

Subject to necessary authorizations and ongoing conservation progress, the amount of resources available for use as described in the SNWA Water Resource Portfolio is sufficient to meet the range of projected demands through the planning horizon. Maintaining this portfolio provides flexibility and enables the SNWA to use an appropriate mix of resources as needed to meet demands. Through this and other adaptive management strategies, the 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 evaluate conservation progress and take steps necessary to achieve established conservation goals;
- 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;
• 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 and need when determining priority of resources for use;

• Support ongoing efforts to increase the elevation of Lake Mead and preserve system operations; and

• Work proactively with other Colorado River water users to explore emerging future resource options of mutual benefit.

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 2021 CRSS results, applying historical Colorado River flows, provided by U.S. Bureau of Reclamation to Southern Nevada Water Authority, August, 2021.

2 The water supply operating condition for 2021 applied the observed Lake Mead elevation for December 31, 2020. The water operating condition for 2022 corresponds with the projected Lake Mead elevation from the August 2021 24-Month Study for December 31, 2021.
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, the SNWA adheres to strict environmental laws and regulations that govern its use and development of resources and facilities. These include the Endangered Species Act (ESA), 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, the 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, the 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, the 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. 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. The 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 threatened 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 the SNWA’s interests in protecting water deliveries, downstream water quality and the threatened 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*), 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, the SNWA purchased the former 1,220-acre “Warm Springs Ranch,” using funding secured under the Southern Nevada Public Land Management Act. Working with federal, state and local stakeholders, the SNWA completed a Stewardship Plan for the Warm Springs Natural Area in 2011. 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, the 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. For more information, including hours of operation for public exploration, 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,
In 1998 at the request of its citizens advisory committee, the 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 more than 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 planned erosion control structures or weirs.
- Stabilized more than 13 miles of the Wash’s banks.
- Removed more than 565 acres of non-native tamarisk.

**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 (\textit{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 2 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, the 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.\(^5\)

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- Completed construction of 21 planned erosion control structures or weirs.
- Stabilized more than 13 miles of the Wash’s banks.
- Removed more than 565 acres of non-native tamarisk.

**Mature Vegetation Along the Wash**
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 of 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 Landscapes program has averted more than 41,000 metric tons of carbon dioxide discharge (more than 90 million pounds) through avoided water pumping, treatment and transmission activities. That is equivalent to taking 8,900 cars off the road every year. On an annual basis, program participants reduce our carbon dioxide footprint by 700 metric tons.

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.
As one of the state’s largest energy users, 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 on track to achieve 24 percent renewable energy by 2021 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 160 million kilowatt hours of clean energy, enough to power nearly 12,000 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

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.
APPENDIX 1

CLARK COUNTY POPULATION FORECAST AND ASSUMPTIONS USED IN 2021 WATER RESOURCE PLAN DEMAND PROJECTIONS

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Endnotes:


2. Adjusted “Population Forecasts: Long-Term Projections for Clark County, Nevada 2020–2060,” June 2021, Center for Business and Economic Research at the University of Nevada, Las Vegas (projected through 2072 with a 15 percent increase by 2041 and a 25 percent increase by 2072).
## APPENDIX 2

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APPENDIX 3

IRPAC 2020 RECOMMENDATIONS

The SNWA Board of Directors established the 11-member Integrated Resource Planning Advisory Committee (IRPAC 2020) in 2019 to evaluate and develop recommendations on various issues critical to the SNWA’s mission. As detailed below, the committee’s deliberations resulted in 22 recommendations that were accepted by the SNWA Board of Directors in September 2020. Major topics include water resources, water conservation, facilities and rates.

GENERAL RECOMMENDATIONS
1. Work with community stakeholders to implement IRPAC recommendations.

MCCP AND FACILITIES
2. Maintain current asset management funding levels and practices to ensure reliable water treatment and transmission in Southern Nevada.
3. Pursue projects to meet Nevada’s Renewable Portfolio Standard.
4. Include the candidate projects presented to IRPAC 2020, totaling $3.166 billion, in the SNWA’s Major Construction and Capital Plan (MCCP).

