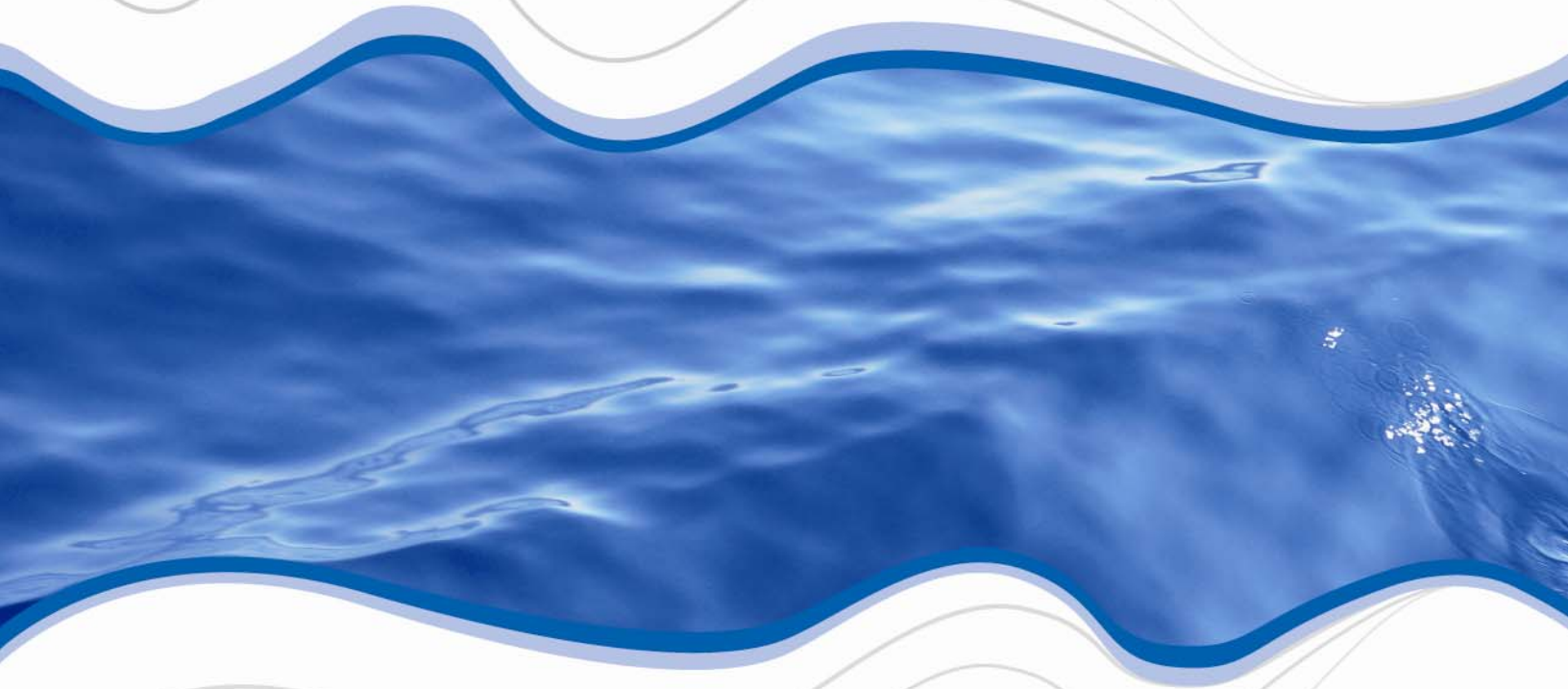
Appendix A

Water Resources Plan 09
Southern Nevada Water Authority



Water Resource Plan 09

SOUTHERN NEVADA WATER AUTHORITY

Southern Nevada Water Authority

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Executive Summary

The Southern Nevada Water Authority (SNWA) was formed in 1991 by a cooperative agreement among the following agencies in Southern Nevada:

- 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

Together, these seven agencies provide water and wastewater service to nearly 2 million residents in the cities of Boulder City, Henderson, Las Vegas and 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. Since its inception, the SNWA has worked to seek new water resources for Southern Nevada, manage existing and future water resources, construct and manage regional water facilities and promote conservation.

The SNWA prepared its first Water Resource Plan in 1996. Since then, the plan has been reviewed annually and updated as needed. The 2009 plan represents the eighth revision in 13 years. This plan provides a comprehensive overview of water resources and demands in Southern Nevada, including a history of water resources and demands in the region; an overview of the SNWA water resource portfolio; and the SNWA's approach to demand forecasting, demand management and meeting long-term resource needs, including during times of declared shortages. The plan also includes a discussion on environmental issues that will influence future resource planning in Nevada and the Colorado River Basin.

An underlying principle of the 2009 Water Resource Plan is to maximize the use of existing resources, while maintaining the flexibility to adjust planning as circumstances or conditions warrant. This approach has proved increasingly valuable as the SNWA continues to work to address unprecedented drought conditions along the Colorado River, evolving demand-forecasting scenarios, and local economic conditions.

The SNWA has worked diligently over the last decade to enhance regional conservation efforts, secure additional in-state resources, enhance the flexibility of Colorado River management, and respond to severe and sustained drought conditions in the region. The following provides an overview of recent developments that continue to influence water-planning efforts in Southern Nevada.

DROUGHT

The SNWA continues to respond to ongoing drought conditions in the Colorado River Basin. Between 1999 and 2008, the average annual inflow to the system was 66 percent of normal. As a result, the combined storage of Lake Mead and Lake Powell – the two primary reservoirs in the Colorado River system – was 52 percent of the total combined capacity in early 2009.

For the SNWA, there are two primary consequences of continued declines in Lake Mead water levels:

possible reduction of available Colorado River supplies and operating challenges associated with water intake facilities at Lake Mead. Drought conditions have required the SNWA to enact contingency plans for Lake Mead intake facilities and develop a plan for responding to severe and sustained shortage of Colorado River resources.

To this end, the SNWA Board of Directors updated its drought plan in 2009 to outline the SNWA's approach to meeting demands during declared shortages in light of new rules and agreements. The drought plan has been updated to include current conditions and incorporated as a new chapter in the 2009 Water Resource Plan.

The SNWA's new shortage response (Chapter 4) outlines several scenarios to offset drought impacts based on the severity of Colorado River conditions. These include the use of Intentionally Created Surplus (ICS), banked resources, shortage-sharing agreements and heightened conservation measures, and development of in-state groundwater resources. SNWA also continues to work with the other Colorado River Basin states to identify and explore options for long-term augmentation of Colorado River resources.

WATER CONSERVATION

Conservation is a long-standing component of the SNWA's water resource portfolio. Conservation will significantly lower projected demands during the 50-year planning horizon.

Building upon the success of its previous efforts, the SNWA Board of Directors in 2009 adopted a new conservation goal of 199 gallons per capita per day (GPCD) by 2035. Achieving this goal will reduce overall use by more than 50 GPCD and save the community approximately 276,000 acre-feet of water per year by the year 2035.

Based on the recommendation of a 2005 citizen advisory committee, the SNWA also is working with its member agencies to make major temporary drought-response measures permanent. These include, but are not limited to, landscape-development codes, assigned-watering schedules and golf course water budgets. The SNWA continues to maintain a broad mix of education and incentive programs, which is discussed further in Chapter 2.

COLORADO RIVER RESOURCES

The SNWA is actively engaged with the other Colorado River Basin states regarding Colorado River management and development guidelines.

In response to severe Colorado River Basin drought conditions, the Secretary of the Interior (Secretary), in cooperation with the seven basin states, initiated a process in 2005 to explore management options for lakes Mead and Powell. These efforts resulted in the Secretary's 2007 Record of Decision for Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead (Interim Guidelines).

Since that time, the SNWA has worked to maximize use of Colorado River resources, including development of Intentionally Created Surplus (ICS). To this end, the SNWA partnered with California and Arizona on funding for the Drop 2 Storage Reservoir to capture U.S. Colorado River water that would otherwise go unused in the lower basin and pass into Mexico, and began utilizing pre-compact water rights from the Muddy and Virgin rivers for use in meeting regional demands. The latter represents the first "new" permanent water supply put to use in the region since large-scale diversions of Colorado River water began in the 1950s.

IN-STATE DEVELOPMENT

In light of ongoing drought conditions in the Colorado River Basin, the SNWA continues to work through the necessary state and environmental permitting processes to develop in-state, non-Colorado River resources.

The 2009 Water Resource Plan assumes the development of 134,000 acre-feet per year (AFY) of in-state groundwater based on current permits and outstanding applications. Under normal hydrological

conditions, the SNWA is planning for use of this resource in 2020 (Figure 1); however, these resources may be needed sooner if drought conditions persist or intensify.

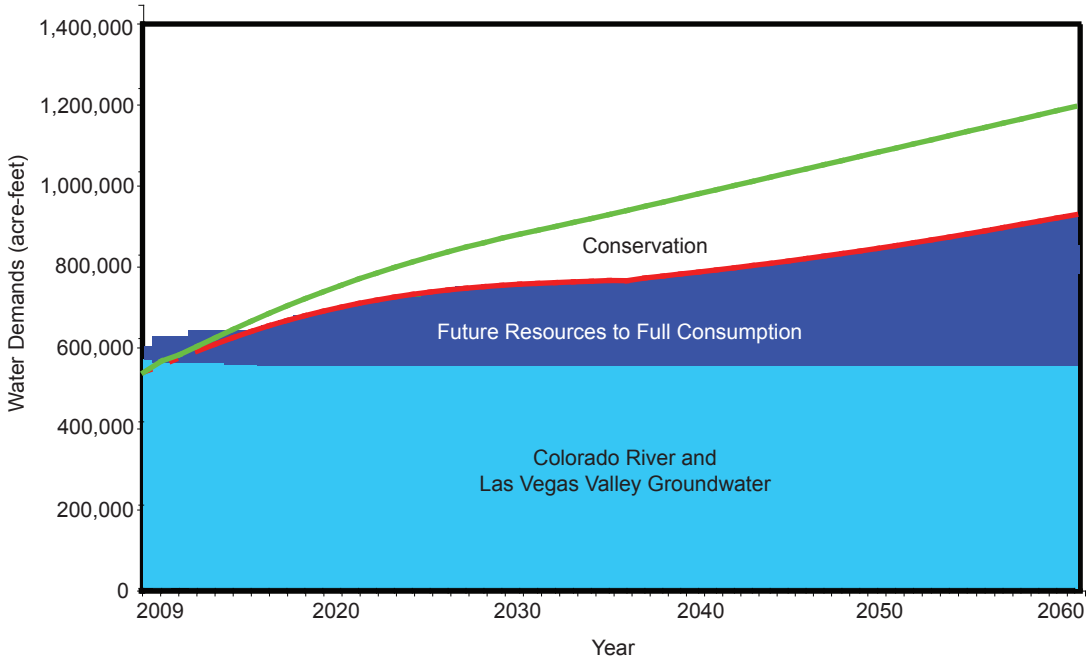
The SNWA depends on the Colorado River for 90 percent of its water-resource needs. Based on Colorado River hydrology and permitted uses, a long-term, non-Colorado River supply is needed to meet demands and provide protection for current and future drought.

DEMAND FORECAST

Several factors affect the timing of when and how resources are brought on-line, including growth, drought, cost and environmental permitting. Having a portfolio of resource options gives the SNWA enough flexibility to shift some resources if any of its other resources prove insufficient or unavailable over the long-term.

The current economic downturn affecting local, national and even global economies has presented unique challenges to planners as to when the local economic condition will recover and what future growth rates will occur. As a result, the 2009 Water Resource Plan reflects planning adjustments taken by the SNWA in response to latest conditions. Figure 1 displays the projected demands, the amount of conservation projected to be achieved and the additional resources needed to meet future demands through 2060.

FIGURE 1 – Summary of Projected Water Demands and Water Resources



CHAPTER 1

A Brief History of Water in Southern Nevada

This chapter provides an overview of milestones and events that have shaped water management issues in the Southern Nevada region during the past century. An awareness and general appreciation of this history is necessary to understand the context in which the SNWA and its member agencies presently manage Southern Nevada's water future.

The chapter is divided into four sections – Introduction, History (1905 to 1945), History (1945 to 1990) and History (1990 to present) – each of which focuses on water demands and the resources that were used to meet those demands. This sets the stage for discussion of the SNWA water resource portfolio in Chapter 2, how SNWA plans to meet future demands in Chapter 3 and how the SNWA will meet demands during shortages in Chapter 4. Chapter 5 discusses the environmental planning and compliance activities relating to SNWA water resource planning and development.

INTRODUCTION

The history of Southern Nevada is inextricably tied to water. 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 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. Over the next century, a series of social and economic developments – including legalized gaming, the construction of Hoover Dam, industrial production for the Second World War, atomic testing, tourism and the advent of the modern mega-resort – would steadily increase local populations and associated demands for water. These increases in population and water demand were often large and unanticipated, particularly in the latter half of the 20th century. As the following sections illustrate, long-term growth forecasts, and consequently water demands, have routinely not kept pace with the actual march of history in Southern Nevada. Forecasting is an effective and necessary tool for planning, but its accuracy over long periods of massive social and economic change (such as that experienced in the Las Vegas Valley) reflects, at best, only an educated guess. Typically, short-term forecasts are more accurate because they are based on the recent past. However, the current economic downturn affecting local, national and even global economies has presented unique challenges to planners as to when the economy will recover and what future growth rates will occur. This inherent uncertainty in forecasting is a routine challenge faced by local planners, one that will continue into the future. Water planning in present-day Southern Nevada is best understood with this in mind, and in the context of past and current events and the various constraints these events impose over time on contemporary resource management.

HISTORY (1905 to 1945)

From the beginning, the Las Vegas Valley was favored by immigrants, wayfarers and the railroad because of its artesian springs. 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 moving local spring water. By 1913, a little more than 3,000 people resided in Clark County and there were approximately 100 groundwater wells in the Las Vegas Valley. In these early years and lasting for the next several decades,

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. By the mid-1920s, the population of Las Vegas would reach about 5,000.[1]

In 1922, the Colorado River Compact defined the geographic areas of the upper and lower basins of the Colorado River. It also apportioned 7.5 million acre-feet per year (AFY) to the upper basin and the same amount to the lower basin, in which Nevada is located (Figure 2). Of the lower basin's 7.5 million AFY, the 1928 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 a more than reasonable amount of water – Southern Nevada had no significant agricultural or industrial users, groundwater seemed plentiful and no one foresaw the changes that would occur.[2]

FIGURE 2 – Colorado River Basin and States

Although the United States suffered economically during the Depression in the 1930s, Southern Nevada flourished. Construction of Hoover Dam attracted thousands of workers to the area, resulting in the establishment of a camp that soon incorporated as the City of Boulder City. The region's first use of Colorado River water occurred when a small water line was built from Hoover Dam to supply water to the many construction workers living in the camp. The dam was completed in 1936 and turned over to the Bureau of Reclamation for operation. The creation of Hoover Dam eventually produced Lake Mead, the largest reservoir on the Colorado River and Nevada's source for its Colorado River allocation.[3]

While the Colorado River Compact and Hoover Dam made Colorado River water a viable future resource for Southern Nevada, the lack of infrastructure and sufficient funding for capital improvements precluded any immediate use. At this time, groundwater was still considered the basic water resource for the area. By 1940, groundwater use had reached almost 20,000 AFY and local resource managers began expressing concerns about limited water supplies, water waste and declining water levels. Their initial attempts to manage local water demands more effectively – for example, efforts to repeal a statutory ban on water meters – were not successful.[4]

With the advent of American involvement in the Second World War, several factors converged to accelerate Southern Nevada growth rates and water demands. In 1941, the City of Las Vegas and the Army Air Force signed an agreement for the establishment of the Las Vegas Aerial Gunnery School. To supply specialized materials for the war effort, construction began in the southeastern Las Vegas Valley on a vast industrial complex later known as Basic Management Inc. (BMI). The complex was granted access to Colorado River water and a small pipeline was built to deliver the water from Lake Mead. That same year, Thomas Hull, a Southern California hotel and motel owner, opened the El Rancho Vegas – the start of Southern Nevada's modern resort industry. This confluence of events significantly heightened interest in the area, attracted more businesses and residents, and led to rapid increases in demands for water.[5] It also marked the beginning of resource and forecasting challenges that continue to this day.

HISTORY (1945 to 1990)

Following the end of the Second World War, population growth continued to accelerate in the southwestern United States, particularly in Southern Nevada. In 1947, the Nevada Legislature created the Las Vegas Valley Water District (LVVWD). Over the next seven years, the LVVWD would acquire the assets of the Las Vegas Land and Water Company to become the municipal water purveyor for Las Vegas and unincorporated Clark County.[6]

By 1950, Southern Nevada's population was more than 40,000, groundwater use was almost 35,000 AFY in the Las Vegas Valley, and the BMI complex diverted about 15,000 acre-feet of Colorado River water annually. Planners forecasted that the area's population would not exceed 100,000 until the end of the century. The City of North Las Vegas was incorporated in 1946 and the City of Henderson in 1953. By the mid-1950s, the LVVWD had entered into agreements with BMI to expand the BMI water line. This effort resulted in the first delivery of Colorado River water into the valley to serve residences and businesses.

At this time, the region still relied significantly on groundwater – the LVVWD owned and operated 13 wells out of approximately 500 to 1,000 wells in the Las Vegas Valley. Planners no longer expected this reliance on groundwater to continue indefinitely. Consequently, the initial delivery of Colorado River water into the community – and the prospect of additional deliveries in the future – resulted in a short-term planning decision with long-term implications for overall resource management.

The Nevada Division of Water Resources (also known as the State Engineer), which is the state agency responsible for managing all non-Colorado River surface water, groundwater and well permits in Nevada, began to issue temporary permits for the Las Vegas Valley in 1955. A temporary permit allowed the permit-holder to pump groundwater, but with the understanding that the state would revoke the right if or when Colorado River water was available to the property.[7]

The decision had two far-reaching effects. First, it created a separate class of water rights ("revocable" water rights) that had to be co-managed with permanent water rights in the Las Vegas Valley. Second, it resulted in the issuance of pumping rights in excess of the perennial yield of the groundwater basin. Essentially, the idea was to over-pump the basin in the near term to meet increasing demands, but eventually to shift that excess use (represented by the temporary permits) to Colorado River water and return groundwater pumping to sustainable levels. In conjunction with the state decision, the LVVWD instituted water metering. Beginning in 1955, meters were installed for any new construction connecting to the LVVWD's distribution system.[8]

Changes also were made in the management of local wastewater. In 1954, the Clark County Sanitation District (now the Clark County Water Reclamation District) was created; the new district began treating county wastewater flows two years later. By 1957, the City of Las Vegas had installed a new sewer system and relocated its wastewater-treatment plant. The local wastewater facilities discharged their treated flows to the Las Vegas Wash, which until then was predominantly an ephemeral stream that ran into the Las Vegas Bay portion of Lake Mead.[9]

By 1960, the local population was just under 120,000, surpassing the forecast made only 10 years earlier for the year 2000. Land use in the Las Vegas Valley had almost doubled and groundwater use was just under 50,000 AFY. The BMI complex, City of Henderson and the LVVWD were receiving about 18,000 acre-feet of Colorado River water each year. Planners estimated that existing water supplies would be fully used in the next 10 years, at most.

Given the astonishing pace of growth and existing limits to the BMI pipeline, the LVVWD began formal engineering studies for new facilities to import additional Colorado River water into the Las Vegas Valley. The Colorado River Commission of Nevada and local leaders spent several years negotiating with the federal government for loans to pay for the work. After funding was approved in 1967, construction

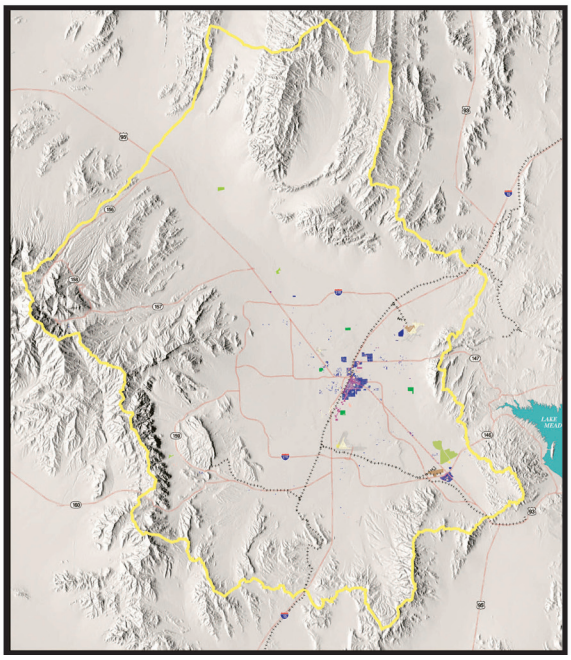
began in 1968 on the Southern Nevada Water System.[10] The project would prove timely. By 1970, population in the Las Vegas Valley had more than doubled to 263,000. Groundwater use had reached about 86,000 AFY and almost 35,000 acre-feet of Colorado River water was being imported annually through the BMI water line.

In 1971, the first stage of the Southern Nevada Water System was complete. It consisted of intake facilities and the Alfred Merritt Smith Water Treatment Facility at Lake Mead, eight pumping stations, a pipeline to Boulder City, a four-mile-long tunnel through the River Mountains and about 34 miles of major pipelines to deliver treated water into the Las Vegas Valley. The first stage provided a maximum capacity of 200 million gallons per day (MGD), and plans were underway for a second stage that would increase this to 400 MGD. It was now forecasted that available Colorado River water would meet local needs beyond 2020. Population for 2000 was forecasted to be 585,000.

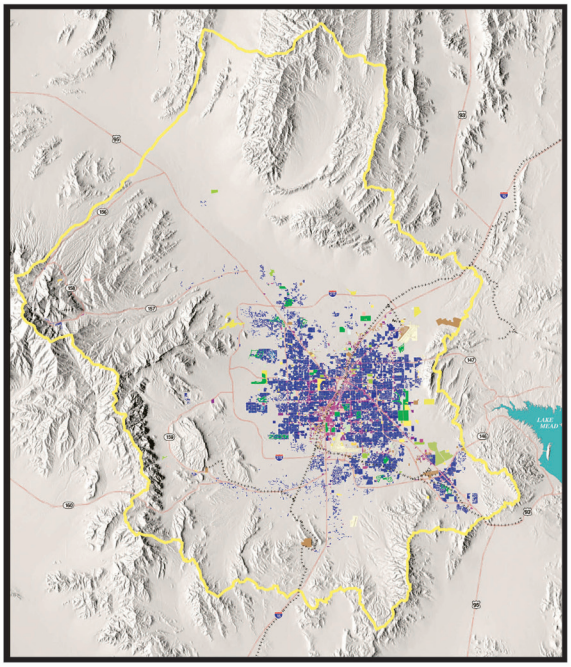
Over the next 20 years, population growth would increase almost threefold, surpassing the 2000 forecast of 1970 by almost 30 percent with many years yet to go. By 1982, the second stage of the Southern Nevada Water System was complete. However, water demands had continued to increase so unpredictably – moving up 13 percent from 1987 to 1988, and 14 percent from 1988 to 1989 – that planners estimated the region would reach the limits of its Colorado River apportionment within a few years, rather than in the next 40 or so years as projected in 1970.

As a result of the profound uncertainties created by massive population growth and the prospect of reaching its limits on Colorado River water, the LVVWD filed 148 applications in 1989 for unappropriated water in the counties of Clark, Lincoln, Nye and White Pine. Most of these applications were for rural groundwater with the exception of a few surface water applications on the Virgin River, which runs through northern Clark County into Lake Mead. After the initial filings with the Nevada Division of Water Resources, the LVVWD reviewed each hydrologic basin, eventually withdrawing a number of its applications. As the next section describes, by the mid-1990s, regional water management efforts, including conservation and other initiatives, returned to the Colorado River.

FIGURE 3 – Valley Land Use, 1950 and 1990



Las Vegas Valley Land Use, 1950



Las Vegas Valley Land Use, 1990

HISTORY (1990 to Present)

In 1990, there were almost 750,000 people in the Las Vegas Valley and land use exceeded 71,000 acres, more than 10 times that in 1950 (Figure 3). The 2000 population was forecast at one million residents, and planners estimated the community would reach its limit of Colorado River water sometime in the early years of the next century. Resource challenges at the end of the 1980s had reached a crisis 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. The following subsections discuss the major water management initiatives that were undertaken during this time.