WATER RESOURCES
5. Pursue emerging water resource opportunities with Colorado River partners to increase Nevada’s water supplies, as presented to IRPAC on December 18, 2019.
6. Require out-of-valley development to return wastewater to Lake Mead and embed the principles of the SNWA’s Out-of-Valley Water Use Policy within municipal codes and Las Vegas Valley Water District (LVVWD) Service Rules.

CONSERVATION
7. Pursue changes necessary to achieve the SNWA’s current water conservation goal of a minimum of 105 GPCD by 2035 and further efforts to achieve additional conservation thereafter.
8. Reduce existing non-functional turf acreage by 50 percent by 2035.
9. Embed the principles of the SNWA’s Non-Functional Turf Resolution in municipal codes and LVVWD Service Rules.
10. Limit future installations of cool-season turf in public spaces and expedite the conversion of cool season turf to warm-season turf at existing public facilities.
11. Implement smart controller technology to automate landscape watering compliance and increase outreach and enforcement efforts.
12. Pursue implementation of advanced metering infrastructure and develop partnerships and programs to improve the speed of customer leak repairs.
13. Evaluate changes necessary to reduce current and future consumptive water losses associated with evaporative cooling technology.

14. Establish an efficiency review policy and process for new large water users to encourage efficient development and disincentivize consumptive use.

15. Continue to make investments that will maintain or improve the existing water loss rates among wholesale and retail water purveyors.

16. Continue outreach efforts to engage the public and effectuate the changes needed to meet the community’s regional conservation goal.

**FUNDING**

17. Fund the MCCP with a combination of debt capital and pay-go to manage unrestricted reserve balances at adequate levels consistent with the Reserve Policy.

18. Implement a six-year annual increase to SNWA charges effective January 2022 to: 1) Phase-in an inflationary catch up, and 2) Adjust for subsequent annual inflation within the six-year period: – Increase the Connection Charge by 9.5% annually for six years effective Mar. 2022 – Increase the Infrastructure Charge by 4.6% annually for six years effective Jan. 2022 – Increase the Commodity Charge by 4.8% annually for six years effective Jan. 2022.

19. Implement an indexed rate component to the SNWA Infrastructure and Commodity charges annually, effective January 2028, and limit future increases to a floor of 1.5% and a ceiling of 4.5% each year. – Infrastructure Charge in accordance with Engineering News Record (ENR) index – Commodity Charge in accordance with the Consumer Price Index (CPI) Do not implement inflationary increases in a year in which the five-year forecast unrestricted reserve balance is projected to be greater than 150% of targeted reserve balances.

20. Implement an indexed rate component to the SNWA Connection Charge annually in accordance with the ENR index, effective March 2028.

21. Eliminate the $16.1 million Connection Charge threshold, require SNWA Connection Charge revenues to fund the pay-go portion of capital expenditures and related debt service, and exclude from funding recurring operating expenses.

22. Provide IRPAC 2020 with an annual update of the funding model and convene the committee as necessary.
APPENDIX 4

WATER SUPPLY 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. 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 for the period of record at that time 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 include one water supply condition within range of the average observed natural flows and two below the range of average observed natural flow. The water supply conditions are more closely aligned with Downscaled GCM projections, as two of the modeled water supply conditions are within the mid-range of the Downscaled GCM projections and one below of the range of the Downscaled GCM projections.

ENDNOTES


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.
APPENDIX 5

VOLUME BY STATE AND COUNTRY

The following table summarizes shortages, delivery reductions, DCP contributions and other water savings by volume under the 2007 Interim Guidelines, Minute 323, Lower Basin DCP and the Binational Water Scarcity Contingency Plan. Participants include Arizona (AZ), Nevada (NV), California (CA) and Mexico (MX). Volumes are represented in thousands of acre-feet (kaf).

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<tr>
<th>Lake Mead Elevation (ft. above mean sea level)</th>
<th>2007 Interim Guidelines Shortages</th>
<th>Minute 323 Delivery Reductions</th>
<th>Total Combined Reductions</th>
<th>DCP Water Savings Contributions</th>
<th>Binational Water Scarcity Contingency Plan Savings</th>
<th>Combined Volumes by States and Country</th>
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