WRMI Process

In 1990, municipal water providers in Southern Nevada began a comprehensive analysis of water resources and facilities. A consulting firm, Water Resource Management Inc., led the project and the effort became known as the "WRMI Process."[11] Population forecasts were provided by the Center for Business and Economic Research at the University of Nevada Las Vegas[12] and a conservation analysis was conducted by Planning and Management Consultants, Limited.[13] The 1991 published results were clear – without serious conservation, Southern Nevada would reach the limit of its existing Colorado River water supply by the mid-1990s; with conservation, the limit could be extended to 2007. The WRMI Process provided the impetus for creation of the SNWA, a study of water-facility expansion, implementation of an ongoing search for new water supplies and a renewed commitment to regional water conservation efforts. In 1991, the community implemented its first major conservation measure in decades – Operation Desert Lawn. The program resulted in ordinances by the local municipalities restricting lawn watering during the hottest times of the day.

Review of Water Commitments

One consequence of the WRMI Process was a temporary cessation of all new water commitments. The LVVWD, as the largest water provider in the Las Vegas Valley, had to ascertain how much water was already committed to new and planned development projects in its service area. To do this, it stopped accepting new applications for water service in February 1991. Upon completion of its analysis, the LVVWD instituted a more formalized water commitment process with the City of Las Vegas and Clark County. Henderson and North Las Vegas also instituted more formal commitment processes. Perhaps more than any other event, it was the temporary cessation of water commitments that awakened the community to the gravity of the water situation. This elevated awareness contributed in large part to the subsequent success of regional water management initiatives.

Creation of the SNWA

One of the most significant outcomes of the WRMI Process was the formation of the SNWA. The SNWA was created in 1991 through a cooperative agreement among the following seven water and wastewater agencies:[14]

- 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 Big Bend Water District provides water service to Laughlin. The cities of Boulder City and Henderson provide water and wastewater service to their respective communities. The City of Las Vegas provides wastewater service to its residents. The City of North Las Vegas provides wastewater service to its residents, and water service to its residents, adjacent portions of Las Vegas and unincorporated Clark County. The City of North Las Vegas will be constructing its own water reclamation facility and currently has contract wastewater treatment services with the City of Las Vegas and the Clark County Water Reclamation District. The Clark County Water Reclamation District provides wastewater service for unincorporated Clark County and Laughlin. The LVVWD provides water service to Las Vegas and

portions of unincorporated Clark County. The SNWA was formed by these seven entities for the purpose of acquiring and managing water resources for Southern Nevada, constructing and managing regional water facilities, and promoting responsible water use.

Integrated Resource Planning

In April 1994, the SNWA began an integrated resource planning process to identify the appropriate combination of resources, facilities and conservation programs to meet future water demands in Southern Nevada. Integrated resource planning brings important concepts to traditional resource and facility planning, including involvement of the public early in the planning process; analysis of both supply-side (resources and facilities) and demand-side (conservation) solutions; consideration of different community goals; and analysis of the trade-offs among different, sometimes conflicting, goals.

Following more than a year of study and public interaction with a stakeholder advisory committee, the SNWA adopted a series of recommendations to guide its future planning efforts (Appendix 2). Principal recommendations related to water resources included:

- Seek permanent, long-term water supplies.
- Formulate a water resources plan that utilizes all available water supplies, including unused Colorado River apportionments, surpluses, leases and other water supplies.
- Place top priority on development of Colorado River water over development of a Virgin River pipeline or water in rural counties.
- Maximize use of the Las Vegas Valley shallow groundwater, when and where practical.

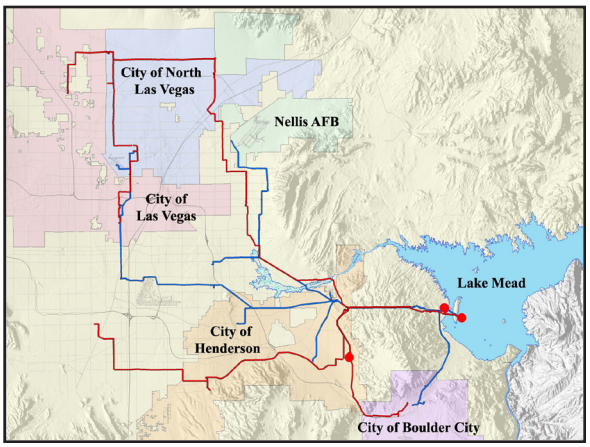
The recommendations also supported the "phasing in" of new regional facilities to meet future water demands.[15] As part of a subsequent planning phase in 1996, recommendations were developed on how to pay for new regional water facilities; specific proposals included a regional connection charge, regional water surcharge and sales tax increase.[16]

Expansion of Regional Facilities

The recommendations of the SNWA integrated resource planning effort supported the expansion of existing water treatment and transmission facilities for the Las Vegas Valley. The SNWA Board of Directors approved the recommendations; design and construction of new infrastructure, including a second intake at Lake Mead and a second water treatment facility (River Mountains Water Treatment Facility) in eastern Henderson, began later that year. The phased expansion increased the treatment capacity of the Southern Nevada Water System to 480 MGD by 1997, 600 MGD by 1999, 750 MGD by 2002, and 900 MGD by 2007.

Additional improvements have included major pipelines and pumping stations in and around the Las Vegas Valley; upgraded communications systems; process improvements at both treatment facilities; upgraded intake pumping capacity; and an emergency bypass pipeline from the second intake to the existing water treatment facility. Today, the Southern Nevada Water System has a treatment and delivery capacity of 900 MGD (Figure 4).

FIGURE 4 – Southern Nevada Water System



Environmental Initiatives

To support its resource planning and facility expansion activities, the SNWA began to participate in a number of environmental initiatives and coalitions in the mid-1990s, taking a proactive and integrated approach to environmental planning with respect to water resource management. The SNWA's commitment to

environmental responsibility typically goes beyond the steps necessary to ensure compliance with applicable regulations or statutes. Efforts have included the support of research and recovery activities related to federally endangered fish and birds, involvement in broader regional programs that address issues such as habitat conservation and water quality, and financial and staff support for environmental research and studies. These environmental planning efforts are discussed in more detail in Chapter 5.

Las Vegas Valley Groundwater Management Program

In conjunction with integrated resource planning and its focus on Colorado River water, the SNWA began working with local well users and the Nevada Division of Water Resources in 1996 to address groundwater management in the Las Vegas Valley. As a result of these efforts, state legislation was passed in 1997 and 1999 implementing a groundwater management program for the Las Vegas Valley hydrographic basin.[17] The Las Vegas Valley Groundwater Management Program (Groundwater Management Program) protects the local groundwater basin from over-drafting and potential sources of contamination. Efforts have included an inventory of all wells in the Las Vegas Valley; a cost-benefit analysis of permanent recharge; increased education of groundwater users; and development of well conversion, landscape conversion, sub-meter assistance and permanent recharge programs to benefit existing and future well users. To pay for these activities, the Nevada legislature authorized the SNWA to assess well users in the Las Vegas Valley hydrographic basin an annual fee.

Water Resource Plans

In 1996, the SNWA Cooperative Agreement was amended to require adoption of a Water Resource Plan. After the first plan was adopted in 1996, the SNWA has reviewed the plan annually, adopting revisions as needed. The 2009 Water Resource Plan represents the eighth revision in 13 years. As reviews and revisions demonstrate, the plan is a dynamic document, intended to reflect changing developments in the water resource picture for Southern Nevada. Since the plan's inception, those developments have come principally from increased water demands, as well as from landmark changes in rules, agreements or other factors affecting the use of Colorado River water (for example, water banking, intentionally created surplus and drought).

In-State Agreements

In the late-1990s, the SNWA and the LVVWD began to work closely with Lincoln, White Pine and Nye counties, as well as other in-state interests to negotiate equitable water-sharing arrangements for available water resources in areas outside the Las Vegas Valley. The various agreements have involved such resources as surface water rights on the Virgin and Muddy rivers, and groundwater rights and applications in Coyote Spring Valley and Lincoln County. These agreements, which are discussed in Chapter 2 in reference to the associated water resources, typify the philosophy that the SNWA brings to the development of in-state water resources. In every instance, the SNWA is open to working closely with counties of origin and local residents to address concerns and identify opportunities for the sharing of resources – not only to meet Southern Nevada's future water needs, but also to help these outlying areas develop the resources needed to meet their own near- and long-term plans for the future.

In-State Water Banking

To maximize the use of Nevada's Colorado River allocation, SNWA member agencies began storing or "banking" water in the Las Vegas Valley in 1987. In Southern Nevada, banking is accomplished by artificially recharging Nevada's unused Colorado River water into the local groundwater aquifer. This provides Southern Nevada with additional resources that can help bridge potential shortfalls in meeting demands while other resources in the SNWA resource portfolio are being developed.

Interstate Agreements

Beginning in the early-1990's and continuing to the present day, the SNWA has worked closely with other basin states to maximize opportunities for the flexible use of Colorado River water, thereby extending available supplies. The following sections highlight the principal achievements to date.

Arizona Water Banking. To develop its storage concepts further, the SNWA participated in a banking demonstration project with Arizona in 1993. Three years later, Arizona dramatically expanded its recharge and banking efforts when the state created and funded the Arizona Water Banking Authority (AWBA). The primary purpose of the AWBA is to ensure all of Arizona's unused Colorado River apportionment is utilized fully for the benefit of Arizona. The 1996 state legislation that created the AWBA also allowed for the creation of an interstate bank to give Nevada and California the opportunity to bank water in Arizona. Federal regulations to facilitate interstate banking were approved by the Secretary of the Interior in 1999 and 2001, allowing Arizona and Nevada to begin formal negotiations for Nevada's participation in Arizona's interstate bank. Shortly thereafter, other agreements were forged to establish, clarify and expand business arrangements for interstate banking efforts in Arizona.

California Water Banking. In October 2004, under existing federal regulations for interstate banking, the SNWA entered into an agreement with the Metropolitan Water District of Southern California (MWD) that allows the SNWA to store a portion of Nevada's unused Colorado River allocation in California for SNWA's future use. Provisions for the recovery of banked resources are discussed in Chapter 2.

Management of Surplus Colorado River Water. In 2001, the Secretary of the Interior implemented a methodology for managing additional supplies in the Colorado River. Interim Surplus Guidelines were established to help the Upper Colorado River Basin states preserve their respective apportionments, while providing time for California to reduce its uses on the Colorado River to its 4.4 million AFY allocation. The Interim Surplus Guidelines also provided the states of Nevada and Arizona with the opportunity to access temporary surplus Colorado River water above their respective basic apportionments for domestic uses through 2016, if there was adequate water storage in Lake Mead.[18]

As a result of worsening drought conditions, the Secretary of the Interior initiated a planning process in 2005 to develop lower basin shortage guidelines and management options for the coordinated operation of lakes Powell and Mead during low reservoir conditions. This planning process resulted in agreements among the seven basin states and a 2007 Record of Decision that modified and extended the 2001 Interim Surplus Guidelines. The process also established new Interim Guidelines for managing shortages, coordinating operations of lakes Mead and Powell, encouraging augmentation and conservation of water supplies in the lower basin. This agreement is discussed in more detail later in this chapter.

Drought

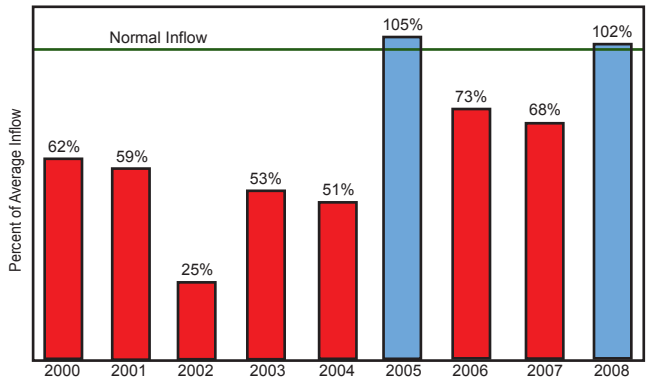
Defining drought can be difficult, since droughts are not distinct climatological events like floods, fires or hurricanes. Instead, numerous factors in the environment interact in complex ways that create conditions where water supplies are not replenished normally. Southern Nevada is dependent on flows from the Colorado River, which in turn are derived from snowmelt and runoff in the Rocky Mountains of the Upper Colorado River Basin. Recent years of below average snow pack in the Colorado Rocky Mountains have resulted in below average runoff to the Colorado River, the source of approximately 90 percent of the water delivered by SNWA and its purveyor members.

In 1999, the Colorado River Basin began to experience drought conditions that, from 2000 to 2004, became the worst five-year drought in the recorded history of the basin. These conditions were aggravated by several years of extremely dry soil conditions, which further reduced total runoff. As a result, water levels in the two primary storage

reservoirs on the Lower Colorado River (Lake Mead and Lake Powell) declined to levels not observed since Lake Powell began filling in the early-1960s. Over the next several years, snowfall and runoff in the basin was well below normal, the worst year (thus far) being 2002, when runoff to Lake Powell was approximately 25 percent of average (Figure 5).[19]

From 1999 to 2004, water levels in Lake Mead and Lake Powell declined by approximately 110 and 80 feet, respectively. These declines reduced the combined water storage in the two reservoirs to 46 percent of capacity.

FIGURE 5 – Lake Powell Annual Inflows[20]



To help offset the impacts of drought, the SNWA and its member agencies conducted a drought planning process in 2002 that resulted in the development of an aggressive plan to lower demands during times of significantly reduced Colorado River inflows. As described later in this chapter and in Chapter 2, this effort has resulted in both interim and permanent changes to how the community uses water.

Except for years 2005 and 2008, when the Colorado River Basin received slightly above-normal runoff (105 percent and 102 percent, respectively), drought conditions in the basin continued to persist. At the end of 2008, the combined storage of Lake Mead and Lake Powell was 52 percent of capacity and Lake Mead water level was about 100 feet lower than that experienced in the late-1990s.

Integrated Water Planning

Several in-state groundwater resources available within Nevada have long been part of the SNWA's water resource portfolio. These resources are available within our state in the form of unused groundwater in Clark, Lincoln and White Pine counties. The LVVWD and SNWA have been working for nearly two decades to secure some of this unused water.

Given persistent drought conditions in the Colorado River Basin, the SNWA began to accelerate the development of these in-state resources in early 2004. At that time, the SNWA Board of Directors approved a concepts document and a work plan for integrated water planning (discussed below) that together provide a framework for development of these in-state resources. Moving some of this unused water to Southern Nevada will increase the reliability of the region's water supply during droughts or future shortages on the Colorado River and also help to meet future demands.

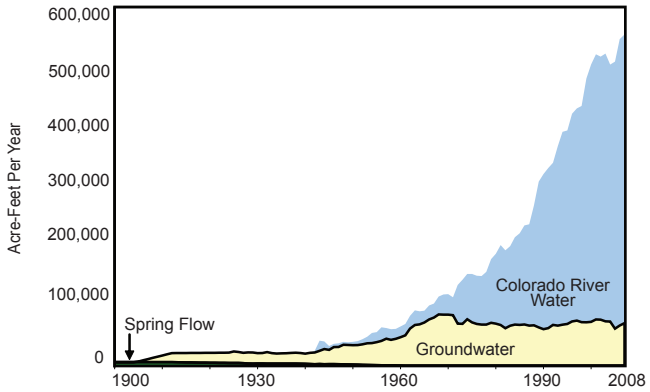
Development of some or all of these in-state water resources has potential implications for a wide range of water resource management and operational issues, as well as environmental and rural economic development issues. To address these questions in a comprehensive manner consistent with the overall resource goals of Southern Nevada, the SNWA initiated an integrated water planning process in early 2004. The purpose of this process was to identify the appropriate combination of in-state resources, facilities and conservation levels needed to provide greater drought protection for Southern Nevada, as well as meet future water demands given SNWA's reliance on Colorado River water (Figure 6). In this respect, the process focused on how best to integrate in-state resources into current SNWA planning and management activities, given the dramatic changes in Colorado River conditions.

Integrated Water Planning Advisory Committee

The SNWA convened an Integrated Water Planning Advisory Committee (IWPAC) to assist in its long-range planning effort. The IWPAC was comprised

of 29 stakeholder representatives. Unlike previous SNWA committees, the IWPAC included not only stakeholder representatives from the metropolitan Las Vegas area, but also representatives from Lincoln, Nye and White Pine counties, as well as the Moapa and Virgin Valley Water Districts. For more than a year, the committee worked with staff to explore various options and scenarios for in-state resource development, building on the previous work done by the Integrated Resource Planning Advisory Committee process of the mid-1990s. In September 2005, the IWPAC finalized 22 recommendations and presented them to the SNWA Board of Directors in November 2005 (Appendix 1).[21]

FIGURE 6 – Water Use by Source, 2008



In an effort to maintain and build upon the success of the community's conservation efforts, the committee recommended that the SNWA and its member agencies pursue more aggressive conservation achievements, including permanent implementation of major drought-related demand reduction tools.

Interim Guidelines and Associated Agreements

In response to severe Colorado River Basin drought conditions, the Secretary of the Interior, in cooperation with the seven basin states, initiated a process in 2005 to explore management options for lakes Mead and Powell. These efforts resulted in the Secretary of the Interior issuing a Record of Decision (ROD) in 2007 for Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead, "Interim Guidelines."[22]

Key elements of the Interim Guidelines include modification and extension of the 2001 Interim Surplus Guidelines, establishing how shortages in the lower basin will be implemented, and the adoption of coordinated operations of lakes Powell and Mead. In addition, the Interim Guidelines define the availability of Colorado River water for use in the lower basin based on the water surface elevation of Lake Mead and create a new type of surplus called Intentionally Created Surplus (ICS). The SNWA has a number of water resources available for use under rules for ICS and other agreements. These resources and provisions for recovery are discussed in detail in Chapter 2.

Intake No. 3

Ongoing drought conditions pose a number of challenges for Southern Nevada, including operational challenges associated with intake facilities at Lake Mead. To help protect Southern Nevada's access to Colorado River resources, the SNWA Board of Directors in 2005 approved the design and construction of a new water intake in Lake Mead.

In addition to preserving supply capacity, Intake No. 3 will provide access to better water quality as Lake Mead water levels decline in times of drought. Construction of Intake No. 3 is currently underway. The project is scheduled to be completed in 2013.

In-State Resource Developments

The SNWA continues to pursue permitting activities associated with development of its Clark, Lincoln and White Pine Counties Groundwater Development Project. Following administrative hearings in 2007 and 2008, the Nevada State Engineer granted the SNWA water rights in Spring, Delamar, Dry Lake and Cave valleys.[23] An administrative hearing for the SNWA's pending applications in Snake Valley is scheduled for 2011.

In conjunction with these water rights processes, the SNWA entered into stipulations with several federal agencies to establish a process for working together to monitor and protect federal resources as the rights are developed and managed.[24] Specific activities include the development of a regional groundwater

flow model; establishment of a regional groundwater monitoring network; the collection and analysis of additional information regarding the relationship between the development of groundwater resources and surface water resources; and the establishment of a technical review panel, biological work group and an executive committee to oversee the implementation of a monitoring, management and mitigation plan.

To more effectively manage water and environmental resources in the project area, the SNWA acquired ranch properties and associated surface and groundwater rights in Spring Valley. These land and water resources were acquired as part of the SNWA's commitment to the adaptive management of the groundwater basins that encompass SNWA's development of water in Clark, Lincoln and White Pine counties. The SNWA does not plan to export any of the acquired surface water resources; instead, the surface water will be used to recharge the basin and help manage and protect the aesthetic and environmental resources in Spring Valley. These surface water resources also will be used to continue ranching and agricultural activities in the area.

Conservation

The SNWA has a long history of setting and achieving water conservation goals to promote water efficiency and extend the availability of limited resources. To build upon this success and to induce additional water savings, the SNWA adopted a new, more aggressive, conservation goal in 2009.

To achieve its new goal of 199 gallons per capita per day (GPCD) by 2035, the SNWA's member agencies began working together to permanently implement previously approved major demand reduction tools such as landscape development codes, turf restrictions and golf course water budgets as part of the community's overall conservation effort. Further discussion is provided in Chapter 2.

The combined effect of Southern Nevada's conservation response and changing water use patterns have resulted in a reduction of consumptive use by approximately 21 billion gallons annually between 2002 and 2008, despite the addition of more than 400,000 residents during that time. A small portion of the reduction is likely due to the economic down-turn.

Climate Change

The onset of drought in the Colorado River has heightened attention to the broader issue of climate change, both within the Colorado River Basin and beyond. The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods."[25] Climate change impacts on the Colorado River and the American Southwest are expected to be significant. The majority of regional climate models project a more arid climate and reductions in Colorado River runoff in the future.[26] These reductions are expected to be in addition to natural-flow variabilities and temporary drought conditions.

In an effort to begin a dialogue on future impacts of climate change for water management, the SNWA partnered with the Natural Resources Defense Council and the Desert Research Institute to host the Urban Water Supplies and Climate Change in the West Conference in September 2005.[27] Since then, the SNWA has worked collaboratively with water utilities across the country to raise awareness of the impacts that climate change will have on municipal water agencies and regional water management.

In 2008, the SNWA partnered with some of the nation's largest water agencies to form the Water Utility Climate Alliance (WUCA).[28] This group works to improve research related to the impacts of climate change on water utilities; develop strategies for adapting to climate change; and implement tactics to reduce their greenhouse gas emissions. Through ongoing collaboration, the SNWA will continue to support research and track potential influences of climate change and increased hydrologic variability.

CONCLUSION

By the end of the 20th Century, the Las Vegas economy had reinvented itself with new mega-resorts and a southwestern lifestyle that continues to attract people from around the world. By 2008, Southern Nevada's population had increased to nearly 2 million people, most of whom reside in the Las Vegas Valley (Figure 7).

From 1910 through 2000, the annual population growth in Southern Nevada averaged 7 percent per year, whereas growth in the United States over the same period has averaged about 1 percent (Figure 8).

Along with the rest of the nation, the Las Vegas Valley has been impacted by recent economic conditions. This has resulted in a near-term leveling of population growth. It is difficult to predict when these conditions will improve, but most forecasts agree that this trend is temporary. To this end, water managers and local planners must continue to take the steps necessary to ensure community water resources are available when needed. Current drought conditions in the Colorado River Basin and climate change predictions emphasize the need for continued assessment of resources, regardless of actual population trends. Current conditions require Southern Nevada to reduce its heavy reliance on Colorado River water and develop more of the non-Colorado River resources contained in its water resource portfolio. Existing in-state resources and other alternatives must be developed to bridge and supplement Nevada's Colorado River resources and provide a sustainable and diverse mix of water resources for the long-term.

In many respects, the challenges of the future of Southern Nevada are not dissimilar to the challenges of its past. Regardless of these challenges, the SNWA and its member agencies will continue to work diligently to anticipate, manage and meet the future water demands of the region. As described in Chapter 2, the SNWA has an extensive portfolio of existing and developing resources. The challenge will remain one of balancing the timing, development and use of these specific resource options.

The dynamic nature of water forecasting is among the key reasons the SNWA reviews its resource plan annually and makes adjustments as needed.

FIGURE 7 – Clark County Population, 2008

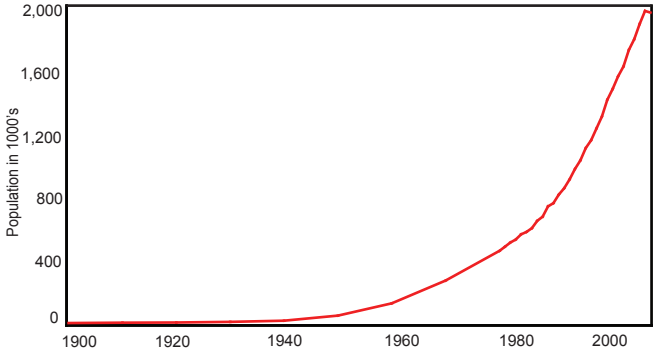
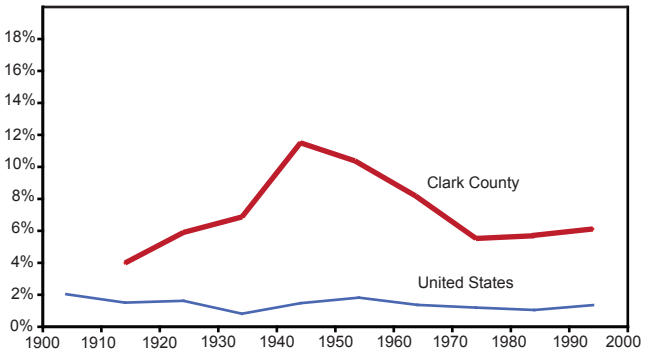


FIGURE 8 – Annual Change in Population



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CHAPTER 2

The SNWA Water Resource Portfolio

Since 1991, the SNWA has worked to develop and manage a flexible portfolio of diverse water resource options. This approach is commonly used in the field of resource planning and is essential in responding to future conditions that may result from drought or other forms of shortage.

The portfolio approach allows the SNWA to assess its overall resource options and make appropriate decisions regarding what to bring on-line when necessary. In determining the priority of resources, some of the factors considered include reliability, availability, accessibility, cost and need. As a result, the SNWA Water Resource Plan is reviewed annually and updated as needed to reflect changing conditions and developments in Southern Nevada's resource picture.

The 2009 Water Resource Plan includes conservation, Colorado River water, groundwater resources and augmentation in its portfolio of current and future resources that will be used to meet demands as needed. This chapter describes each of the water resources available to Southern Nevada over the planning horizon. It is important to note that while most resources are currently quantified, such as Nevada's Colorado River allocation, others are still being assessed, developed or are pending action by the state.

The development of some of the future resources discussed below depends on a number of factors, such as rulings by the Nevada State Engineer, interpretations of Colorado River law, negotiations with other users, and need. Consistent with its approach to capital improvements planning, the SNWA considers phasing when assessing the timing and use of resources. By securing future water resources, obtaining appropriate state and federal permitting and building infrastructure in advance of when they are needed, the SNWA retains the ability to adapt to changing demand and supply conditions. The resources currently available or under development to meet Southern Nevada's demands are described in the following sections.

CONSERVATION

Promoting the efficient use of water is central to the mission of the SNWA. The ability to increase efficient water use and reduce water waste wherever possible has a direct impact on the amount of resources that will be needed in the future. Conservation is a resource, but it is fundamentally different from other resources available in the SNWA portfolio. Unlike typical "wet" resources, which are acquired to meet demands, conservation is a tool that is used to reduce overall demands (relative to levels that would have occurred in the absence of conservation) and extend supplies. The more successful a community's conservation achievement becomes, the lower the community's overall demand for water and the more efficient its use of existing supplies.

However, the more aggressive and responsive a community is to calls for increased conservation, the more difficult it becomes to realize additional conservation gains. This phenomenon of diminishing returns is referred to as "demand hardening." For growing communities where a majority of the water supply comes from one source (such as Southern Nevada), the prospect of demand hardening requires development of additional alternative water supplies regardless of conservation levels achieved. The SNWA is pursuing such resource development as described

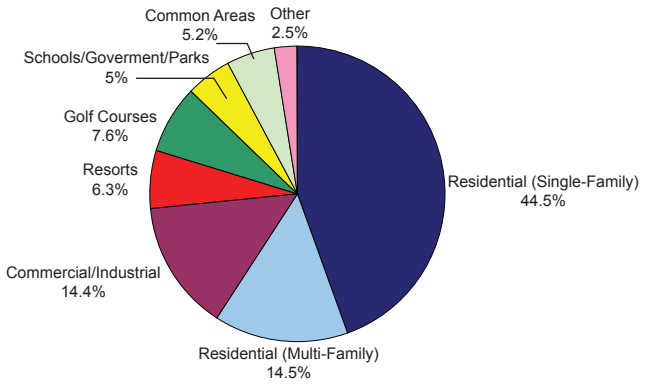
later in this plan. Conservation and the remaining elements of the SNWA water resource portfolio are described further in this chapter.

Conservation in Southern Nevada

Since its creation in 1991, the SNWA has implemented a number of conservation programs focused on reducing water use throughout the community. While the SNWA actively promotes indoor conservation, in Southern Nevada the greatest opportunity for water conservation lies in curbing outdoor water use.

According to consolidated data provided by SNWA member agencies, residents account for approximately 59 percent of water use (Figure 9). Most of that water is used consumptively for outdoor landscaping. While business and commercial customers account for a substantially smaller portion of the community's overall water use, the SNWA continues to work with all customer classes to identify opportunities for increased conservation.

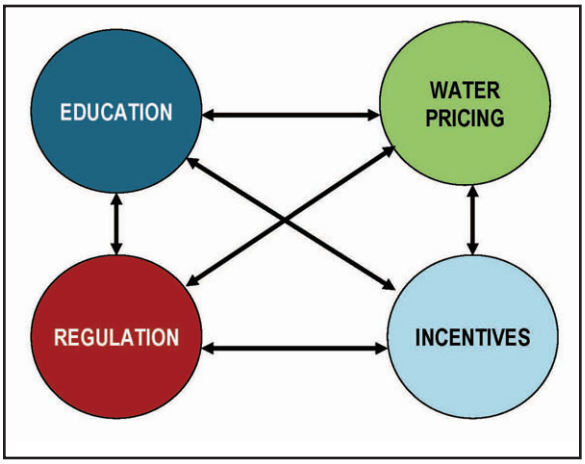
FIGURE 9 – Municipal Metered Water Use, 2007



CONSERVATION TOOLS

The SNWA and its member agencies utilize a variety of tools to promote conservation and reduce overall water use. These include a combination of regulation, water pricing, incentives and education to elicit the necessary community response to reduce demands (Figure 10). Because the biggest potential for water savings comes from reductions in consumptive water demands, primarily in the form of outdoor water uses such as landscape irrigation, the major conservation tools are designed to achieve results in these areas. Each conservation tool is related to the community's total conservation effort – used in concert, these tools maximize the water conservation potential in the community. The following sections describe the major conservation initiatives used by the SNWA and its member agencies.

FIGURE 10 – Demand Management Tools



Regulation

During the past 18 years, city and county governments have adopted a variety of land use codes and water use ordinances to promote more efficient use of water resources in Southern Nevada. In 1991, local government agencies adopted watering restrictions that prohibited watering during the hottest times of the day in the warmer months. In 2003 and in response to the onset of severe drought conditions in the Colorado River Basin, SNWA member agencies adopted more stringent policies designed to offset drought impacts. These policies included additional restrictions on landscape watering, vehicle washing, lawn installation, mist systems and golf course water use (budgets) during declared drought. In 2005, a citizen advisory committee recommended permanent adoption of these restrictions as a way to help meet long-term resource needs for the community. In the years following, the SNWA and its member agencies began working together to permanently implement the measures detailed below as part of the region's overall conservation effort.

- Landscape watering: customers are assigned mandatory watering groups that limit watering to one day a week in winter, three days a week in spring and fall, and prohibit watering from 11 a.m. to 7 p.m. in summer.
- Vehicle washing: a positive shutoff nozzle is required for residential vehicle washing. Commercial vehicle washing is prohibited unless water is captured to the sanitary sewer where that water can be treated and reused.
- Lawn installation: turf installation is prohibited in new residential front yards and is limited to a maximum of 50 percent the landscapeable area in new residential backyards. Turf is prohibited in new commercial development.
- Mist systems: use of commercial mist systems is limited to summer months.
- Golf course water budgets: golf courses are subject to mandatory water budgets (6.3 acre feet of water per year, per irrigated acre).
- Fountains and ornamental water features: these features are prohibited except as allowed by jurisdiction policy.
- Water waste: allowing water to runoff into streets and/or adjoining property is prohibited. It also is considered water waste to violate policies that limit the time of day or assigned days of the week when watering may occur.

Water Pricing

Water rates, including increasing block rate structures (tiered rates), are one of the most effective conservation tools. Tiered rate structures charge higher rates as water use increases. These rate structures encourage efficiency, while ensuring the affordability of water for essential uses.

While the SNWA member agencies have adopted conservation oriented water rates, the rates must be revisited regularly to ensure that they keep up with inflation and maintain their effectiveness in encouraging conservation. The SNWA member agencies regularly review their water rates to assess their effectiveness and make adjustments as needed.

In adjusting rates for conservation, one complexity that water managers must consider is the relationship between water pricing and the fiscal integrity of the water utility. Conservation results in a decline in purveyor water sales. When coupled with increasing operating costs, conservation that exceeds expectations may require additional rate increases to maintain financial integrity. This can, in turn, result in a further decrease in water sales, resulting in price instability, fiscal uncertainty and a loss of community confidence in the utility. As a result, water utilities must delicately balance pricing to ensure rate stability while sending an appropriate pricing signal that supports the community's conservation goals.

Incentives

Where regulation and water pricing are considered more common approaches to achieving conservation, incentives are more flexible tools that invite the community to participate in the conservation effort. Incentives give customers flexibility in determining how they will manage and reduce their overall water use. The SNWA has a number of "water smart" incentive programs that are critical to achieving its conservation goals.

Water Smart Landscapes Rebate Program. This program provides incentives for residential and commercial property owners to upgrade lawn to water-efficient landscaping. The current program rebate amount is $1.50 for the first 5,000 square feet of lawn removed and $1 for additional lawn removed, up to $300,000. Since program inception, more than 130 million square-feet of lawn have been replaced, saving an estimated 7 billion gallons of water annually.

Efficient Landscape Irrigation Equipment. This program pays up to half the cost of replacing inefficient irrigation controllers with new generation "smart" controllers. Smart controllers have the ability to predict plant water needs and apply the necessary amount of water at the appropriate time. These controllers are capable of reducing water use by 15 to 30 percent. This program also pays up to half the cost of rain sensors that can interrupt irrigation whenever the valley receives significant rainfall.

Water Efficient Technologies. Business customers who choose from a menu of proven conservation technologies, or who select a custom technology that conserves at least 500,000 gallons of water per year, qualify for a rebate of up to $150,000 per property. The program can be used to facilitate retrofit of existing equipment or to purchase certain approved technologies for new installations. It is estimated that businesses in Southern Nevada have conserved more than 1.75 billion gallons through participation in this program since its inception.

Water Smart Car Wash. The Water Smart Car Wash program is a public-private partnership that encourages residents to use commercial car wash facilities instead of washing their vehicles at home. Water Smart Car Washes recover all of their wastewater for treatment and reuse. Water used at these facilities is either reused on site, or treated and returned to Lake Mead for return-flow credits. In contrast, water used for car washing at home is largely lost to evaporation.

Pool Cover Rebate Program. The SNWA Pool Cover Rebate Program pays up to half the cost of a swimming pool cover. Typical use of a cover is estimated to save 13,000 gallons annually on an average-size pool. Since inception, the program has assisted more than 14,000 customers and produced estimated water savings of more than 187 million gallons annually.

Water Smart Contractor Program. The Water Smart Contractor Program is a highly successful partnership program in which landscape contractors assure that their projects meet specific criteria to conserve water. Close to 100 landscape contractors in Southern Nevada currently participate in the program. To obtain status as a Water Smart Contractor, licensed landscape contractors must attend SNWA water efficiency training and pass a proficiency exam.

Water Smart Homes. Launched in 2005, the Water Smart Home Program certifies new homes as water smart, ensuring that homeowners are purchasing a home that can save as much as 75,000 gallons of water per year. This is the nation's largest program for water efficiency in new homes, with almost 7,000 water smart homes constructed so far.

Water Upon Request. The SNWA and several local partners teamed up with local restaurants, which agree to serve water only when patrons request it. This program saves participating restaurants water, time and money by eliminating unconsumed glasses of water. For every glass of water not served, as much as 1.5 to 3 gallons of water is saved. There are currently more than 300 restaurants participating in the program.

Education

An integral element of the SNWA conservation strategy is education. Before communities will accept regulation and pricing mandates, or participate in incentive programs, they must recognize the importance of conservation and understand how they can conserve water most effectively. The SNWA public education programs described below are designed to elicit buy-in from the community and help residents to understand that responsible water use is a critical part of living in a desert environment.

Water Conservation Coalition. Established in 1995, the Water Conservation Coalition is a public-private partnership formed by community leaders to help increase water-efficient practices within the Southern Nevada business community and to promote community-wide water conservation. Through initiatives such as its speakers bureau, Business-to-Business Challenge and various public projects, the Coalition works closely with the SNWA to identify areas of conservation that are most beneficial to local businesses and the community's overall water conservation goal. For example, the Coalition has partnered with local resorts and other leading properties to initiate a Linen Exchange Program. As part of this voluntary program, linens are changed only on the third day of a guest's stay, unless otherwise requested.

Water Smart Innovations. In 2008, the SNWA, in partnership with the U.S. Environmental Protection Agency's WaterSense program, hosted the inaugural WaterSmart Innovations Conference & Expo. Roughly 1,200 participants from across the U.S. and 17 foreign nations came together to share information about conservation programs and water-efficient technologies.

Conservation Helpline. The Conservation Helpline is an information line that customers can call to obtain conservation information or report water waste. The Helpline is available in both English (258-SAVE) and Spanish (258-AGUA).

Publications and Media. The SNWA regularly executes a comprehensive campaign of television, print and radio ads that educates the community on the need for water conservation and offers help through the SNWA Web site and Conservation Helpline. In addition, the SNWA operates a speakers bureau, produces a news-and-information television show, and produces and distributes dozens of publications to help customers conserve water, including a landscape watering guide. The SNWA also continues to implement a bicultural outreach campaign specifically for Southern Nevada's Spanish-speaking audience.

Demonstration Gardens. Through the combined efforts of the SNWA and its member agencies, there is a demonstration garden in every part of the valley. The SNWA also promotes visits to the Springs Preserve, a 180-acre facility that offers hundreds of examples of water-efficient landscaping, as well as classes by master gardeners and horticulturists. Advice from the facility's staff is available seven days a week. Free tours also are available for area students.

The SNWA supports the development of smaller demonstration projects throughout the Las Vegas Valley to show the public that water-smart landscaping is attractive and a water-efficient choice for Southern Nevada. Currently, schools may apply annually for SNWA funded conservation grants of up to $5,000 to develop demonstration projects for their own campuses.

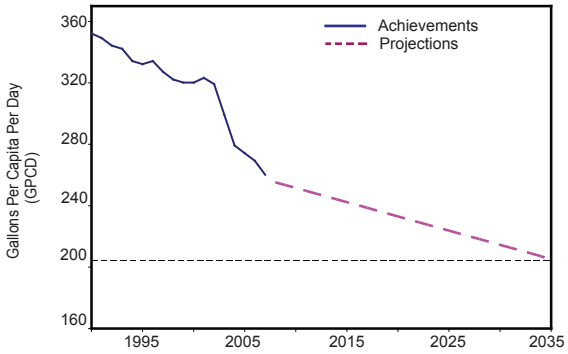
H2O University. The SNWA is committed to educating the next generation on the importance of water resources and conservation. To this end, the SNWA has partnered with the Springs Preserve to develop a comprehensive education program known as H2O University for teachers in the Clark County School District, one of the largest school districts in the nation. One innovative component of the program is the Youth Advisory Council, which allows select students to pursue an interest in water-related issues and further develop leadership skills.

Conservation Achievements

Since its formation in 1991, the SNWA has embarked on an aggressive long-term water conservation program that has contributed to extraordinary conservation gains. In recent years, participation in the SNWA's rebate programs realized record-breaking results, including peak participation levels in almost every area. The combined effect of Southern Nevada's conservation responses was a reduction of consumptive use by roughly 21 billion gallons annually between 2002 and 2008.

Figure 11 illustrates the results of past conservation efforts, reducing water use from approximately 350 gallons per capita per day (GPCD) in 1990 to approximately 250 GPCD in 2008.

FIGURE 11 – GPCD Reduction from Conservation



In an effort to maintain and build upon the community's response to calls for greater water conservation, the SNWA and its member agencies established a new conservation goal in early 2009 to reduce water use to 199 GPCD by 2035. Chapter 3

describes how this additional conservation will impact long-term water demand forecasts.

Conservation remains an important element in planning and balancing the various resource and infrastructure needs in Southern Nevada. Continued conservation, coupled with the acquisition and development of additional water resources, will allow SNWA to meet projected water demands through 2060.

COLORADO RIVER WATER

A series of documents composed of contracts and regulations, state/federal statutes and compacts, court cases, and a treaty known as the "Law of the River" governs how and where Colorado River water is used. The 1922 Colorado River Compact and the 1928 Boulder Canyon Project Act defined all apportionments of Colorado River water in "consumptive use" units. Consumptive use is defined as water diversions minus any water that is returned to the Colorado River (the latter is referred to as "return-flow credits").

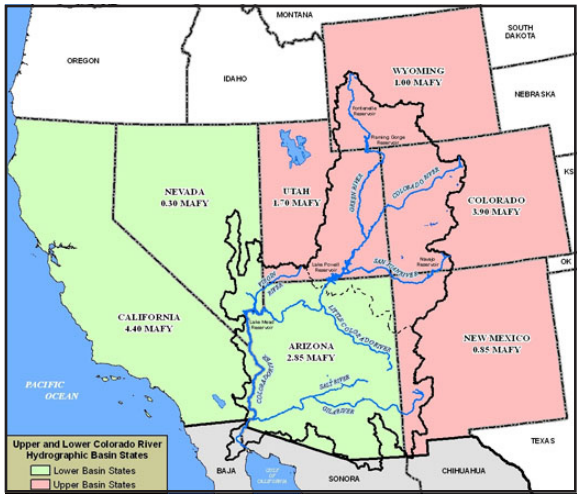
The 1948 Upper Basin Compact assigned the upper basin's apportionment of 7.5 million AFY among the states of Wyoming, Utah, Colorado and New Mexico. The 1964 Supreme Court Decree in Arizona v. California verified the lower basin apportionment of 7.5 million acre-feet among Arizona, California and Nevada, including Nevada's consumptive-use apportionment of 300,000 AFY of Colorado River water (Figure 12).[1]

With return-flow credits, Nevada can actually divert more than its 300,000 AFY apportionment, as long as there are sufficient return flows to ensure the consumptive or net use is no more than 300,000 AFY. Return flows in Nevada consist mainly of treated Colorado River wastewater that is returned to Lake Mead via the Las Vegas Wash and to the Colorado River at Laughlin, Nevada.

Nevada Basic Apportionment

Pursuant to the 1964 Supreme Court Decree in Arizona v. California, any entity wishing to divert Colorado River water within a state must have a specific contract with the Secretary of the Interior for the water. These contracts are typically called "delivery" contracts and are in diversion units, not consumptive-use units. Thus the sum of the delivery contract volumes within a state can be greater than the state's consumptive-use apportionment, as long as there are enough return flows to ensure that the consumptive or net use is within the consumptive-use apportionment.

FIGURE 12 – Colorado River Basin



Early on, the SNWA member agencies contracted for most of Nevada's 300,000 AFY of Colorado River water. Between 1992 and 1994, the SNWA determined that additional water was available and worked to acquire additional Colorado River water resources. The following subsections describe these contracts.

Colorado River Contracts (pre-SNWA). Prior to the SNWA's creation in 1991, total entitlements for diversion for Colorado River users in Nevada equaled 417,116 AFY (Appendix 3). Of that amount, 342,161 acre-feet of diversion rights belonged to the purveyors who would later form the SNWA.

1992 SNWA Colorado River Contract. In 1992, SNWA entered into a water delivery contract with the Secretary of the Interior that gave SNWA a right to the remainder of Nevada's consumptive-use apportionment that was not allocated under other

contracts.[2] This apportionment was estimated in 1992 to be 58,000 AFY, assuming a portion was returned to the river for return-flow credits. The 1992 contract also gave the SNWA the right to Colorado River water made available due to reduction, expiration or termination of a Nevada entitlement; surplus water; and unused Nevada apportionment and other states' unused apportionment. Portions of these rights are not quantifiable because they are dependent upon return-flow credits and the availability of Colorado River water (for example, surplus water).

1993 Colorado River Water (Edison). In 1993, Southern California Edison agreed to terminate its Colorado River water consumptive-use contract of 23,000 AFY. Under Section 4(a)(1) of the SNWA 1992 water delivery contract with the Secretary of the Interior, the SNWA has the right to Nevada Colorado River water made available by reason of entitlement termination. In return for Edison's contract termination, the SNWA purveyor members agreed to provide the Fort Mohave generating station in Laughlin with up to 19,000 AFY through July 2026.[3] The SNWA purveyor members agreed to meet the generating station's needs with unused/surplus Colorado River water available to Nevada, or with water that the LVVWD is storing for SNWA purveyor members in the Southern Nevada Water Bank.[4]

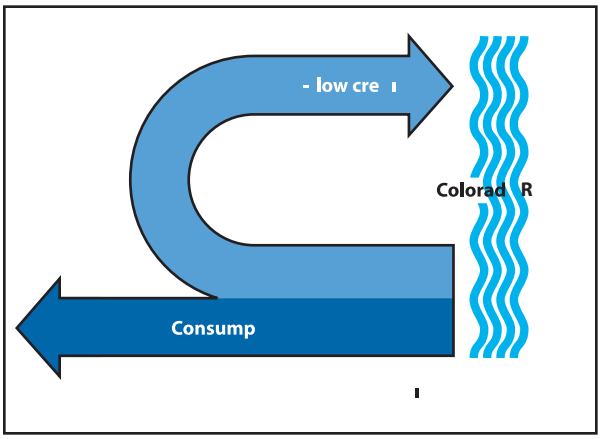
Several years ago, the station encountered substantial difficulties maintaining compliance with Clean Air Act standards and the plant was subsequently closed. There are no plans to reopen the plant at this time. As a result, the SNWA demand forecast presented in Chapter 3 no longer includes this obligation and the SNWA projects this water to be available for future use. Should the station come back on-line, the SNWA will meet the station's needs through 2026.

1994 Colorado River Water (BMI). In 1994, Basic Management Inc. agreed to transfer 14,550 AFY of its Colorado River consumptive use contract to the SNWA.[5] Under Section 4(a)(1) of the SNWA 1992 water delivery contract with the Secretary of the Interior, the SNWA has the right to use Nevada Colorado River water made available by reason of entitlement reduction.

Return-Flow Credits

As mentioned previously and shown in Figure 13, with return-flow credits, the total of Nevada's Colorado River delivery contracts is greater than the state's total Colorado River apportionment. Return-flow credits constitute a significant portion of the region's permanent Colorado River resource. The Las Vegas Valley returns most of its treated wastewater back to the Colorado River for return-flow credit via the Las Vegas Wash.[6]

FIGURE 13 – Return-Flow Credits



Unused Apportionment

Under the Law of the River, particularly the 1964 Supreme Court decision, at the Secretary of the Interior's discretion, Lower Basin States (Arizona, California and Nevada) are allowed to use the unused apportionment of another state. For example, if Arizona does not use all of its basic apportionment, the Secretary of the Interior may authorize Nevada and California to use the unused portion.

The SNWA also has a right to Nevada's unused Colorado River water as part of its 1992 Colorado River water contract. In recent years, a portion of Nevada's Colorado River apportionment contracted to Nevada users has been unused, and the SNWA has utilized this water. However, this water is expected to gradually decline in the long-term.

At present, Arizona plans on using or banking all of its apportionment in the future, as does California. As a result, none of the SNWA planning scenarios include unused apportionment from other Lower Basin States. However, the SNWA would utilize this resource if it becomes available to meet demands.

Flood Control Surplus

Each year, the Secretary of the Interior decides whether or not to declare a surplus of Colorado River water. 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."[7]

A surplus of water is typically a function of Colorado River reservoir storage and weather conditions, primarily snowmelt and the resulting runoff in the upper basin. Over the period of record, beginning in 1906, the average flow of the Colorado River has been 15 million AFY (Figure 14) at Lees Ferry, including flows from the Paria River just downstream of Lees Ferry.[8] However, the respective annual flows are highly variable – much higher or lower from year to year than the average. Because Colorado River uses are relatively constant, the variation in annual flows results in changes in reservoir storage, primarily in lakes Mead and Powell.

Surpluses have historically been limited to "flood control" surpluses, which allows the Lower Basin States to use excess water released from Lake Mead to control potential flooding along the Colorado River system. Every year, the Bureau of Reclamation issues its "Annual Operating Plan for Colorado River Reservoirs" and determines whether or not a surplus condition is expected to exist for the upcoming year. If additional water is available and demands are greater than 7.5 million acre-feet in the lower basin, then a surplus condition can be declared by the Secretary of the Interior.

A flood control surplus on the Colorado River was first declared in 1996 and in subsequent years through 2002 (Figure 15) because of the high storage content in Colorado River reservoirs. The 2009 Water Resource Plan does not assume the availability of flood control surplus during the planning horizon. However, the SNWA will utilize flood control surplus water when it is available and needed to meet demands.

FIGURE 14 – Colorado River Historical Flow

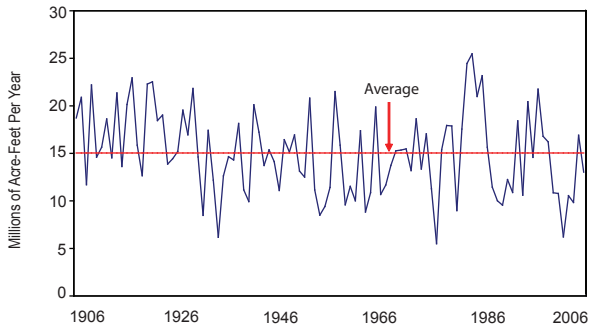
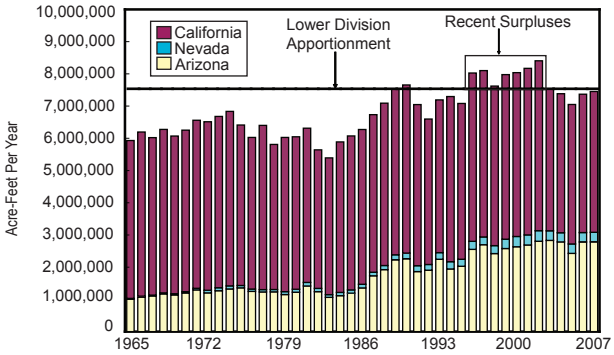


FIGURE 15 – Lower Basin Colorado River Water Usage



Domestic Surplus

As the water level in Lake Mead began to decline in the early 2000s, the Secretary of the Interior used the 2001 Interim Surplus Guidelines to declare "limited" surpluses from 2003 through 2007, based on specific Lake Mead elevations. During this period, the Lower Basin States did not utilize the limited surplus volumes and instead left the water in Lake Mead. As discussed in Chapter 1, the Interim Guidelines (implemented in December 2007) modified and extended the previously adopted 2001 Interim Surplus Guidelines.

Under provisions for "Domestic Surplus," when Lake Mead's elevation is above 1,145 feet, Nevada is allowed to consumptively use up to 400,000 AFY. In the future and until the Interim Guidelines expire in 2026, the SNWA will utilize domestic surplus water when it is available and needed to meet demands. However, the 2009 Water Resource Plan does not assume the use of domestic surplus during the planning horizon.

Intentionally Created Surplus

As discussed in Chapter 1, another element of the Interim Guidelines is the creation of a new type of surplus called Intentionally Created Surplus (ICS). In December 2007, the SNWA entered into a Delivery Agreement with the Secretary of the Interior and a Forbearance Agreement with lower basin water users that, in conjunction with the Interim Guidelines, ensure the availability and delivery of these water resources. ICS will enable the SNWA to develop some water resources by conveying them to the Colorado River for credit.[9] In addition, the SNWA will receive credits in exchange for funding a system efficiency project on the Colorado River. The SNWA's current ICS projects include:

- Virgin/Muddy Rivers Tributary Conservation ICS
- Coyote Spring Valley Groundwater Imported ICS
- Drop 2 Reservoir System Efficiency ICS

Tributary Conservation and Imported ICS credits can be created and used during any operating condition, including shortages. If the water is not used in the year it is created, it converts to Extraordinary Conservation ICS credits. Extraordinary Conservation ICS credits can be used like a bank account – the water is stored in Lake Mead for multiple years. The SNWA can accumulate up to 300,000 acre-feet of credits in Lake Mead for future use. Unlike other forms of ICS, Extraordinary Conservation ICS is not available during declared shortages.

Virgin/Muddy Rivers Tributary Conservation ICS. The SNWA is allowed to develop the full consumptive use of up to 95 percent of its Muddy and Virgin rivers rights that have a priority date that precedes the June 25, 1929 effective date of the 1928 Boulder Canyon Project Act. It is anticipated that more than 30,000 AFY of consumptive use rights will be acquired on the Muddy and Virgin rivers and conveyed to Lake Mead for ICS credit. Based on agreements with the Lower Division States, a maximum amount of 50,000 AFY could be acquired and used to create Tributary Conservation ICS.

These rights will be developed by allowing them to flow into Lake Mead as Tributary Conservation ICS under the Interim Guidelines. The ICS credits will then be withdrawn through existing SNWA facilities at Lake Mead. The SNWA is working with the U.S. Bureau of Reclamation and the Lower Basin States to account for the conveyance of SNWA's rights on the Muddy and Virgin rivers to Lake Mead.

In 2008, the SNWA began diverting approximately 10,000 AF of Muddy and Virgin Rivers Tributary Conservation ICS resources for use in Southern Nevada. Doing so marked an important milestone for the community – importation of these resources represents the first "new" water supply put to use in the region since large-scale diversions of Colorado River water began in the 1950s.

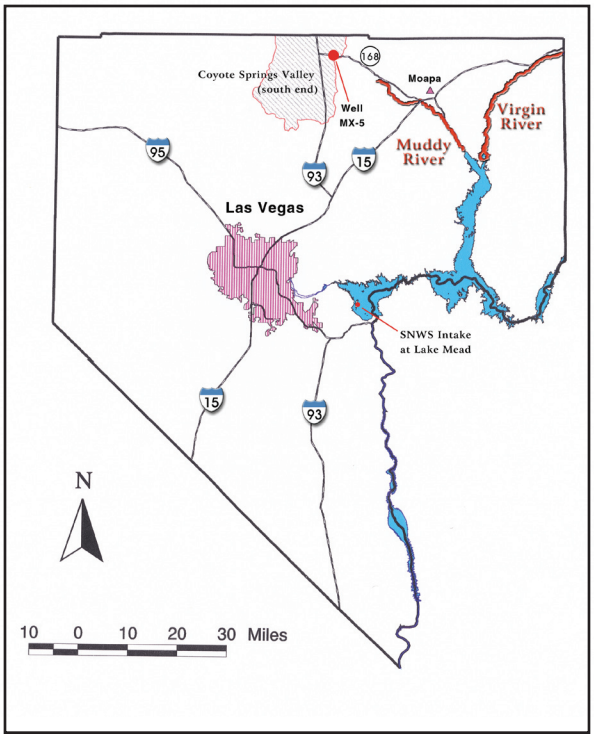
In 2009, the SNWA has approval from the Bureau of Reclamation to develop and use up to 30,000 AF (less 5 percent) of Tributary Conservation ICS. Creation of this ICS is based on SNWA's Muddy and Virgin rivers water rights discussed below and that the maximum amount that can be created is 50,000 AFY.

Muddy River. The Muddy River is a perennial river fed by the Muddy Springs in Southern Nevada, originating in Nevada and flowing into Lake Mead (Figure 16). The surface water on the Muddy River is fully appropriated with a priority date of pre-1905. Until recently, the majority of the flow was used for agriculture and power generation.

The SNWA has acquired about 9,200 AFY of Muddy River water rights represented by Muddy Valley Irrigation Company shares purchased from 1997 through 2009. In addition, SNWA is leasing

approximately 2,200 AF of Muddy Valley Irrigation Company shares in 2009. The leases are between the SNWA and individual shareholders and vary in length from one to 10 years.

FIGURE 16 – Virgin and Muddy Rivers



The SNWA also leases and owns water rights on the upper Muddy River. In March 2006, the SNWA and Moapa Valley Water District entered into a lease agreement with The Church of Jesus Christ of Latter-day Saints for 2,001 AFY of Muddy River water rights, allowing the SNWA to utilize half (1,000.5 AFY) of the leased rights. The term of the lease is 20 years with the option for two additional 10-year terms. The SNWA Board of Directors also approved the purchase of 1,340 AFY of upper Muddy River water rights in September 2008. In December 2008, the SNWA Board of Directors approved the purchase of 811 AFY, which will become available to the SNWA in 2011. In addition, the SNWA entered into a lease agreement with the Moapa Band of Paiutes in February 2009 to lease a portion of their upper Muddy River water rights for a period of five years. In 2009, this lease represents approximately 3,300 AF. The SNWA will receive Tributary Conservation ICS credits for conveying these and any other Muddy River water acquired to Lake Mead and can use the credits during any operating condition, including shortages.

Virgin River. The Virgin River originates in southwestern Utah, flows through the northwestern corner of Arizona and then into Nevada, where it eventually joins the Colorado River at Lake Mead (Figure 16). In 1994, the Nevada State Engineer granted to the SNWA an annual maximum diversion right to Virgin River surface flows of 190,000 AFY, with a long-term average annual diversion of 113,000 AFY. Under the Seven States' Agreement, the SNWA has agreed to postpone development of these rights while it makes efforts to pursue long-term Colorado River augmentation as described later in this chapter.

In 2000, the SNWA entered into an agreement with the Virgin Valley Water District establishing provisions for sharing surface water rights and groundwater rights from the Virgin Valley hydrographic basin. To ensure that future municipal water supplies exist for Virgin Valley Water District customers, the SNWA agreed to limit the amount of Virgin River water that will be purchased and transferred from Virgin Valley. In addition, for each acre-foot of Virgin River water acquired, the SNWA agreed to convey one acre-foot of its Virgin River rights to the Virgin Valley Water District. In 2003, pursuant to the agreement, the SNWA assigned an undivided one-half interest in 15 groundwater applications in the Virgin Valley hydrographic basin to the Virgin Valley Water District.

In July 2005, the SNWA entered into an agreement for the purchase of 350 shares in the Bunkerville Irrigation Company (representing approximately 3,710 AFY). Pursuant to its 2000 agreement with the Virgin Valley Water District, the SNWA transferred 3,710 AFY of its 1994 Virgin River rights to Virgin Valley. Acquisition of water rights from the Mesquite and Bunkerville Irrigation Companies is desired because these water rights have a priority date that precedes the Boulder Canyon Project Act.

In March 2008, the SNWA acquired 1,062 AFY of Virgin River surface water rights with a priority date

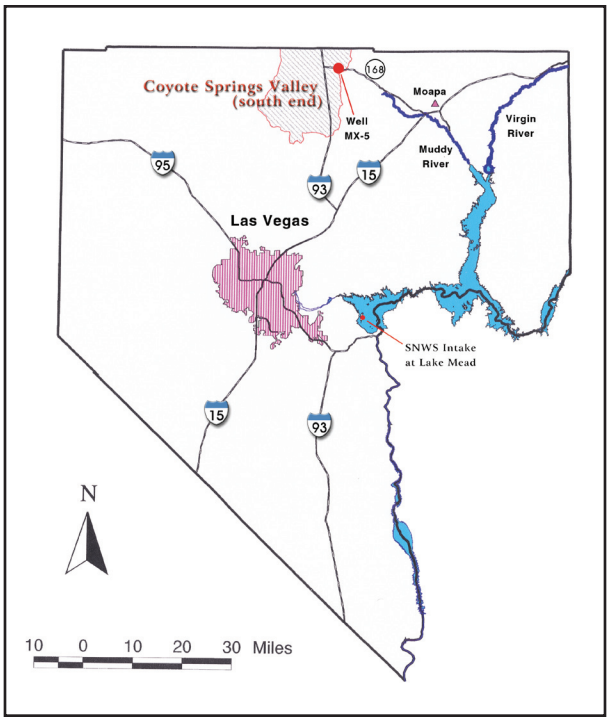
of 1914 and 1,200 AFY of surface rights with a priority date of 1990. Coincident with the purchase, the SNWA and Virgin Valley Water District entered into an agreement that exchanged the 1,200 AFY of 1990 priority rights for 89 shares in the Bunkerville Irrigation Company and removed the limitation on water rights SNWA could purchase and transfer from the Virgin River Valley. The SNWA also transferred to Virgin Valley Water District the remaining balance of the 5,000 AFY transfer obligation from its 1994 Virgin River rights pursuant to the 2000 Agreement. In addition, the SNWA transferred its remaining interest in the 15 groundwater applications in the Virgin Valley hydrographic basin to the Virgin Valley Water District.

Under the purchase agreements described above and recent purchases in 2008 and 2009 from shareholders in the Bunkerville and Mesquite Irrigation Companies, the SNWA has acquired about 5,000 AFY of pre-Boulder Canyon Project Act rights on the Virgin River. In addition, SNWA is leasing approximately 9,000 AF of Virgin River water rights in 2009. The SNWA will receive Tributary Conservation ICS credits for conveying these and any other Virgin River water acquired to Lake Mead and can use the credits during any operating condition, including shortages.

Coyote Spring Valley Groundwater Imported ICS. Coyote Spring Valley is located in northern Clark County (Figure 17). In 1998, the SNWA purchased 7,500 AFY of water rights in this valley, along with five one-acre parcels of land for placement of future wells to develop the water rights.[10] Another 1,500 AFY was purchased in 2002, for a total of 9,000 AFY. In addition, the LVVWD has 27,512 AFY in applications, filed in 1989. Up to 15,000 AFY of the Coyote Spring Valley permits and applications can be used to develop Imported ICS credits.

In 1996, the SNWA signed an agreement with the Moapa Valley Water District outlining various water management strategies for the area.[11] As part of that agreement, the SNWA agreed to assign up to half of the LVVWD filings in Coyote Spring Valley to the Moapa Valley Water District.

FIGURE 17 – Coyote Spring Valley



In 2001, the Nevada State Engineer considered the LVVWD's 1989 applications (27,152 AFY), as well as applications filed by Coyote Springs Investment (CSI), LLC (108,000 AFY). The CSI applications were filed after the LVVWD applications in 1989.

In March 2002, the SNWA, LVVWD, CSI and Moapa Valley Water District agreed to terms regarding groundwater applications in Coyote Spring Valley. Under this agreement, the Moapa Valley Water District will receive the first 3,750 AFY. Any water granted by the Nevada State Engineer above 3,750 AFY will be divided on a percentage basis between the LVVWD and the Moapa Valley Water District (58/42, respectively). This agreement effectively divides the total applications between the two entities, but ensures that the first cut of available water provides long-term benefit to the Moapa Valley Water District.

In March 2002, the Nevada State Engineer also issued Order No. 1169[12] regarding the LVVWD's 1989 groundwater applications for 27,512 AFY of water rights in Coyote Spring Valley. Per the ruling, the SNWA is conducting extensive monitoring, which included the construction of eight monitoring wells.

The SNWA is also working with other stakeholders to implement the five-year study mandated by the ruling. The study includes a two-year aquifer test to identify what potential impacts additional permits, if granted, may have on existing water right holders and regional springs in adjacent basins.

In April 2006, the SNWA entered into a Memorandum of Agreement with the U.S. Fish and Wildlife Service, CSI, Moapa Valley Water District and the Moapa Band of Paiutes that established conservation measures, and management and monitoring criteria for the SNWA's development of its 9,000 AFY and the future development of other groundwater resources in the area. To facilitate the pump test and deliver SNWA's existing water rights to meet demands, the SNWA is constructing a 15-mile pipeline that will tie into the Moapa Valley Water District's water distribution system, enabling the SNWA to develop and convey its existing 9,000 AFY of Coyote Spring Valley groundwater rights to the Lower Moapa Valley and Lake Mead. The water conveyed to Lower Moapa Valley can be used by the Moapa Valley Water District or by the SNWA through the creation of Imported ICS credits.

Following the completion of Order No. 1169 testing, the SNWA will provide a hydrological report to the Nevada State Engineer, detailing the results of the test. It is anticipated that following the submittal of the report, the Nevada State Engineer will determine the volume of water to be permitted under the LVVWD applications for 27,512 AFY in Coyote Spring Valley.

Drop 2 Reservoir System Efficiency ICS. System Efficiency ICS allows a water user to fund a system efficiency project to conserve Colorado River water. The project must increase the amount of water available in the U.S. and a portion of the saved water will be credited to the user funding the project. A project that meets this criteria is the Drop 2 Storage Reservoir Project.

This project will capture U.S. Colorado River water that would otherwise go unused in the lower basin and pass into Mexico. The SNWA has agreed to fund a portion of this project in exchange for receiving 400,000 acre-feet of available water (consumptive use volume) from Lake Mead under normal conditions on the Colorado River at a maximum rate of 40,000 AFY (consumptive use volume) beginning in 2011. These resources will expire upon full use, or in 2036, whichever comes sooner.

In 2008, the Secretary of the Interior and other project partners broke ground on the project. The reservoir is designed to conserve about 70,000 AFY of water and help manage flows along the lower Colorado River.

Banked Resources

Through local and interstate arrangements, the SNWA has acquired a number of banked resources. As discussed in Chapter 4, these temporary supplies serve as an important management tool – banked resources can be used to offset reductions in permanent supplies due to shortages, meet short-term gaps and serve as a temporary bridge to meet demands while other permanent resources are being developed. As discussed below, these banked resources include the Arizona, California and Southern Nevada water banks.

Arizona Water Bank. The SNWA acquires a storage credit by paying the Arizona Water Banking Authority (AWBA) to bank a portion of Arizona's Colorado River allocation, or other available Colorado River water, in Arizona's underground aquifer. In 2004, the SNWA Board of Directors approved an amendment to a previously approved agreement with the AWBA, ensuring Southern Nevada access to 1.25 million acre-feet of water in the Arizona Water Bank. As part of the agreement, SNWA could recover 30,000 AFY in 2009 and 2010. For 2011 and beyond, the parties agreed to a maximum recovery rate of 40,000 AFY until the banked reserves have been fully exhausted. Banked water is stored in the form of "credits." For the SNWA to recover a portion of its storage credits, Arizona will utilize the banked water and forego the credited amount of Colorado River water to Nevada. The SNWA will then divert the water from existing facilities at Lake Mead.

California Water Bank. In October 2004, the SNWA and Colorado River Commission of Nevada entered into agreements with the Metropolitan Water District and Bureau of Reclamation to store a portion of Nevada's unused Colorado River water in Southern California until it is needed. Under the agreements, Nevada can recover up to 30,000 AFY from the storage account, with six months notice provided to Metropolitan. The SNWA has banked 70,000 acre-feet in the California Water Bank through 2008.

Southern Nevada Water Bank. Within the Las Vegas Valley Groundwater Basin, the LVVWD and the City of North Las Vegas artificially recharge Nevada's unused Colorado River water directly into the primary aquifer using recharge wells during the winter months. In addition, the agencies have conducted in-lieu recharge by refraining from pumping their respective non-revocable groundwater rights.[13]

Since 1987, the LVVWD has recharged 333,639 acre-feet in the Las Vegas Valley groundwater basin through direct and in-lieu recharge. In addition, 17,378 acre-feet has been recharged by LVVWD for the Las Vegas Valley Groundwater Management Program (LVVGMP). The LVVGMP has purchased 9,303 acre-feet of this volume and has been approved to purchase the remaining 8,075 acre-feet based on SNWA Board action approvals in November 2008. The water acquired by the LVVGMP is not available to the SNWA for future use.

Colorado River Augmentation

In accordance with the 2007 Seven States' Agreement, the SNWA has agreed to suspend development of its 1994 Virgin River water rights until at least 2014 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.

The SNWA will not pursue its 1994 Virgin River rights so long as the 75,000 AFY has been obtained or a specific project is being developed by the year 2020. In 2007, the SNWA funded the "Study of the Long-Term Augmentation Options for the Water Supply of the Colorado River System."[14] This study examined water resource augmentation options, evaluating engineering feasibility, environmental viability, and potential for water resource yield. This is an important first step in identifying and assessing potential actions to implement water supply augmentation on the Colorado River or through exchanges of Colorado River water.

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. However, discussions of transfers/exchanges generally describe lower basin, interstate transfers of Colorado River water. Full-scale transfers and exchanges, over and above Colorado River augmentation to offset development of 1994 Virgin River rights, are still in the distant future. Examples of both short- and long-term augmentation and transfers/exchanges include desalination and transfers of conserved water.

Seawater Desalination Exchanges. Advances in technology may alleviate the high costs associated with seawater desalination, making it a potentially viable future water resource for Southern Nevada. This would occur in the form of an exchange. For example, Southern Nevada could pay California or Mexico to construct and operate desalination facilities in exchange for an equivalent portion of their Colorado River water at Lake Mead. The SNWA is currently participating in a bi-national process between the United States and Mexico to discuss desalination opportunities. Any formal arrangement regarding desalination exchanges is still many years out and subject to international treaty obligations.

Brackish Water Desalination. The Yuma Desalting Plant (YDP), a brackish water reverse osmosis plant near Yuma, Arizona, was constructed to treat pumped agricultural drainage water from the United States' lower Gila River Valley area. The quality of the desalted water would be improved so that it could become part of the U.S. treaty deliveries to Mexico.[15] Construction of the YDP was complete in 1992. The

YDP operated at one-third capacity for six months in 1992-1993 until flood damage caused operations to cease. The YDP has not operated since, except for a 90 day test at 10 percent capacity in 2007. Since 1993, the pumped agricultural drainage water from the U.S. has been conveyed in a concrete lined canal and released on a salt flat near the upper end of the Gulf of California. This water is not counted as part of Mexico's 1.5 million AFY Colorado River treaty water because of its salinity.

Under a proposed agreement among municipal water agencies in Nevada, California and Arizona, and the U.S. Bureau of Reclamation, a pilot operation of the YDP could begin as early as fall 2009. The YDP would operate at one-third capacity to collect data on the viability of operating the plant at full capacity on a sustained basis.

Transfer of Conserved Water. This potential resource would include interstate transfer of water that has been conserved through a verifiable water conservation program or through the fallowing of agricultural land with a recent history of use.[16] This conserved water would be leased or purchased by the SNWA. There is also an opportunity for interstate transfers of Tribal water, but the topic still needs considerable discussion and agreement.

While Colorado River transfers and exchanges are an important future resource for Southern Nevada, they do not resolve supply shortages associated with drought conditions. This is because all of these options would involve an exchange for Colorado River water. This would increase Southern Nevada's dependency on Colorado River water at a time when the SNWA and other users are exploring ways to reduce their dependency on the river and make their supplies more drought tolerant.

GROUNDWATER

The SNWA has acquired and continues to develop a significant number of in-state groundwater resources. These resources are intended to provide Southern Nevada with a more balanced mix of Colorado River water and non-Colorado River water than currently exists.

Nevada Water Law

Unlike the water of the Colorado River, which is managed by the U.S. Bureau of Reclamation through a series of agreements, laws, contracts and judicial or administrative decisions known collectively as the Law of the River, the groundwater and surface waters of Nevada are managed and controlled by the state. The Nevada Division of Water Resources (also known as the Office of the State Engineer) is the state entity that regulates groundwater and surface water resources within Nevada (other than the Colorado River).

The Office of the State Engineer was created in 1903 to protect existing water rights and bring about a better method for utilizing the state's water resources. The General Water Law Act of 1913 gave the office jurisdiction over all wells tapping into artesian water or water in definable underground aquifers. The 1939 Nevada Underground Water Act granted the Nevada State Engineer total jurisdiction over all groundwater in the state. The 1939 Act has been amended a number of times and is now considered one of the most comprehensive groundwater laws in the West.[17]

Nevada water law follows the doctrine of prior appropriation, or "first in time, first in right" – meaning the first person to file on a water resource for beneficial use is typically considered first for a permanent right to the water, subject to the Nevada State Engineer's determination of available unappropriated water. The process for obtaining a permit to develop unappropriated groundwater or surface water includes: filing an application, having the Nevada State Engineer act on the application, and then issuing the permit or denying the application.

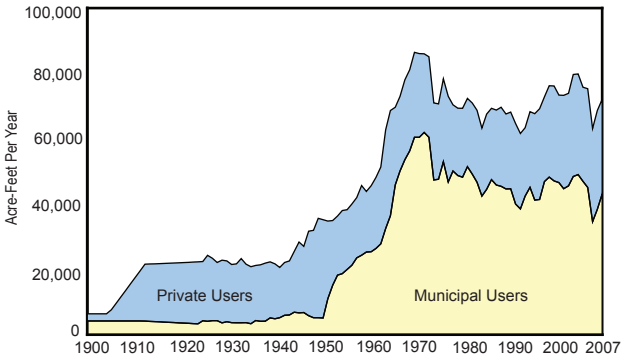
As indicated in Chapter 1, groundwater was the first and most critical resource for Southern Nevada for much of the last century. It remains a key component of Southern Nevada's water resource portfolio. In addition to the existing purveyor groundwater rights in the Las Vegas Valley, the SNWA has in-state groundwater rights and applications in hydrographic basins outside the Las Vegas Valley. Many of these rights and applications stem from filings made by the LVVWD, but others are the result of specific SNWA efforts that were initiated in the mid- to late-1990s. The following subsections discuss these in-state groundwater resources in more detail.

Las Vegas Valley Groundwater

Until large scale importation of Colorado River water was achieved in the early 1970s, the Las Vegas Valley relied on local groundwater supplies to meet demands. In this respect, it is worthwhile to note that older estimates of long-term annual groundwater supply or "perennial yield" for the Las Vegas Valley were about 30,000 AFY.[18] More recent analysis in the 1990s indicates the yield is approximately 57,000 AFY.[19] As part of its effort to manage excessive demands on this supply, the Nevada State Engineer designated a portion of the Las Vegas Valley as an underground artesian water basin in 1941. The designated area was expanded in 1944 and 1946, and a portion of the basin was closed to new irrigation rights in 1949. In 1955, the Nevada State Engineer began to issue temporary groundwater permits in the Las Vegas Valley. All permits within the designated portion of the basin and with a priority date after March 24, 1955, were issued as temporary rights subject to revocation.[20]

In the years that followed, the Nevada State Engineer issued a series of orders that systematically restricted the issuance of revocable water rights within the Las Vegas Valley. These orders culminated on April 15, 1992, with the issuance of Amended Order No. 1054. Order No. 1054 is significant because it means that, with few exceptions, all applications to appropriate groundwater in the Las Vegas Valley that are filed after March 23, 1992 will be denied.[21] Of the seven SNWA member agencies, the LVVWD and North Las Vegas have permanent groundwater rights totaling 40,629 acre-feet and 5,711 acre-feet, respectively. The two entities operate about 100 permitted municipal wells in the Las Vegas Valley. Figure 18 displays groundwater use in the Las Vegas Valley by type of user, and shows how this use shifted from primarily private wells around 1950 to primarily municipal wells by 1970.

FIGURE 18 – Groundwater Use by User Type



Although Southern Nevada's primary supply is Colorado River water (about 90 percent), the municipal groundwater rights of the SNWA member agencies are among the most senior groundwater rights in the valley, and groundwater remains a critical component of the area's resource picture. In particular, groundwater is instrumental in helping purveyors meet peak summer water demands.

In-State Groundwater Resources

In addition to the groundwater rights previously noted, the SNWA has a number of other groundwater permits and applications in southern and eastern Nevada. In 1989, the LVVWD filed 147 groundwater applications with the Nevada State Engineer to appropriate unallocated groundwater in 30 basins. Because of potential environmental concerns and existing appropriations, the LVVWD eventually withdrew some applications, limiting potential diversions to 21 basins in four Nevada counties, including Clark, Lincoln, Nye and White Pine (Figure 19).

FIGURE 19 – Groundwater Applications

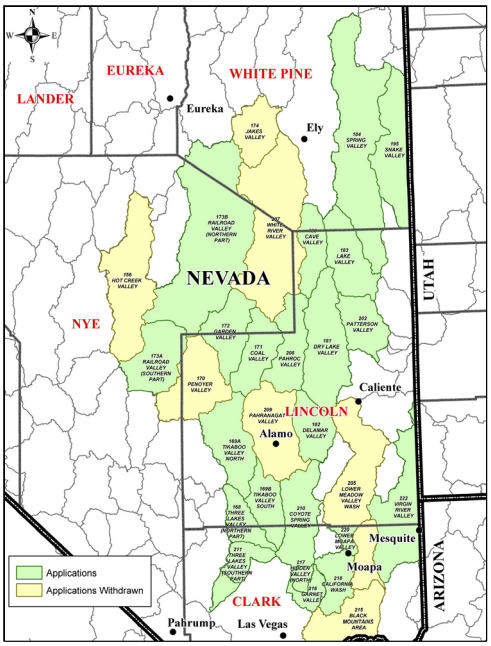
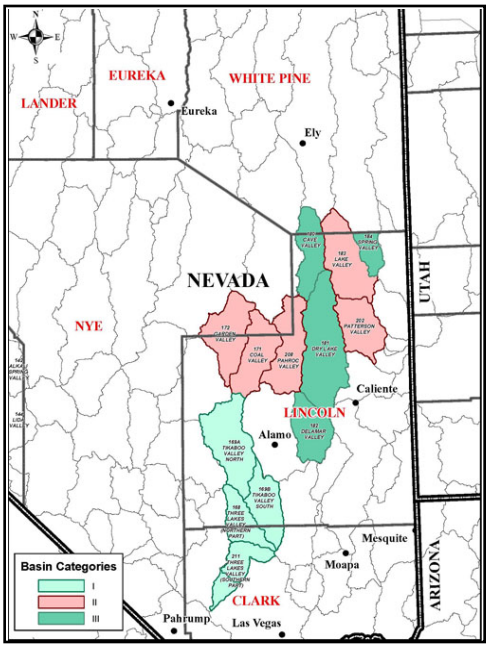


FIGURE 20 – Groundwater Basins Addressed in the SNWA/Lincoln County Agreement



Since 1989, the LVVWD and/or the SNWA have withdrawn, transferred or otherwise declined to pursue development of 49 of its original applications. In 2003, the SNWA entered into an agreement with Lincoln County that effectively resolved longstanding concerns over applications for groundwater in that county. Under the agreement, the applications in Lincoln County are divided into three categories (Figure 20):

- Category I Basins are allocated to the SNWA;
- Category II Basins are allocated to Lincoln County;
- Category III Basins are shared, where Lincoln County is entitled to the first 3,000 AFY from the water rights that may be granted in these basins.

The agreement established a cooperative relationship between Lincoln County, the LVVWD and SNWA that includes sharing resources and data during the development of groundwater in eastern and central Nevada.

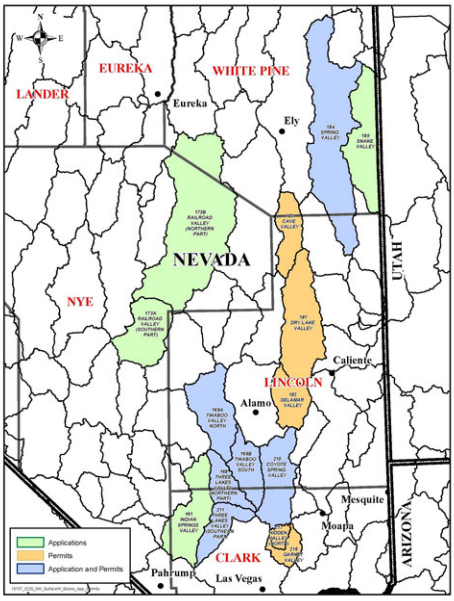
Several of the groundwater applications filed in 1989 have been reviewed by the Nevada State Engineer's office, and many have been permitted according to Nevada Water Law. The SNWA has also acquired groundwater rights through direct purchase. Figure 21 displays the groundwater basins in which the SNWA and/or LVVWD have groundwater rights, applications or both. The following sections describe the water rights and applications in these basins and the associated development projects.

Garnet and Hidden Valleys. The Nevada State Engineer permitted a combined total of 2,200 AFY to the LVVWD in 2001 based on the 1989 groundwater applications in these basins. The majority of these rights have been leased to dry-cooled power plants located in Garnet Valley, which are extremely water efficient. The SNWA owns a 25 percent interest in one of these facilities, the Silver Hawk facility, which is owned and operated by the NVEnergy Company.

California Wash Basin. In 2002, the Nevada State Engineer issued Ruling No. 5115, which permitted the SNWA 2,500 AFY of groundwater rights in the California Wash groundwater basin. The SNWA's other application in this basin was held in abeyance

until the completion of the study under Nevada State Engineer Order No. 1169. As part of the settlement agreement with the Moapa Band of Paiutes, which resolved regional water resources issues on the groundwater and surface water rights on the Muddy River, the 2,500 AFY of permitted rights and the application held in abeyance were transferred to the Moapa Band of Paiutes. The SNWA and the Moapa Band of Paiutes are working closely to manage and develop water resources on the Muddy River and surrounding groundwater basins.

FIGURE 21 –Groundwater Basins with Active Applications/Permits



Three Lakes Valley (North and South) and Tikaboo Valley (North and South). In 2003, the SNWA requested that the Nevada State Engineer act on 17,000 AFY of water right applications filed in 1989 for groundwater in Three Lakes Valley (North and South) and Tikaboo Valley (North and South). Following an administrative hearing in 2004, the Nevada State Engineer issued Ruling No. 5465 in 2005, approving permits totaling 8,905 AFY. Ruling No. 5465 also identified an additional 1,700 AFY of unappropriated water in Three Lakes Valley North. In 2005, the SNWA requested the Nevada State Engineer grant the 1,700 AFY under an existing SNWA application from 1989 that was not considered in Ruling No. 5465. The Nevada State Engineer subsequently issued Ruling No. 5533, granting SNWA the 1,700 AFY in Three Lakes Valley North, bringing the total rights from the four basins to 10,605 AFY.

In 2005, the SNWA filed applications to change points of diversion for a portion of the 8,018 AFY of water rights from Tikaboo Valley South and Three Lakes Valley North and South to proposed well sites. In 2006, the Nevada State Engineer issued Ruling No. 5621, which approved a portion of the change applications and denied others. The SNWA is working to develop options for the development of its 8,018 AFY of groundwater permits in Three Lakes Valley South and North and Tikaboo Valley South and deliver the water to the northwest part of the Las Vegas Valley. In 2008, the SNWA and LVVWD entered into an agreement with the Las Vegas Paiute Tribe establishing a right-of-way on the reservation for the proposed project.

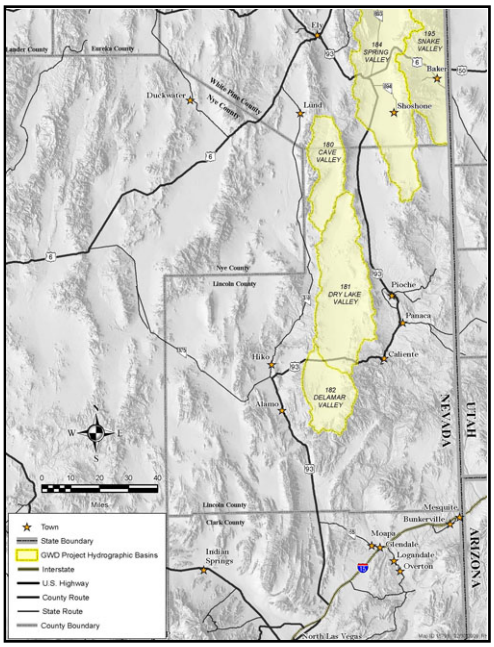
Indian Springs. In 2004, the SNWA filed applications for 16,000 AFY of groundwater in Indian Spring Valley. The availability and development of this resource is subject to further research and analysis.

Clark, Lincoln and White Pine Counties Groundwater. To develop and convey the SNWA's 1989 groundwater rights, applications, and acquired rights from Delamar, Dry Lake, Cave, Spring and Snake valleys for use by SNWA's member agencies in Clark County, the SNWA has proposed a pipeline project as defined in the Southern Nevada Water Authority Clark, Lincoln and White Pine Counties Groundwater Development Project. The proposed pipeline would extend from the Las Vegas Valley to Spring and Snake valleys (Figure 22). Based on the SNWA's current permitted rights, acquired rights, and pending applications, up to 137,000 AFY could be developed from these valleys, 3,000 AFY of which would be transferred to Lincoln County based on a 2003 agreement.

In 2006, the SNWA and the Lincoln County Water District (LCWD) passed a resolution through which the SNWA and the LCWD agreed to cooperate

in the National Environmental Policy Act (NEPA) process associated with the SNWA's proposed Clark, Lincoln and White Pine Counties Groundwater Development Project. The agreement provides that LCWD will pay a portion of any costs charged by the BLM to the SNWA for completing NEPA compliance. It also outlines the basic concepts for a future agreement that will allow the LCWD to acquire capacity rights in the future pipeline facilities to transmit water within Lincoln County, and sets forth a framework for a future operation, maintenance and replacement agreement.

FIGURE 22 – Clark, Lincoln and White Pine Counties Groundwater Development Project



While many of the water resources associated with the SNWA's Clark, Lincoln, and White Pine Counties Groundwater Development Project have been quantified, final project volumes remain uncertain because the SNWA still has applications in Snake Valley pending consideration by the Nevada State Engineer. The sections below discuss the SNWA's groundwater rights, applications, and acquired rights within the specific groundwater basins encompassed by the project.

Spring Valley. The Nevada State Engineer held an administrative hearing in 2006 to consider the SNWA's applications for 91,224 AFY of groundwater in Spring Valley hydrographic basin. In 2007, the Nevada State Engineer issued Ruling No. 5726, granting the SNWA 60,000 AFY of groundwater from Spring Valley, the pumping of which is limited to 40,000 AFY for the first ten years. In addition to these groundwater rights, the SNWA began acquiring various ranch properties in Spring Valley in mid-2006. In addition to substantial land holdings, the SNWA also acquired surface and groundwater rights associated with the properties. To date, the SNWA has acquired approximately 34,000 AFY of surface water rights, 6,000 AFY of groundwater rights and 24,000 AFY of supplemental water rights. The SNWA does not intend to export the surface water rights associated with these ranches. Instead, the surface water rights will be used to help manage the groundwater basin and support other environmental management activities associated with groundwater development.

Delamar, Dry Lake and Cave Valleys. In 2008, the Nevada State Engineer held an administrative hearing to consider the SNWA's applications for unappropriated groundwater in Delamar, Dry Lake and Cave valleys. Later that year, the Nevada State Engineer issued Ruling No. 5875 granting the SNWA 18,775 AFY of groundwater from these valleys.

Snake Valley. The Nevada State Engineer has scheduled a hearing for 2011 to consider the SNWA's applications for 50,679 AFY of unappropriated groundwater in Snake Valley. The Lincoln County Land Act requires that the states of Nevada and Utah reach an agreement regarding the division of water resources in the basin before water can be diverted. The two states continue to work together to reach an agreement that will allow the maximum sustainable beneficial use of the water resources and protect existing water rights.

RECLAIMED WATER RESOURCES

Southern Nevada currently reclaims all of its wastewater, either through return-flow credits

or direct reuse. The following sections describe Southern Nevada's efforts to maximize its use of both Colorado River and in-state groundwater resources.

Reclaimed Colorado River Water

While reclaimed Colorado River water may have distinct advantages in terms of environmental sustainability and lower cost, additional reuse does not extend Southern Nevada's Colorado River allocation. Comparing Figures 23a and 23b shows that the size of the total resource "pie" does not change when more wastewater is used to meet a reuse demand rather than returned to Lake Mead for return-flow credit. The reason for this is that an increase in reuse will offset or reduce the amount of water available for return-flow credit. That is, as wastewater reuse increases, the area's return-flow credits will decrease. However, the overall supply from consumptive use, return-flow credits and reclaimed water will not materially change.

Full Consumptive Use/Recycled In-State Groundwater Resources

The water resources described in this chapter have generally been quantified and discussed based on consumptive-use volumes. Through return-flow accounting and water reuse, the water supply available for diversion is approximately 70 percent greater than the consumptive-use volume.

Current Reclaimed Water Resources

The following describes current reclaimed-water activities among the SNWA member agencies.

Boulder City. Boulder City is both the potable and reclaimed water provider within its municipal boundaries. Currently a portion of its treated effluent is sold and used at sand and gravel operations (about 273 acre-feet in 2007).

City of Las Vegas. In the LVVWD service area, the City of Las Vegas provides reclaimed water within its municipal boundaries and unincorporated Clark County. The Water Pollution Control Facility (WPCF), the city's 91 million-gallon-per-day (MGD) main treatment plant, is located on the Las Vegas Wash in unincorporated Clark County. The WPCF currently provides reclaimed water to an adjacent power plant and four adjacent golf courses. The Bonanza Mojave Water Resource Center, a 1 MGD satellite reuse facility, became operational in May 1999. It is capable of providing approximately 1,120 AFY of reclaimed water to an adjacent park and golf course. The Northwest Water Resource Center, a 10 MGD satellite reuse facility, became operational in July 2001. It will ultimately be capable of providing more than 11,200 AFY of reclaimed water for use at golf courses, schools and parks. Total reuse for the City of Las Vegas in 2007 was about 5,538 acre-feet.

FIGURE 23a – SNWA Water Resources with Decreased Reuse

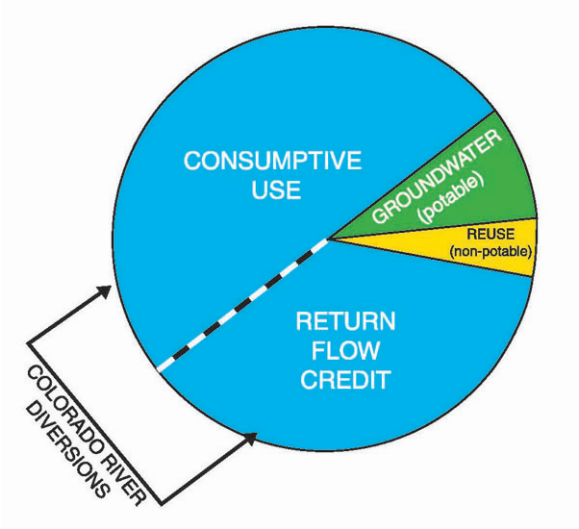
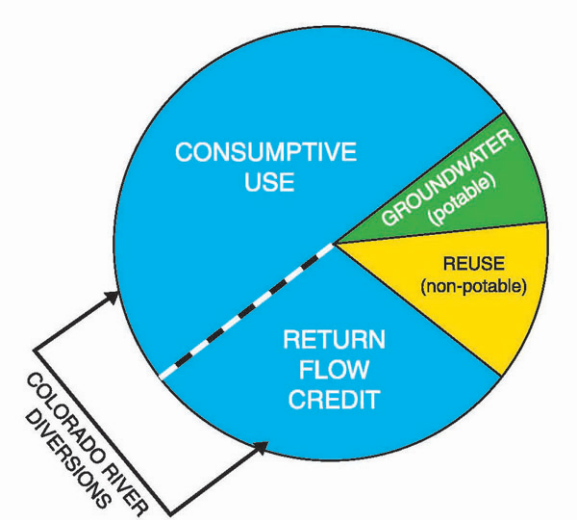


FIGURE 23b – SNWA Water Resources with Increased Reuse



Clark County Water Reclamation District. In the Clark County portion of the LVVWD service area, the Clark County Water Reclamation District currently provides reclaimed water to power plants, golf course irrigation and parks from the Water Pollution Control Facility, the county's 120 MGD main treatment plant located on the Las Vegas Wash. Phase I of the Desert Breeze Water Resource Center was completed in January 2003. The facility currently treats up to 5 MGD of reclaimed water. The facility can be expanded to 10 MGD, which is equivalent to 11,200 AFY, of reclaimed water for use at golf courses, schools and parks. In addition, Clark County now requires new golf courses and nearby landscape areas to utilize reclaimed water, when applicable. The Reclamation District recently completed an In-Valley Water Reclamation Facilities Master Plan to evaluate reclaimed water needs for the Reclamation District's service area. Total Reclamation District reuse in 2007 was approximately 12,693 acre-feet.

In Laughlin, the Clark County Water Reclamation District is currently supplying reclaimed water for dust control at a local landfill.

City of Henderson. The City of Henderson is both the potable-water and reclaimed-water provider within its boundaries. The city has a water-reclamation facility capable of treating 32 MGD of wastewater. Customers currently utilizing reclaimed water for irrigation include nine golf courses, highway landscaping and a mortuary. Total reclaimed water in 2007 was approximately 8,338 acre-feet.

City of North Las Vegas. The City of North Las Vegas currently receives wastewater treatment through an agreement with the City of Las Vegas. In November 2008, the City of North Las Vegas began construction of a water reclamation facility.[22] The City of North Las Vegas plans to construct a 50 MGD wastewater treatment facility to treat and reclaim a portion of its wastewater. The project is projected to consist of two phases with 25 MGD of operating capacity constructed in each phase. The first phase of construction is scheduled for completion in early 2011.

Valley-Wide Reuse Plans

The cities of Las Vegas, North Las Vegas and Henderson, the Clark County Water Reclamation District and the LVVWD completed an Area-Wide Reuse Study for the Las Vegas Valley in July 2000.[23] Opportunities for additional satellite reuse facilities were identified in North Las Vegas, the northwest area of the City of Las Vegas, and in the southwest area of Clark County near Henderson. The agencies are evaluating these opportunities to determine which projects might be the next most likely projects for development. A siting feasibility study in the southwest area of Clark County was jointly explored by Henderson, the Clark County Water Reclamation District and the LVVWD. This study, also completed in 2000, identified several locations for possible future satellite facilities in the valley, which are being considered independently by the Clark County Water Reclamation District. In response to the study, the City of Henderson has begun construction of its Southwest Water Reclamation Facility.

In September 2007, the SNWA and Clean Water Coalition initiated a cooperative effort to update the Area-Wide Reuse Study to reflect current conditions. The revised "Policy Regarding Recycled Water" presents seven recommendations for reuse practices in Southern Nevada. The plan was approved by the SNWA Board of Directors in December 2008.

ENDNOTES

1. "Compilation of Records in Accordance with Article V of the Decree of the Supreme Court in Arizona v. California et al. dated March 9, 1964," February 1967-June 2005, United States Bureau of Reclamation.

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

3. "Contract for the Provision of Water to Mohave Generating Station," effective March 1, 1993; between Southern Nevada Water Authority Purveyors and Southern California Edison, on behalf of itself and the other co-tenants of the Mohave Generating Station.

4. "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.

5. "Water Supply Agreement," effective November 17, 1994; among Victory Valley, SNWA, SNWA purveyors and BMI. "Amended Contract for Delivery of Water to Basic Management," effective November 17, 1994, between Secretary of Interior and BMI.

6. "Procedure for Determining Return Flow Credits to Nevada from Las Vegas Wash," 1984, U.S. Bureau of Reclamation. This procedure was modified slightly in "The Accounting of Return Flow Credits from Recharged Colorado River Water in the Las Vegas Valley," 1991, U.S. Bureau of Reclamation. There are three sources of water in the Las Vegas Wash – metered returns, which are mostly treated wastewater flows; urban runoff and intercepted shallow groundwater; and storm water. Nevada only receives credit for those return flows that are considered Colorado River water, not groundwater or storm water. There are meters on the wastewater flows exiting the wastewater-treatment plants, a meter on BMI's surface return flows, and a gauge at Lake Las Vegas that measures total flow in the Wash. However, these meters and gauges cannot physically measure what portion of the flows was originally Colorado River water. Given this limitation, the Bureau of Reclamation and the Colorado River Commission agreed in 1984 to a return-flow-credit methodology that would calculate how much of the flows in the Las Vegas Wash was originally Colorado River water diversions. Nevada is the only state on the Colorado River with such a detailed measuring procedure for its return flows. This procedure has been updated as needed in consultation with the U.S. Bureau of Reclamation.

7. Sometimes the phrases "lower division states" and "lower basin states" are used interchangeably. However, this document follows the definitions found in Article II of the "Upper Colorado River Basin Compact, 1948." Paraphrased, the lower division states are Arizona, California and Nevada; the lower basin states are Arizona, California, Nevada, New Mexico and Utah.

8. 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 1995 are official, while estimates for the period 1996 to 2003 are provisional, October 2005, U.S. Bureau of Reclamation.

9. In the 2006 SNWA Water Resource Plan, SNWA's groundwater rights in Coyote Spring Valley and surface water rights in the Virgin and Muddy rivers were previously classified as an in-state water resource. The 2009 Water Resource Plan includes these resources under the Colorado River heading, since the Secretary of Interior's December 2007 Record of Decision concerning Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake

Mead (Interim Guidelines) allows the SNWA to receive Colorado River credit for conveying portions of these water resources to Lake Mead. Surface water rights controlled by the SNWA on the Virgin and Muddy rivers that pre-date June 25, 1929, the effective date of the 1928 Boulder Canyon Compact, can be used to generated Intentionally Created Surplus credits in Lake Mead. The Interim Guidelines allows the creation of up to 50,000 afy of Colorado River credits from the Virgin and Muddy rivers. In addition, Coyote Spring Valley groundwater rights controlled by SNWA can also be conveyed to Lake Mead for ICS credits. A maximum of 15,000 AFY of Colorado River credits can be created from Coyote Spring Valley. SNWA is credited for 95% of the water demonstrated to augment the Colorado River system from these sources. The remaining 5% benefits the Colorado River system-storage as a whole.

10. "Agreement for option, purchase and sale of water rights, real property and easements," approved by the SNWA Board of Directors on 4/16/98, between Southern Nevada Water Authority and Coyote Spring Investment, LLC.

11. "Agreement" signed February 14, 1996, between Southern Nevada Water Authority and Moapa Valley Water District.

12. The Nevada Division of Water Resources issued Order 1169 March 8, 2008, which addressed LVVWD's groundwater applications for 27,512 AFY. The Order also held in abeyance all groundwater applications in five nearby groundwater basins. The Order requires a 5-year minimum study during which at least 50% of the water rights currently permitted in the Coyote Spring Valley are pumped for at least 2 consecutive years. Following the study, the SNWA and Las Vegas Valley Water District (LVVWD) may update and resubmit its hearing documents from the July 2001 administrative hearing to include study results, allowing the Nevada State Engineer to further consider the LVVWD's groundwater applications in Coyote Spring Valley.

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

14. "Study of the Long-Term Augmentation Options for the Water Supply of the Colorado River System," March 2008. Prepared for the Colorado River Basin States by Colorado River Water Consultants - a joint venture by Black & Veatch and CH2MHill.

15. The 1944 United States-Mexico Treaty for Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande allots to Mexico a guaranteed annual quantity of water from these sources. Specifically, the treaty guarentees Mexico the delivery of 1.5 MAFY 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.

16. In 1989, the Metropolitan Water District paid the Imperial Irrigation District for canal lining and other conservation measures, in return for up to 106,000 acre-feet of conserved water per year for 35 years. In addition, from 1992 through 1994, 186,000 acre-feet of water was conserved from a land fallowing program that Metropolitan set up with the Palo Verde Irrigation District. The latest development is an agreement between the Imperial Irrigation District and the San Diego County Water Authority. Over an extended period San Diego will pay the Imperial Irrigation District to conserve up to 200,000 AFY.

17. "Groundwater and Wells in the Las Vegas Valley," 1998, Southern Nevada Water Authority and Clark County Conservation District.

18. "Available Water Supply of the Las Vegas Ground-Water Basin," U.S. Geological Survey Water Supply Paper 1780, 1965, G.T. Malmberg; "Geology and Water Resources of Las Vegas, Pahrump, and Indian Spring Valleys, Clark and Nye Counties, Nevada," State of Nevada, Office of the State Engineer Water Resources Bulletin No. 5, 1948, G.B. Maxey and C.H. Jameson.

19. "Hydrologic Implications of Greater Ground-Water Recharge to Las Vegas Valley, Nevada," Journal of the American Water Resources Association, Volume 36, Number 5, October 2000, David J. Donovan and Terry Katzer.

20. "Groundwater and Wells in the Las Vegas Valley," 1998, Southern Nevada Water Authority and Clark County Conservation District.

21. Ibid.

22. "Water Reclamation Facility Cost Analysis," October 20, 2004, prepared for the City of North Las Vegas by Black & Veatch.

23. "Area Wide Reuse Study Las Vegas Valley Area," July 2000, prepared by Black & Veatch for the City of Henderson, City of Las Vegas, City of North Las Vegas, Clark County Sanitation District and the Las Vegas Valley Water District.

CHAPTER 3

Meeting Future Demands

This chapter discusses future water demands and resource options available to meet those demands, given current and projected conditions on the Colorado River and in Nevada.

Resource planning is dependent on conditions that may change in unpredictable ways. As evidenced by Southern Nevada's history, numerous factors can impact demands over long periods of time, as well as from year to year. The farther in the future that demands are projected, the greater the uncertainty in the forecast. This underscores the need for the SNWA to review its Water Resource Plan annually and make adjustments as needed.

To address this uncertainty, the SNWA has taken a portfolio approach to water resource development. The portfolio approach emphasizes acquisition and development of diverse resources, both surface water and groundwater (Colorado River and Nevada in-state resources), in an effort to offset risks typically associated with any single resource option (for example, availability, volume and timing of use). The SNWA water resource portfolio was described in Chapter 2.

Once a portfolio of resource options is acquired, the most challenging aspect is ensuring the development and availability of these resources when they are needed. Several of Southern Nevada's resource options require infrastructure investment or negotiation of legal, environmental, regulatory and administrative processes to bring the resources online. The SNWA works diligently to plan and prepare for these efforts, but the possibility always exists for short-term gaps to occur between demands and the specific resources identified in the SNWA Water Resource Plan to meet those demands. This is why conservation and banked resources are of paramount importance to Southern Nevada. Conservation helps reduce overall demands (relative to levels that would have occurred in the absence of conservation) and increase efficiency, thus extending the availability of existing developed resources over time. Banked resources, in turn, are intended to provide a bridge until permanent, long-term resources in the SNWA portfolio are fully developed and ready for use. Banked resources also provide flexibility in that these resources can help to offset reductions in permanent supplies due to shortages (discussed further in Chapter 4).

Meeting demands through 2060 will require both the efficient use of existing and future supplies and the development of additional water resources. Demands in the 2009 Water Resource Plan cover the SNWA member purveyor service area. The 2009 SNWA Water Budget, a companion document to the Water Resource Plan, provides more detailed forecasts by purveyor through the year 2011.

WATER DEMAND FORECAST

Forecasting is critical for the SNWA, which must plan and build costly infrastructure over a number of years to meet projected demands. Since 1996, the SNWA has adopted water resource plans that show demand forecasts for Southern Nevada across a long-term planning horizon, and the resources anticipated for meeting those demands. Water demand forecasting is based on both population projections and expected conservation. As a result, significant variations in

either factor can impact forecast demands. For example, both higher population and lower levels of conservation will result in higher demands and can significantly impact water resource planning.

The 2009 Water Resource Plan forecasts demands through 2060 based on the June 2008 Clark County Population Forecast prepared by the University of Nevada Las Vegas Center for Business and Economic Research (CBER) (Appendix 4).

Typically, short-term forecasts are more accurate because they are based on the recent past. However, the current economic downturn affecting local, national and even global economies has presented unique challenges to planners as to when the economy will recover and what future growth rates will occur.

As a result, the SNWA has made short-term adjustments to CBER's 2008 population forecast. To reflect current population trends for the year 2009, no growth/additional water demand is assumed; however, annual growth is assumed in future years to bring the forecast in line with the CBER 2008 Clark County Population Forecast. The SNWA will continue to assess these factors in future plan updates.

Figure 24 illustrates near-term adjustments and how water demand forecasts have changed over time as a result of conservation goals and achievements. The upper demand line reflects the SNWA's 2004 baseline water demand level of 274 GPCD. The middle demand line reflects the SNWA's 2005 water conservation goal of 250 GPCD by 2010 and 245 GPCD by 2035. The lower demand line reflects the SNWA's current conservation goal of 199 GPCD by 2035, which was established in 2009. Achieving this goal will reduce water demands by approximately 276,000 acre-feet in 2035, with additional savings in later years. Figure 25 shows the current SNWA demand forecast through 2035.

FIGURE 24 – Summary of SNWA Water Demands and Conservation

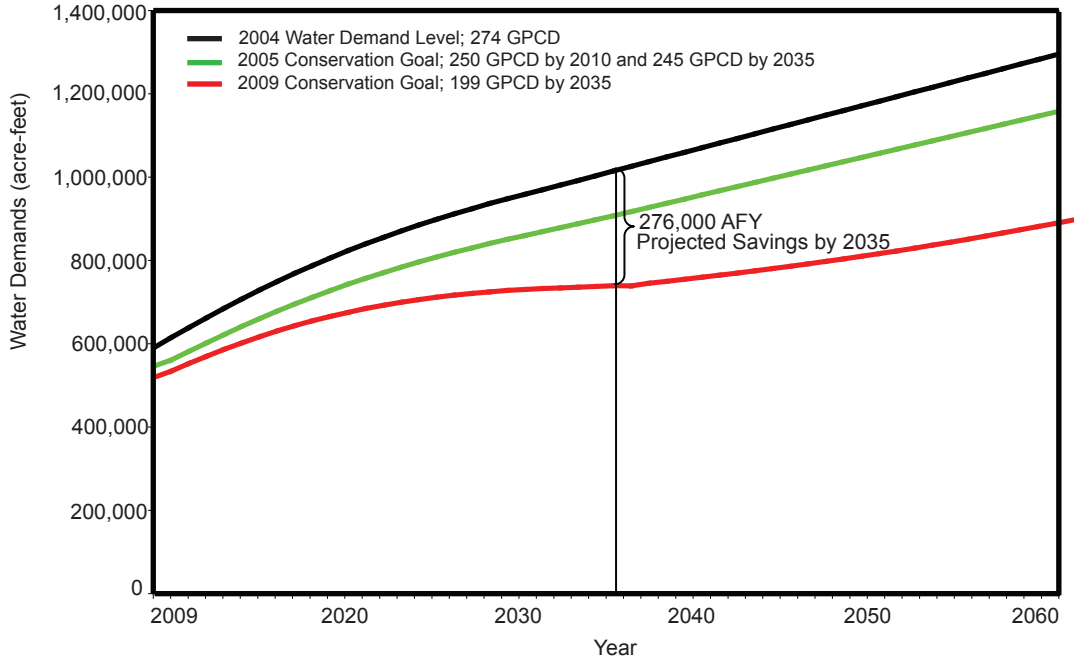


FIGURE 25 – SNWA Annual Demand Forecast*

Year	2010	2015	2020	2025	2030	2035
Demand	553	631	684	717	732	739

**Potable and Non-Potable voumes in thousands of acre-feet.*
Excludes Fort Mohave Generating Station Water Demands

Colorado River Water and Las Vegas Valley Groundwater

To meet demands over the planning horizon, the SNWA intends to utilize a combination of Colorado River and groundwater resources. As discussed in Chapter 2, these include Nevada's basic consumptive-use apportionment of Colorado River water, return-flow credits, Las Vegas Valley groundwater rights, reclaimed water and unused Nevada Colorado River water. Figure 26 depicts these resources, as well as the updated demand forecast.

Nevada's Basic Apportionment and Return-Flow Credits

Nevada's basic Colorado River consumptive-use apportionment and associated return-flow credits is the first resource priority for use. Nevada is allocated 300,000 acre-feet of Colorado River water for consumptive use each year. When combined with return-flow credits, this allocation allows Southern Nevada to divert more than 300,000 acre-feet of water from the river annually. As the largest renewable resource in the SNWA portfolio, Nevada's basic Colorado River allocation and return-flow credits will be used throughout the planning horizon.

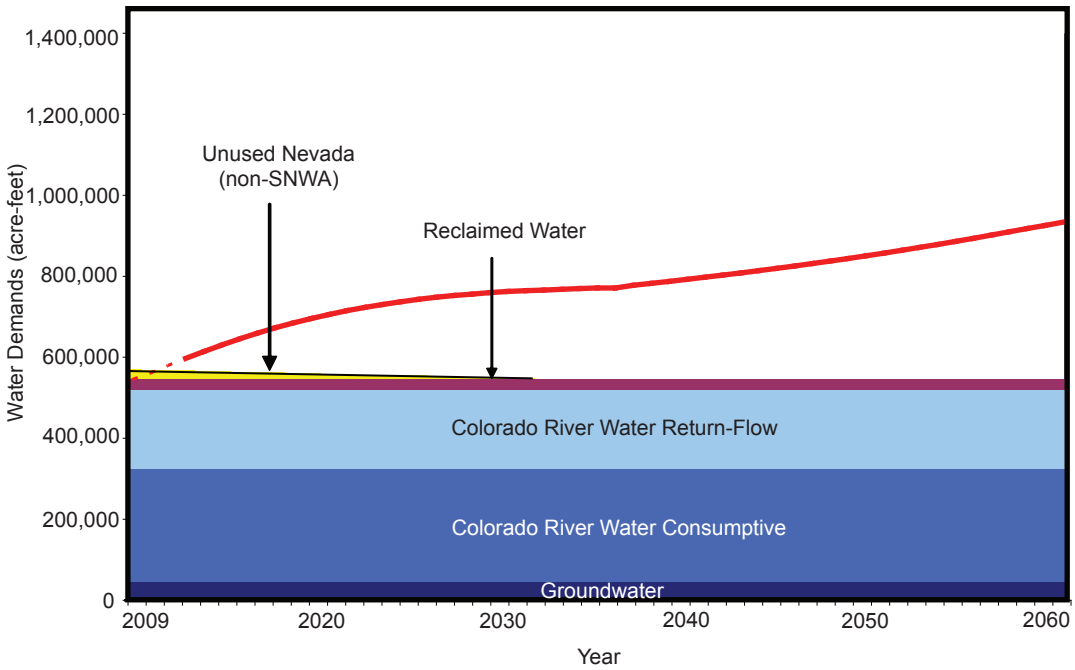
Las Vegas Valley Groundwater Rights

As its next priority, the SNWA will use a total of 46,340 acre-feet of permanent groundwater rights in the Las Vegas Valley each year to meet demands throughout the planning horizon. These groundwater rights are not only a fundamental resource, but also a critical tool to manage peak summer demands for municipal purveyors in the Las Vegas area.

Reclaimed Water

In addition to return-flow credits, Southern Nevada reuses a portion of its highly treated wastewater through direct reuse. This ensures maximum use of resources, including Colorado River and groundwater resources that are being used to meet the SNWA's water needs. As with Nevada's consumptive-use

FIGURE 26 – Water Demand Projections and Current Resources



apportionment and Las Vegas Valley groundwater rights, the SNWA will utilize reclaimed water throughout the planning horizon.

Unused Nevada Colorado River Water

Under existing contracts with the Secretary of the Interior, the SNWA has the right to utilize unused Nevada Colorado River water. In recent years, a portion of Nevada's Colorado River allocation that was contracted to other Nevada users has been unused. The SNWA may use this water to meet demands as appropriate. However, this water is expected to gradually decline in the long-term.

MEETING FUTURE DEMANDS

In addition to the resources just described, the following options are anticipated for use to meet water demands from 2009 through 2060.

Conservation

As discussed in Chapter 2, achieving Southern Nevada's conservation goal is critical to meeting demands across the planning horizon. Figure 27 illustrates the amount of conservation projected to be achieved and the additional resources needed to meet future demands through 2060. The 2009 Water Resource Plan anticipates that conservation will save the community approximately 276,000 AFY by the year 2035.

Flood Control Surplus and Domestic Surplus

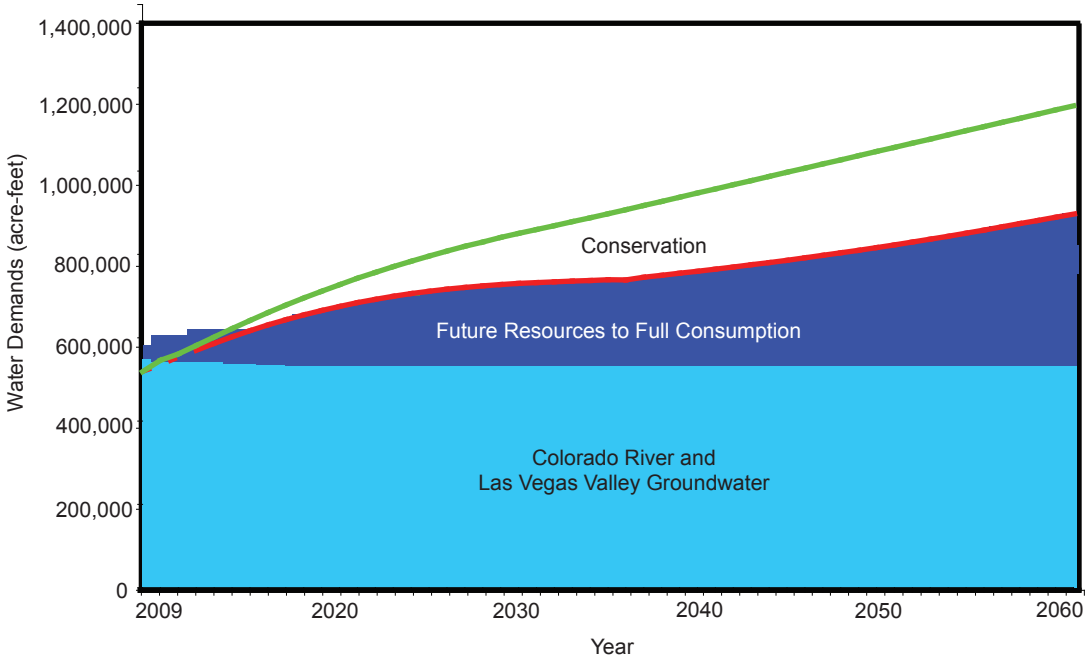
As noted in previous chapters, drought conditions on the Colorado River have affected storage on the river system and thus the availability of flood control surplus and domestic surplus water. The SNWA does not anticipate that flood control surplus or domestic surplus Colorado River water will be available in the near future, and does not include it as a resource available to meet future demands. If flood control surplus or domestic surplus water becomes available under the Interim Guidelines through 2026, these resources will be used to the fullest extent possible.

Intentionally Created Surplus

As discussed in Chapter 2, the SNWA anticipates developing ICS credits as discussed below.

Muddy River/Virgin River Tributary Conservation ICS. The SNWA began using its pre-Boulder Canyon Project Act rights on the Muddy River in 2008. These

FIGURE 27 – Summary of Projected Water Demands and Water Resources



rights will be used in subsequent years and will be utilized to their full consumptive use volume through ICS. For planning purposes, it is anticipated that 30,000 AFY of these rights will be acquired and used to create ICS; however, more than 30,000 AFY may be acquired and used to create ICS in the future.

Coyote Spring Valley Groundwater Imported ICS. The SNWA is constructing a pipeline and facilities to convey its 9,000 AFY of Coyote Spring groundwater rights to the Muddy River and Lake Mead. The project is scheduled to be completed in 2010. These rights will be utilized to their full consumptive use volume through Imported ICS.

Drop 2 Reservoir System Efficiency ICS. The SNWA anticipates using 400,000 acre-feet of water generated by its financial contributions toward the construction of the Drop 2 reservoir project. A maximum of 40,000 AFY is available for recovery during normal conditions. Based on the Drop 2 agreement, the SNWA is limited to a cumulative use of 100,000 acre-feet from 2011 to 2015. The SNWA estimates that this resource could be fully exhausted by 2027.

In-State Groundwater

In-state groundwater resources are long-term, permanent resources that the SNWA will develop over time and manage in conjunction with its Colorado River water supplies. In-state groundwater resources are comprised of rights and applications for groundwater as discussed in Chapter 2, including existing groundwater rights from Three Lakes Valleys (North and South) and Tikaboo Valley South, and existing rights and applications associated with the Clark, Lincoln and White Pine Counties Groundwater Development Project. While many of the water resources associated with the project have been quantified, final project volumes remain uncertain because the SNWA still has applications pending consideration by the Nevada State Engineer.

The resource scenario presented in Figure 28 reflects the development of 134,000 AFY of groundwater associated with the Clark, Lincoln and White Pine Counties Groundwater Development Project. This amount represents the expected volume to be developed based on existing groundwater rights in Spring, Delamar, Dry Lake and Cave valleys, as well as the full volume of applications in Snake Valley that have not yet been acted upon by the Nevada State Engineer. This scenario also assumes the development of 8,018 AFY associated with permitted rights in Three Lakes Valleys (North and South) and Tikaboo Valley South. Current and possible future conditions in the Colorado River necessitate priority development of these resources to protect the community from drought and shortage impacts, and meet future demands.

Full Consumptive Use/Reclaimed In-State Water

As described in Chapter 2, the SNWA currently reclaims all of its wastewater through direct reuse or return-flow credits. Nevada's return-flow credit methodology acknowledges the diverse nature of SNWA's resource portfolio and provides Southern Nevada a method for accounting for future imports of Nevada in-state water to be consumptively used. This will increase the yield of the in-state groundwater imported to the Las Vegas Valley by approximately 70 percent. Figure 28 reflects this increased yield through the full consumption of these in-state resources.

Banked Resources

As discussed in Chapter 4, the SNWA does not anticipate the use of banked resources in the near-term planning horizon (2009-2024). While these resources are available for use if needed to meet short-term gaps between supply availability and demand, banked resources provide a critical tool for the SNWA to meet demands during shortage.

The amount and timing of banked resources that the SNWA ultimately uses will depend on the extent to which conservation continues to be effective in meeting demands, along with the progress achieved by the SNWA in its ongoing development of in-state groundwater resources. The SNWA projects utilizing up to 40,000 AFY of banked resources in Arizona beginning in 2025 until other permanent resources, such as in-state groundwater and Colorado River augmentation (below) are fully developed.

Colorado River Augmentation

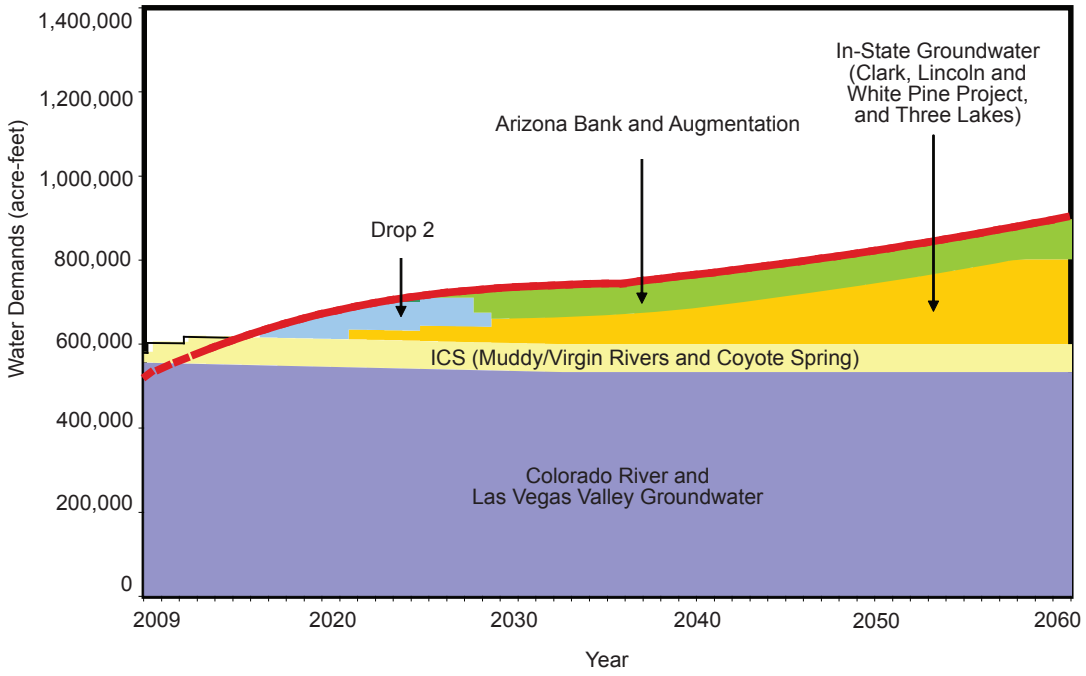
As described in Chapter 2, the other Basin States have committed to working with Nevada to develop additional permanent supplies through system augmentation projects in exchange for deferring development of SNWA's 1994 Virgin River rights. The 2009 Water Resource Plan reflects the consumptive use of up to 75,000 AFY anticipated to be available from future Colorado River augmentation projects. Augmentation is expected to replace banked resources when exhausted.

CONCLUSION

Based on current conditions, the SNWA has sufficient resources available or under development to meet water demands through the year 2060. Beyond continued conservation, Nevada's basic apportionment and Las Vegas Valley groundwater rights, the highest priority resources to meet demands will be development of ICS, in-state groundwater and non-Colorado River resources. When necessary, banked reserves and other temporary resources will be used to bridge demands while the SNWA brings other permanent in-state groundwater resources on-line.

As discussed in Chapter 2, several factors may affect the timing of when and how resources are brought on-line, including future agreements, cost and environmental concerns (see Chapter 5). As a result, having a portfolio of options permitted, under development or being pursued gives the SNWA the ability to adjust some resources if other resources are delayed or revised, or if demands decrease. Likewise, if options such as transfers or exchanges become a reality sooner rather than later, other options in the SNWA water resource portfolio may be given lower priority for development. As the SNWA continues its resource planning efforts, the outlook for future demands will be examined as part of the annual resource planning process and adjusted accordingly.

FIGURE 28 – Projected Water Demands and Future Resources (under normal Colorado River conditions)



CHAPTER 4

Meeting Demands During Shortage

From 2000 to 2004, the Colorado River Basin experienced the most severe 5-year drought in recorded flows on the Colorado River. This extreme drought has been followed by recent years of average and below average Colorado River in-flows.

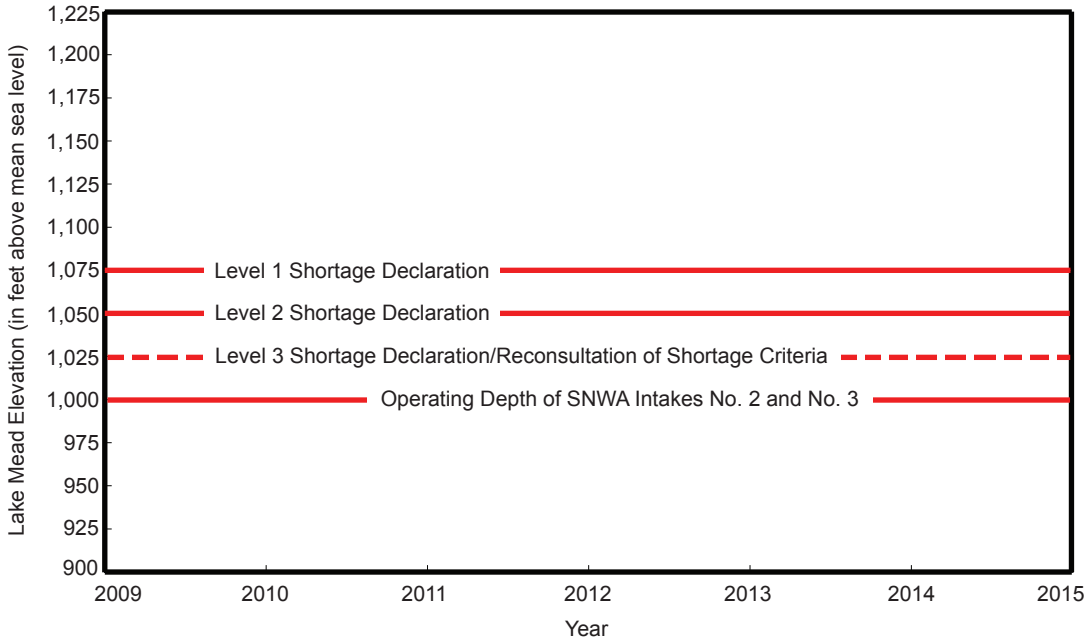
As a result, the water stored in Lake Mead and Lake Powell has declined to 52 percent of the total combined capacity. In early 2009, the surface elevation of Lake Mead was at 1,111 feet, down approximately 100 feet since the late 1990s.

These drought conditions may continue in the future, or may be further aggravated by the effects of climate change, which are not yet fully understood. For the SNWA, there are two primary consequences of continued declines in Lake Mead water levels: possible reduction of available Colorado River supplies and operating challenges associated with water intake facilities at Lake Mead.

This chapter describes how Colorado River shortages will be managed; the resources available to the SNWA during shortage; and what measures will be taken to ensure sufficient water resources are available to the SNWA in the event of supply reductions.

As described in Chapter 2, the Secretary of the Interior's Record of Decision on Colorado River Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead established shortage levels based on Lake Mead elevation (Figure 29). Based on these levels, and according to the shortage sharing agreement

FIGURE 29 – Shortage Declarations



between Nevada and Arizona (Figure 30), the SNWA will incur shortages when Lake Mead water levels drop below 1,075 feet. The volume of water available to Nevada and Arizona decreases as lake levels continue to decline. If Lake Mead reaches an elevation of 1,025 feet, the lower division states of Arizona, Nevada, and California will re-consult with the Secretary of the Interior to determine what additional measures are necessary to minimize further declines in Lake Mead elevation and preserve Lower Basin States' access to Colorado River water.

Figure 30 – Nevada Share of Shortage

Lake Mead Water Level	Nevada Shortage	Arizona Shortage
1,075 - 1,050 ft.	13,000 afy	320,000 afy
1,050 - 1,025 ft.	17,000 afy	400,000 afy
Below 1,025 ft.	20,000 afy	480,000 afy
	Reconsultation	

As detailed in Chapter 3, the SNWA has a number of water resource options available for use under normal (non-shortage) conditions. However, many of these resources depend on the operation of existing and planned water intake facilities at Lake Mead. As a result, the community's ability to utilize these resources may be diminished as lake levels decline. To this end, the SNWA committed to sharing in Colorado River shortages to maintain Lake Mead surface elevations at or above 1,000 feet – the operational level of SNWA's lower intake facilities.

SHORTAGE RESPONSE

As outlined in Figure 30, reductions to Southern Nevada's Colorado River consumptive-use apportionment could reach 20,000 AFY when Lake Mead water levels are above 1,000 feet. Analysis of Colorado River Basin uses and inflow indicate a 1 percent probability that Lake Mead will reach an elevation of 1,075 feet by 2011 and 1,025 feet by 2014.

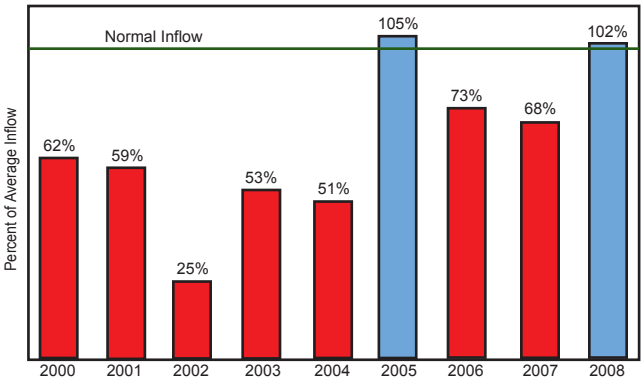
Figure 31 (page 46) displays one possible scenario for how the SNWA would adjust its water planning efforts to accommodate a long-term shortage through the year 2026.

The SNWA would continue to utilize tributary conservation and imported ICS water (Muddy/Virgin rivers and Coyote Spring Valley resources), but would be required to forego use of its System Efficiency ICS water (Drop 2 Storage Reservoir), which is restricted from use during a declared shortage. To bridge this gap, the SNWA could utilize temporary resources, including banked water supplies, until in-state groundwater is brought on-line.

SEVERE SHORTAGE RESPONSE

Between 2000 and 2008, the 9-year average historical inflow to Lake Powell was 66 percent of normal (Figure 32).

Figure 32 – Historical Lake Powell Annual Inflows



According to modeling conducted by the Bureau of Reclamation, with an average runoff of 69 percent of normal for the next six years (2009-2014), Lake Mead elevation could decline to 1,000 feet in as early as 2015. This elevation impairs the operational capability of SNWA intakes (Figure 33). Even more severe conditions, such as those experienced between 2000 and 2004 (50 percent of average) could cause Lake Mead water levels to decline even faster. In either case, water levels below 1,000 feet would impair SNWA's ability to access Colorado River water resources.

Figure 31 – Meeting Demands During Declared Shortage Conditions

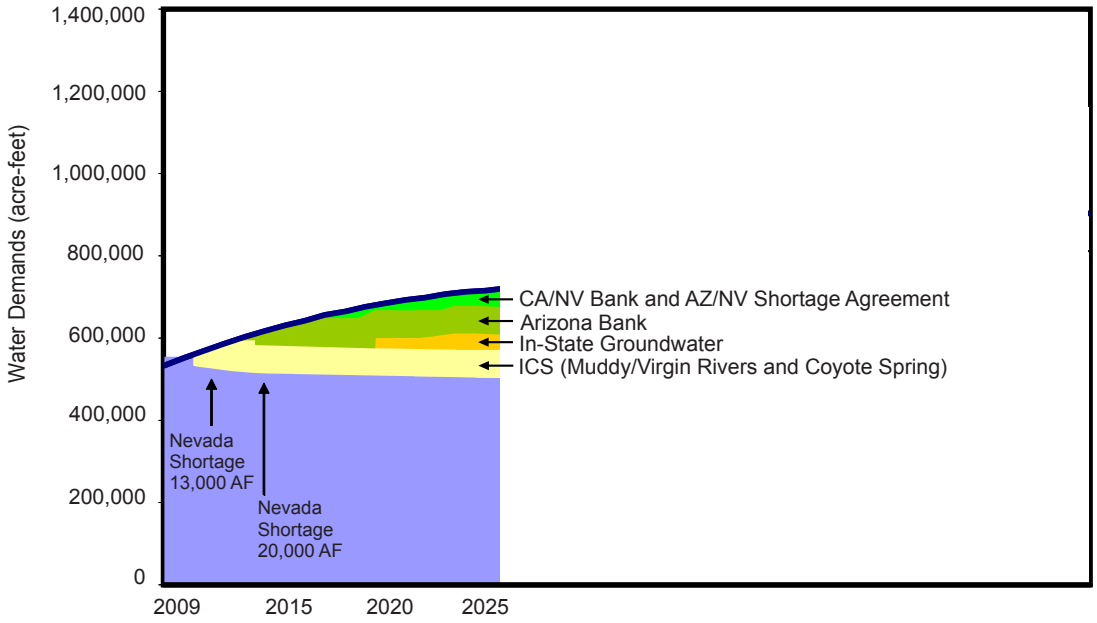
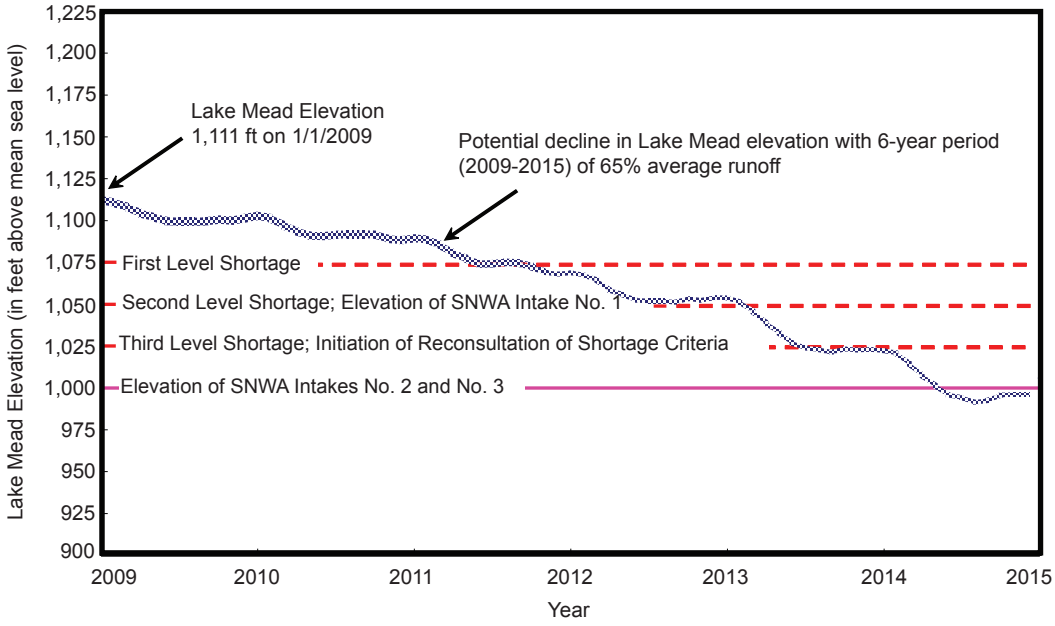


Figure 33 – Impacts to Lake Mead Intakes with Six Year Period of 65 Percent Average Runoff



The following section outlines SNWA's planned response to a "severe shortage." This response is intended to protect the SNWA by offsetting possible impacts of supply reductions and ensuring that sufficient resources are available to the community should the elevation of Lake Mead decline below 1,000 feet, the operational limit of SNWA's current and planned intake facilities.

A staged response, as detailed below, will occur based on Lake Mead water levels:

- 1,075 to 1,025 feet
- 1,025 to 1,000 feet
- Below 1,000 feet

Lake Mead Elevation 1,075 to 1,025 feet

Facility Construction. To preserve the lead time required to construct the Clark, Lincoln and White Pine Counties Groundwater Development Project, the SNWA will take the steps necessary to begin project construction when Lake Mead reaches a surface elevation of 1,075 feet; these resources are currently planned for use in 2020 under normal, non-shortage conditions.

Demand Management Assessment. The SNWA will also examine additional demand-management needs over and above existing water conservation goals and annual targets, as discussed in Chapter 2.

It is important to note that arbitrarily reducing water demands beyond those levels currently defined will not have a measurable benefit to Lake Mead water levels – Nevada's Colorado River allocation represents approximately two percent of the recorded total average system flow. As an example, 100,000 acre-feet in Lake Mead is equivalent to about 1 foot of elevation. Evaporation on Lake Mead alone exceeds this amount by two to four times, depending on surface elevation. However, additional conservation will help extend the use of Nevada's existing supplies if severe shortages occur.

Lake Mead Elevation 1,025 to 1,000 feet

Reconsultation. In accordance with the Secretary of the Interior's 2007 Record of Decision, the Colorado River Basin states will re-consult on Colorado River management strategies when Lake Mead reaches a surface elevation of 1,025 feet and shortage volumes have the potential to exceed 500,000 AFY. Parties will work together to determine what measures can be employed to protect a Lake Mead surface elevation above 1,000 feet.

Demand Management. The SNWA will implement additional mandatory demand management tools defined by earlier assessment. These additional water saving measures will help to maximize the availability of existing supplies and new in-state supplies, when available.

Contingency Assessment. The SNWA will assess options for continued access to Colorado River resources in the event that Lake Mead intakes become inoperable. This includes examining the potential for temporary infrastructure to extend the operational capabilities of SNWA's intakes in Lake Mead to pump water below 1,000 feet into existing water intakes.

Lake Mead Elevation Below 1,000 feet

In the unlikely event that Lake Mead water levels reach a depth below 1,000 feet, the SNWA will have a significantly limited ability to withdraw its Colorado River apportionment, as well as other water supplies accessed through Lake Mead, including return-flow credits, ICS resources (Muddy/Virgin rivers and Coyote Spring), and banked resources such as the Arizona and California water banks.

Restrict Non-Essential Water Use. The SNWA will maximize in-state and locally banked resources when Lake Mead reaches 1,000 feet by restricting non-essential water uses. Doing so will ensure that critical supplies are preserved for health and safety uses.

Figure 34 provides a summary of these actions, as well as triggers associated with Lake Mead water levels.

Figure 34 – Severe Shortage Plan

Lake Mead Elevation	Goal	Action
1,075 to 1,025 ft.	Preserve lead time for new facility development.	Construct Clark, Lincoln and White Pine Counties Groundwater Development Project. Examine demand-management needs over and above existing conservation goals/annual targets.
1,025 to 1,000 ft.	Preserve Lake Mead elevation of 1,000 ft.	Reconsult with the Secretary of the Interior and Basin States on additional Colorado River shortage management strategies. Implement additional demand-management measures through mandatory policies to offset further Colorado River Basin supply shortages. Examine potential for temporary infrastructure to extend the operational capabilities of SNWA's intakes in Lake Mead.
Below 1,000 ft.	Preserve water supply for health and safety uses.	Maximize use of available groundwater supplies (Southern Nevada Groundwater Bank and in-state resources). Significantly limit non-essential uses.

CONCLUSION

Water managers throughout the West recognize that even if Colorado River system inflows consistently return to pre-drought levels, it will take several years of above-average runoff for system reservoirs to fully recover. Likewise, if drought conditions continue to persist, further declines to storage will occur, possibly resulting in shortages due to reduced water storage. Given the current elevation of Lake Mead, one exceptionally dry year – such as that experienced in 2002 (25 percent of average inflow) – could have a significant effect on area reservoirs.

To this end, the greatest protection the community has against further Lake Mead water level decline is development of in-state groundwater resources. Additional water conservation will also play a critical role by helping to reduce demands, but conservation alone will not provide sufficient protection to completely replace those supplies lost if access to Lake Mead is interrupted or otherwise significantly reduced.

To mitigate any possible supply reductions, the SNWA will utilize banked water resources to meet near-term community water demands during times of declared shortage or severe shortage. The SNWA must complete necessary permitting activities and construct in-state water facilities, as dictated by Colorado River hydrology, implement appropriate water demand management tools to extend available supplies during times of severe shortages and investigate alternatives for Colorado River access.

The SNWA will closely monitor drought conditions throughout the Colorado River Basin and enact the appropriate response necessary to help protect the community from possible supply reductions. While the SNWA Water Resource Plan is reviewed annually, a detailed assessment of Colorado River conditions will occur regularly to inform community response.

In the event Lake Mead water levels decline rapidly, the SNWA will take appropriate and measurable actions to ensure that sufficient resources are available to preserve essential municipal water supplies.

CHAPTER 5

Environmental Commitment

To support its resource planning and facility expansion activities, the SNWA began to participate in a number of environmental initiatives and coalitions in the mid-1990s, taking a proactive and integrated approach to water resource management.

The SNWA's commitment to environmental responsibility typically goes beyond the steps necessary to ensure compliance with applicable regulations or statutes. Efforts have included the support of research and recovery activities related to federally endangered fish, birds and wildlife; involvement in broader regional programs that address issues such as habitat conservation and water quality; and financial and staff support for environmental research and studies.

As part of its long-term resource planning, the SNWA is working with various stakeholders in the region to address environmental issues and concerns through regional planning programs. Some of these programs form the basis for compliance with appropriate environmental laws and regulations.

The following sections briefly describe the SNWA's environmental initiatives – planning, compliance and environmental commitments – related to SNWA's water resource portfolio.

COLORADO RIVER

The majority of water used in Southern Nevada comes from the Colorado River, making Colorado River environmental issues among the most important to the SNWA. Alterations along the river have affected its ecosystems in both the United States and Mexico. Native fish, birds and other wildlife species have been listed by the U.S. Fish and Wildlife Service (USFWS) under the federal Endangered Species Act (ESA) as threatened and endangered. Riparian, wetland and aquatic habitats have been reduced and/or modified. These environmental issues have the potential to directly affect the SNWA's ability to construct necessary facilities and continue withdrawing water from the river.

Lower Colorado River Multi-Species Conservation Program

In 1994, major portions of the Colorado River were designated as critical habitat for four endangered fish. The four federally-listed endangered fish are the razorback sucker (Xyrauchen texanus), bonytail (Gila elegans), humpback chub (Gila cypha) and Colorado pikeminnow (Ptychocheilus lucius). The 1994 critical habitat designation meant that federal agencies had to consider not just potential project impacts on endangered fish, but also potential impacts on the habitat as well. This requires all federal agencies to consult with the USFWS under the ESA for most actions on the river, including the operation of existing facilities.

As a result of the critical habitat designation, Arizona, California, Nevada and the Department of Interior began developing the Lower Colorado River Multi-Species Conservation Program (MSCP) in 1994 and completed program development in 2004. The goal of the MSCP is to implement a coordinated conservation strategy that will permit federal and non-federal operations in the Lower Colorado River to continue with flexibility, while working toward the

recovery of listed species. A Steering Committee of stakeholders, including the SNWA, oversees program implementation, which will provide ESA compliance for federal and non-federal operations on the Lower Colorado River for the next 50 years.

Implementation of the program began in 2005 and is estimated to cost $626 million (in 2003 dollars) over the 50-year life of the program. The Bureau of Reclamation will provide 50 percent of the program funding with the remaining 50 percent to be split between the three Lower Basin States (California – 50 percent, Nevada – 25 percent, Arizona – 25 percent). The MSCP Steering Committee meets three times a year to discuss and approve action items for the MSCP. The Steering Committee has 56 members including federal agencies, state agencies, Indian tribes, and interested conservation organizations. The Bureau of Reclamation is currently pursuing more than 60 restoration and research projects as part of the Fiscal Year 2009 Work Plan.

Some of the MSCP projects currently underway in Nevada include razorback sucker studies on Lake Mead and southwestern willow flycatcher surveys along the Virgin and Muddy rivers. In December 2005, the SNWA purchased the Boy Scout Property in Laughlin, Nevada, a 15-acre property located along the Colorado River and surrounded by Big Bend State Park. In October 2008, the MSCP Steering Committee agreed to fund restoration of the property. The SNWA is currently working with Nevada State Parks, Nevada Department of Wildlife and the Bureau of Reclamation to develop a restoration plan.

In addition to the MSCP, the SNWA participates in species-specific research and conservation efforts related to Nevada's Colorado River resource. The information gained from these activities has proven instrumental to ensuring the best available information is utilized in making critical decisions concerning water resources and species conservation.

Colorado River Delta

Historically, the Colorado River Delta (Delta) in Mexico sustained significant wetland and estuarine ecosystems that support a diverse array of plant and animal species including several that are listed as endangered in both the U.S. and Mexico. During the last century, the construction of dams, and subsequent diversion of water from the Colorado River in the U.S. and Mexico to support agricultural and urban uses, reduced water and sediment flows to the Delta. This contributed to a substantial reduction of riparian and wetland areas in the Delta from pre-dam levels and resulted in listing of several species as endangered. Many environmental organizations have advocated increased water flows and changed management of the river flows to improve and restore more of the Delta ecosystem.

The SNWA participates in a bi-national process formed by the United States and Mexico International Boundary and Water Commissions. This process includes bi-national efforts to explore potential cooperative actions in the areas of water conservation, new water sources, environmental issues and system operations.

Continued drought and increased demands for Colorado River water resources will likely increase the complexity of Colorado River Delta issues.

Las Vegas Wash and Lake Mead

The Las Vegas Wash (Wash) plays an important role in the environmental and water-resource issues facing Southern Nevada. The Wash is the primary drainage channel for all stormwater flows, surface runoff, highly-treated wastewater flows and shallow groundwater flows in the Las Vegas Valley. These flows represent less than 2 percent of the flow into Lake Mead, but are an important component since they contribute to return-flow credits associated with Nevada's Colorado River allocation. Historically, wetlands to the Wash have served to remove pollutants and suspended solids as urban flows pass into the Colorado River system. However, since the 1970s, erosion and head-cutting have dramatically reduced the amount of wetlands in the Wash, leading to

increased sedimentation into Lake Mead, habitat loss and water quality concerns.

In 1998, the Las Vegas Wash Coordination Committee (Coordination Committee) was formed to address the many issues associated with the Wash. The Coordination Committee consists of 30 member entities, representing federal, state and local agencies, organizations and citizens. In 1999, the Coordination Committee completed the Las Vegas Wash Comprehensive Adaptive Management Plan, which provides a comprehensive set of management actions for stabilizing and enhancing the Wash. Implementing these actions are needed to improve water quality and protect the valley's watershed. Erosion control, environmental monitoring, and wetlands restoration and enhancement are key priorities. The plan was adopted by the SNWA Board of Directors in 2000.

Later that year, the SNWA was designated the lead agency for the implementation of the Las Vegas Wash Comprehensive Adaptive Management Plan and established the Las Vegas Wash Project Coordination Team to provide administrative and technical support to the Coordination Committee. Since its inception, the Coordination Committee and its partners have constructed eleven grade control structures, installed roughly 40,000 linear feet of stream bank protection, conducted bioassessment monitoring as well as water quality and tributary monitoring, implemented a variety of fish and wildlife surveys, revegetated more than 195 acres with native plants, and performed archaeological investigations. These efforts have resulted in a nearly 80 percent total sediment reduction, improving water quality in both the Wash and Lake Mead.

The Clean Water Coalition (CWC), comprised of the City of Las Vegas, City of North Las Vegas, City of Henderson and Clark County Water Reclamation District, has been studying alternatives to the discharge of treated effluent in the Wash for several years, known as the Systems Conveyance and Operations Program (SCOP). In 2002, the CWC formed a citizens advisory committee to address alternatives to protect water quality in the Wash and Las Vegas Bay of Lake Mead so that conditions do not degrade or result in regulatory action. In February 2004, the committee's recommendations were approved by the CWC Board. A Final EIS for the SCOP was completed in October 2006 and Records of Decision from both the National Park Service and Bureau of Reclamation were issued on July 5 and July 9, 2007, respectively.

Given the nexus between water and wastewater in Southern Nevada, the SNWA is working closely with the CWC to coordinate various activities. In January 2007, the SNWA entered into a Memorandum of Understanding (MOU) with the CWC, National Park Service and Bureau of Reclamation committing to participate in the development and implementation of the Boulder Basin Adaptive Management Plan (BBAMP). A subsequent MOU was approved that included a representative from the Metropolitan Water District of Southern California as a member of the Technical Coordination Team for the BBAMP. In September 2007, the USFWS was added as a participant in the BBAMP.

The BBAMP will:

1. Establish management objectives regarding water quality, nutrient management and recreational uses;
2. Establish procedures for and undertake water quality monitoring and analysis of the data;
3. Develop management indices and decision making processes to address areas of concern;
4. Develop an annual operation and management action plan; and
5. Establish a core management team to oversee and manage the BBAMP.

Four Technical Advisory Teams have been established, which include:

- Water Quality Objectives
- Monitor and Modeling
- Selenium Management
- Plant Operations

Las Vegas Valley Watershed Advisory Committee

In May 2007, SNWA adopted a resolution supporting the establishment of regional water quality goals and the development of a regional water quality committee. In support of this effort and in coordination with several regional partners, the Las Vegas Valley Watershed Advisory Committee (LVVWAC) was created. LVVWAC is comprised of the following agencies:

- Clean Water Coalition
- Clark County
- Clark County Regional Flood Control District
- Clark County Water Reclamation District
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Las Vegas Valley Water District
- Southern Nevada Water Authority

Through its mission, the LVVWAC works to protect, preserve and enhance the quality and quantity of water resources in the Las Vegas Valley watershed and to sustain economic well-being and protect the environment for present and future generations. Another important charge of the LVVWAC is coordinating management decisions associated with the Las Vegas Wash.

A major accomplishment of the LVVWAC was the development of a Regional Water Quality Plan (Plan) in 2008. The Plan represents a demonstrated effort among agencies in Southern Nevada to coordinate all existing plans, policies, documents and efforts related to water quality in the Las Vegas Valley watershed and Lake Mead. The Plan identifies seven goals and associated strategies that work to protect the overall water quality of the Las Vegas Valley watershed, while also working to protect the watershed's resources, uses and values.

LVVWAC Regional Water Quality Goals include:

1. Protect Lake Mead as a source of water for Southern Nevada and downstream users.
2. Meet or surpass federal, state and local standards and regulations.
3. Preserve and enhance the natural, cultural, historic and recreational values for the watershed and Lake Mead.
4. Coordinate water resource management.
5. Manage flood risks.
6. Sustain water and energy resources for future generations.
7. Build community awareness and support for regional watershed management.

The regional member agencies of the LVVWAC (CWC, Clark County Regional Flood Control District and SNWA) have began developing Annual Operating Plans that detail operational-level tactics to achieve the water quality goals adopted in the plan.

MUDDY RIVER AND COYOTE SPRING VALLEY

As noted in Chapter 2, the SNWA has Muddy River surface water rights and Coyote Spring groundwater rights. This section describes the environmental initiatives underway with respect to the development of these resources. The Interim Guidelines include provisions that will allow the SNWA to recover Muddy River water rights it owns or leases that pre-date the Boulder Canyon Project Act and its Coyote Spring Valley groundwater rights as Intentionally Created Surplus (ICS) from Lake Mead through existing infrastructure. The mainstem Muddy River tributaries and springs of the upper Muddy River provide habitat for several fish species that are considered rare and sensitive. The Muddy River and the Warm Springs area are home to the endangered Moapa dace (Moapa coriacea) as well as species of concern, which include the Moapa White River springfish (Crenichthys baileyi moapae), the Moapa speckled dace (Rhinichthys osculus moapae), and the Virgin River chub (Gila seminuda).

The USFWS manages the Moapa Valley National Wildlife Refuge (MVNWR) in this area for conservation of the Moapa dace, as well as additional sensitive species on the river including three fish, two snails and two insect species. Conservation of the Muddy River species is a priority for local, state and federal agencies.

In April 2006, the SNWA approved a Memorandum of Agreement (MOA) among the USFWS, Coyote Springs Investment, LLC (CSI), Moapa Band of Paiutes (Tribe), Moapa Valley Water District (MVWD) and the SNWA, which establishes a plan for monitoring, management and mitigation that allows for groundwater development in Coyote Spring Valley and California Wash groundwater basins, while simultaneously working to protect and recover the Moapa dace. The MOA is also the subject of a Programmatic Biological Opinion that covers a total of 16,100 AFY of groundwater development. The 16,100 AFY includes 9,000 AFY by the SNWA in Coyote Spring Valley; 4,600 AFY by CSI in Coyote Spring Valley; and 2,500 AFY by the Tribe in California Wash.

The MOA and Programmatic Biological Opinion specify conservation measures to be implemented by the signatories. In 2007, the SNWA Board of Directors approved an agreement with USFWS to implement the following conservation measures:

- Construction of fish barriers in the Muddy River. The SNWA will contribute $50,000 towards construction of fish barriers.
- Eradication of non-native fishes. The SNWA will provide $25,000 to help eradicate tilapia and other non-native fishes on privately-owned lands in the area.
- Improvement/restoration of Moapa dace habitat on the Apcar Unit of the MVNWR. The SNWA will provide $750,000 to implement non-native vegetation removal and stream restoration within the Apcar Unit of MVNWR.
- Development of a Recovery Implementation Program. The SNWA will provide $300,000 towards development of a recovery program that will prioritize and identify implementation of recovery measures for the Moapa dace.
- Development of an Ecological Model. The SNWA and USFWS will provide $125,000 each for development of an ecological model for the Moapa dace. It is anticipated that the U.S. Geological Survey will develop the ecological model under contract with the USFWS.
- Establishment of a Hydrologic Review Team (HRT). The signatories to the MOA formed the HRT to develop and coordinate regional monitoring efforts of the groundwater pumping proposed under the MOA. The HRT members discuss and perform analyses of groundwater pumping effects and natural climatic variation on the Muddy River and Muddy Springs.

Muddy River Recovery Implementation Program

Development of the Muddy River Recovery Implementation Program (RIP) was identified in the Programmatic Biological Opinion. The purpose of the RIP is to provide a comprehensive umbrella ESA program for water resource management in the Coyote Spring Valley, as well as the Warm Springs and Muddy River areas, while working toward recovery of listed species and identifying opportunities for sensitive species and their habitat. The RIP Executive Committee is comprised of the SNWA, USFWS, CSI, the Tribe, and MVWD. The RIP geographic program area extends from the upper Muddy River to Lake Mead.

The RIP is expected to be completed in mid-2009 and program implementation will begin shortly thereafter. When the RIP is finalized, SNWA and the Executive Committee members will be able to undertake restoration actions that contribute toward the recovery of listed species. The restoration actions will contribute to a species recovery bank and can be utilized as credit toward future water development actions requiring ESA compliance.

Warm Springs Natural Area

In February 2006, the Secretary of the Interior approved funding through the Southern Nevada Public Lands Management Act (SNPLMA) for SNWA to purchase 1,218 acres of land historically known as the Warm Springs Ranch, located in the Moapa Valley. In July 2006, the SNWA Board approved a purchase agreement for the property located in the Moapa Valley, and completed the purchase in 2007. Because that funding was secured under the SNPLMA "Parks, Trails and Natural Areas" category, SNWA committed to protect and preserve the property as a natural

area. SNWA began convening cooperators to identify long-term management priorities and renamed the property the "Warm Springs Natural Area."

By purchasing the property, the SNWA was able to protect the majority of the endangered Moapa dace population and its habitat, and prevent the property from being developed for residential purposes. By protecting the Moapa dace and its habitat, the SNWA can responsibly move forward with development of SNWA's water resources in the Muddy River and Coyote Spring areas.

The Warm Springs Natural Area and the Moapa Valley National Wildlife Refuge encompass about 20 springs that form the headwaters of the Muddy River. The springs and their outflows onto the Warm Springs Natural Area are home to the majority of the Moapa dace population. A total of 18 endangered, sensitive and endemic species are found on the Warm Springs Natural Area. In addition, the property has the largest breeding population of vermillion flycatchers in Nevada.

Although the primary purpose is to manage the property for the protection of the Moapa dace, the SNWA committed to manage the entire property as a natural area and develop a long-term management plan. SNWA also committed to manage the property in close coordination with the Moapa Valley National Wildlife Refuge and the Nature Conservancy Muddy River property.

VIRGIN RIVER

As noted in Chapter 2, the SNWA has water rights in the Virgin River. The Secretary of the Interior's Interim Guidelines include provisions that will allow the SNWA to recover its Virgin River rights that pre-date the effective date of the 1928 Boulder Canyon Projects Act as ICS through existing facilities in Lake Mead. This section describes the environmental initiatives currently underway with respect to these resources.

The SNWA has been involved in environmental studies on the Virgin River since 1993. In fact, much of the available biological information concerning the lower Virgin River has been collected as a result of efforts by the SNWA. This includes population and habitat surveys for fish, birds, mammals, amphibians and sensitive plants. The SNWA participates in a number of environmental stakeholder forums involving the upper and lower Virgin River. For example, the SNWA has been a member of the Virgin River Fishes Recovery Team since 1994.

The Virgin River is one of the largest riparian corridors in the desert southwest and is home to the federally endangered woundfin (Plagopterus argentissimus), Virgin River chub, southwestern willow flycatcher (Empidonax traillii extimus) and Yuma clapper rail (Rallus longirostris yumanensis), and the candidate species yellow-billed cuckoo (Coccyzus americanna) and Virgin River spinedace (Lepidomeda mollispinis mollispinis). There are more than 200 other species of wildlife that also utilize this riparian corridor as a residence or seasonal migration route. Supporting a high level of biodiversity, the Virgin River is regarded by federal and state resource agencies and environmental organizations as an integral component of the desert southwest ecosystem.

In the upper Virgin River, in the State of Utah, federal, state and local agencies and various other stakeholders are implementing the Virgin River Resource Management and Recovery Program. This program provides environmental compliance for water development and flood-control projects by implementing resource-management agreements aimed at recovery of listed species, conservation of native species and protection of the river corridor.

The lower Virgin River in Nevada is increasingly facing similar ESA issues surrounding development pressures and as a result, has been begun a regional environmental planning effort called the Virgin River Habitat Conservation and Recovery Program.

Virgin River Habitat Conservation and Recovery Program

Developing the Virgin River Habitat Conservation and Recovery Program (VRHCRP) was a requirement of the Mesquite Lands Act of 1998. This Act authorized the BLM to sell 10,620 acres of BLM land to the City of Mesquite. The City of Mesquite plans to sell that land to developers and reserve some acreage for an airport.

In October 2002, special legislation as part of the Clark County Conservation of Public Land and Natural Resources Act of 2002 was passed in Congress. The legislation allows the City of Mesquite to use proceeds from the BLM land sale for the development of the VRHCRP and a Hydrological Monitoring and Mitigation Program (HMMP). The intention of the HMMP is to address future unknown potential effects of groundwater pumping on the Virgin River. The HMMP is designing a monitoring program and will collect and evaluate data from new and existing groundwater monitoring wells and existing surface water gages. The data will be used to determine a baseline and whether increased groundwater pumping by Virgin Valley Water District (VVWD) is affecting habitat or species along the Virgin River.

The City of Mesquite started development of the VRHCRP in 2004. In 2005, an Executive Committee was formed consisting of the City of Mesquite, SNWA, Clark County, VVWD, National Park Service, Nevada Department of Wildlife and BLM. Technical committees have also been established to provide recommendations to the Executive Committee. The VRHCRP is expected to become final through an implementation agreement in 2009.

In addition to the VRHCRP effort, the Lower Virgin River Recovery Implementation Team is working to develop a conservation action plan for the endangered woundfin and Virgin River chub. This team is also conducting research and implementing interim conservation measures for these listed fish. The Virgin River Conservation Partnership is a stakeholder group composed of federal, state and local agencies working to share information and make recommendations to planning efforts like the VRHCRP. The SNWA is a key participant in these Virgin River environmental efforts to ensure they are coordinated with the development of SNWA's water rights in the Virgin River.

CLARK COUNTY

After the ESA listing of the desert tortoise (Gopherus agassizii) in 1989, local agencies in Clark County recognized the need to address concerns about listed or sensitive species that could affect development in the county.

Clark County Multiple Species Habitat Conservation Plan

Beginning in 1998, the Clark County Multiple Species Habitat Conservation Plan (MSHCP) was developed to address biological resources within Clark County. In addition to the desert tortoise, the program provides ESA coverage for 77 additional species. 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 in order to meet the needs of the growing population in Clark County. The SNWA actively participates in the MSHCP. The MSHCP serves as an insurance policy to cover future federal listings of species in areas where urban development is taking place.

CLARK, LINCOLN AND WHITE PINE COUNTIES GROUNDWATER

In August 2004, the SNWA applied to the BLM for rights-of-way to construct facilities to develop the Clark, Lincoln and White Pine Counties Groundwater Development Project (GWP) in eastern Nevada. The BLM has determined that it is necessary to prepare an EIS and Biological Assessment (BA) to evaluate the environmental impacts of issuing these rights-of-ways. Public scoping for the EIS was held from April through August 2005, and again from July through August 2006.

The SNWA has submitted a draft Conceptual Plan of Development for the project to the BLM, which describes information such as project

location, construction methods, and operation and maintenance. The SNWA has conducted hydrologic and environmental research in this region since the early 1990s and has provided these data to the BLM for their consideration through the environmental compliance process. Biological information provided includes survey data for bats, small mammals, pygmy rabbits, sage grouse, raptors and ferruginous hawks, breeding birds, sensitive plants, general wildlife, weeds, terrestrial invertebrates and aquatic ecosystems The SNWA has also collected extensive geologic and hydrologic data from published sources, field surveys and studies, and new monitoring and testing wells. A groundwater flow model is being developed from this data as part of the EIS analysis, which will evaluate potential effects of groundwater production on water levels and spring flows. This information will allow SNWA and the BLM to better predict potential impacts from groundwater development and develop hydrologic monitoring and management plans to reduce or avoid impacts.

The EIS will analyze potential effects of the project on the human environment, which includes such resource topics as geology, soils, water, biology, paleontology, geologic hazards, land ownership and use, special use areas, noise, air quality, visual, cultural resources and socioeconomics. It is anticipated that the EIS will be available for public review in late-2009 and completed in late-2010. The BA will analyze potential project effects on federally listed and candidate species, and will be submitted to the USFWS late-2009

As noted in previous chapters, the SNWA entered into a stipulated agreement with the USFWS, National Park Service, BLM and Bureau of Indian Affairs (Department of Interior Agencies) to work together to protect the Great Basin National Park and the groundwater dependent ecosystems in Spring Valley. The stipulation establishes an Executive Committee, a Biological Work Group and a Technical Review Panel to develop and implement monitoring, management and mitigation measures. Both Hydrological and Biological monitoring plans have been completed and approved by the Nevada State Engineer, and implementation will begin in early 2009.

In 2008, the SNWA again entered into a stipulated agreement with the Department of Interior (DOI) Agencies, and a separate agreement with the Moapa Band of Paiutes. The stipulated agreement with the DOI is intended to protect groundwater dependent ecosystems and federal resources within Dry Lake, Delamar and Cave valleys, three of the five basins included in the GWP, and in White River and Pahranagat valleys. As with Spring Valley, this agreement provides for monitoring, management and mitigation measures, which are currently being developed by biological and hydrological technical committees. Baseline monitoring for Dry Lake, Delamar and Cave valleys is anticipated to begin in 2010.

To support groundwater development in eastern Nevada, the SNWA has acquired seven ranch properties comprised of more than 24,000 acres, approximately 950,000 acres in grazing allotment permits, more than 5,000 head of livestock, and more than 33,900 AFY in surface water rights. These land, water and livestock resources are an important suite of management tools that will allow SNWA to meet its environmental commitments by integrating their management with groundwater development. Protection of sensitive habitats, wildlife and the aesthetic values of eastern Nevada can be balanced with SNWA groundwater development through proactive integrated resource management.

THREE LAKES VALLEY GROUNDWATER

In April 2004, the SNWA applied to the BLM for rights-of-way to construct facilities to develop groundwater resources in Three Lakes Valley. After decisions have been made regarding water right points of diversion by the Nevada State Engineer, an Environmental Assessment will be prepared so the BLM can assess the environmental issues associated with this action. In addition to potential effects on desert tortoise from construction, the potential impacts from groundwater pumping on sensitive springs located at Ash Meadows, Corn Creek and Indian Springs would also be analyzed.

CONCLUSION

Access to water resources can be affected by a number of environmental laws, regulations or issues. Compliance requirements can significantly influence when certain resources are made available, or whether certain resources are ultimately made available at all. To facilitate development of future water resource options while taking steps to preserve and protect species and habitats, the SNWA participates in a broad range of environmental processes. The SNWA's commitment to the environment as well as these environmental processes are a critical component of SNWA planning, and will assist the SNWA in maintaining and developing a portfolio of water resource options, as described in Chapter 2.

Appendices

Appendix 1
SOUTHERN NEVADA WATER AUTHORITY
INTEGRATED WATER PLANNING ADVISORY COMMITTEE
RECOMMENDATIONS

CONSERVATION

1. Pursue more aggressive promotion of water conservation and regulation of water use through methods such as the reduction of turf.

2. Decrease total water demand from 272 GPCD to 250 GPCD by 2010 and to 245 GPCD by 2035.

    a. Permananently implement major Drought Alert demand reduction tools identifi ed in the SNWA Drought Plan, including landscape watering restrictions, landscape development codes, golf course water budgets and increased water waste fi nes and enforcement

    b. Sustain current pricing signals by ensuring water rates keep pace with inflation.

    c. Maintain or exceed the 2004 participation levels in the SNWA Water Smart Landscapes Rebate Program.

3. Assess conservation achievement annually, investigate the potential for further GPCD reductions and revise conservation goals accordingly.

RESOURCE DEVELOPMENT

4. Pursue development of all the resource options considered in the IWPAC planning scenarios.

    - Arizona Water Bank
    - Coyote Spring Valley Groundwater Rights
    - Three Lakes Valley Groundwater Rights
    - Pre-Compact Water Rights (Virgin and Muddy Rivers)
    - Virgin River Water Rights
    - Clark, Lincoln and White Pine Counties Groundwater Applications
    - Augmentation Credits
    - Additional Conservation

5. Provide additional safeguards for communities and the environment in areas where in-state groundwater resources are developed.

   a. Implement a committee with SNWA and White Pine County representatives to develop annual pumping strategies for Spring and/or Snake Valleys.

   b. Comprehensively monitor and manage any in-state groundwater pumping to assess hydrological effects, sustain the resource and protect the surrounding environment.

   c. Review groundwater situation in Spring and/or Snake Valleys in 75 years, including White Pine County supply needs, basin hydrology and overall pumping data, and revise SNWA permits if conditions warrant it.

6. Work with the Colorado River Basin States and the Bureau of Reclamation to implement augmentation credits for in-state, non-Colorado River resources.

7. Pursue delivery of pre-compact Muddy and Virgin River water rights through Lake Mead and the existing Southern Nevada Water System ("lake conveyance").

8. Pursue "lake conveyance" for the development and use of post-compact Virgin River water rights.

9. Pursue an interstate agreement with Utah and Arizona concerning use of the Virgin River.

10. Pursue fl exible use of Colorado River resources over the long term.

11. Utilize the Southern Nevada Water Bank and California Water Bank as "bridge resources" to help meet any supply deficits.

12. Utilize surplus and interim surplus Colorado River water, if and when they are available.

13. Continue to pursue ocean desalination as a long-term resource.

14. Pursue additional wastewater reuse to maximize supply availability if augmentation credits can not be implemented.

RESOURCE MANAGEMENT

15. Restrict or eliminate the use of salt-using water softeners at residential and commercial facilities to reduce total dissolved solids ("salts") in wastewater discharge and to improve reuse and raw water quality.

16. Utilize the Integrated Water Planning Advisory Committee's evaluation criteria when assessing priorities for the development of in-state water resources.

17. Utilize and maintain water supplies in a sustainable manner.

FUNDING

18. Continue to support the use of diverse funding sources.

    - Commodity Charges (water rates)
    - Connection Charges
    - Sales Tax
    - Southern Nevada Public Land Management Act (SNPLMA) Funding
    - Other state and federal funding as available

19. Revisit the current funding formula for fairness and affordability when a specific project/funding scenario is determined.

20. Pursue an extension of the ¼ cent sales tax to help pay for future water infrastructure.

21. Support the continued allocation of 10% of the funds received from the SNPLMA to the SNWA.

22. Increase conservation education, including the financial ramifications that could occur if additional conservation is not achieved.

Appendix 2
SOUTHERN NEVADA WATER AUTHORITY
INTEGRATED RESOURCE PLAN ADVISORY COMMITTEE
RECOMMENDATIONS
(Adopted June 1995 by SNWA Board of Directors)

1.0 RESOURCES

1.1 Seek permanent, long-term water supplies. However, a water resources plan should be formulated to meet future water demands that utilizes all available water supplies, including unused apportionments, surpluses, leases, and other water supplies.

1.2 Place top priority on development of Colorado River water to meet future water demands over development of a Virgin River pipeline or the Cooperative Water Project.

1.3 Maximize the use of the Las Vegas Valley shallow aquifer when and where practical.

2.0 FACILITIES

2.1 Implement a water facilities program that is phased and expandable in order to respond to future uncertainties (e.g., demands, regulations, etc.).

2.2 Expand the existing Southern Nevada Water System from its existing capacity of 400 million gallons per day (MGD) to its ultimate capacity of 600 MGD as soon as possible.

2.3 Maximize the reuse of wastewater when and where practical.

2.4 Maximize artificial recharge when and where practical.

2.5 Build a new treatment and transmission facility (TTF) as soon as possible that is big enough to be reliable (avoid shortages) and to provide backup capability in the event of a catastrophic failure.

3.0 CONSERVATION

3.1 Achieve a 10% - 15% reduction in maximum day usage by summer 2000 through the "planned" conservation program or something similar. For facility planning purposes, assume this reduction will occur until further study.

3.2 Study conservation possibilities immediately to see if a higher level than "planned" is achievable, and incorporate as practical. Make adjustments to the facilities program as necessary.

3.3 Establish an SNWA water conservation committee to examine water conservation measures.

3.4 Promote economic incentives and provide economic information to encourage the efficient use of water.

4.0 FINANCE

4.1 Study the impacts of water and wastewater programs on customer costs.

4.2 Study demand elasticity (i.e., the impact of customer costs on water demands).

4.3 Study different approaches to financing and rate setting.

5.0 PLANNING

5.1 Continue the SNWA Integrated Resource Planning (IRP) process.

5.2 Integrate wastewater planning fully into the IRP process.

5.3 Maintain the SNWA Integrated Resource Plan Advisory Committee as a critical inputto the IRP process.

5.4 Continue to update water demand projections as needed.

Appendix 3
NEVADA COLORADO RIVER ENTITLEMENTS
PRIOR TO 1991 / PRE-SNWA

Entitlement Holder	Year[1]	Nature of Entitlement	Diversion Amount*
Fort Mojave Tribe	1890	Present perfected right	12,534
U.S. For Lake Mead Recreation Area	1926	Present perfected right	500
U.S. for Lake Mead Recreation Area[2]	1930	Perfected right	1,500
Basic Management, Inc.	1969	Contract	23,158
Lakeview Company[3]	1965	Contract	0
Pacifi c Coast Building Products	1965	Contract	928
CRC for Nellis AFB portion	1967/77	Contract	4,000
Southern Nevada Water System (SNWS)			
U.S.	1992	Secretarial Reservation	300
Nevada Division of Wildlife	1972	Contract (consumptive use)	25
Boy Scouts of America	1978	Contract	10
CRC for Southern California Edison	1966	Contract	23,000
Total			**65,955**
SNWA Purveyors (pre-SNWA)			
Boulder City[4]	1931	Prefected right	5,876
Las Vegas Valley Water District	1969	Contract	15,407
CRC for SNWS (minus 4,000 AFY Nellis, 9,000 AFY system loss)	1967/77	Contract	295,000
Big Bend Water District	1983	Contract	10,000
City of Henderson	1990	Contract	15,878
Total			**342,161**
CRC for SNWS (system loss)	1967/77	Contract	9,000
TOTAL NEVADA ENTITLEMENTS (prior to 1991 / pre-SNWA)			**417,116**

*All figures provided in acre-feet per year

[1] Year is priority date of present perfected rights and perfected rights and initial contract year for contract rights.
[2] Estimate; "annual quantities reasonably necessary to fulfill the purpose" of the Rec. Area. (1964 Supreme Court Decree).
[3] The contract entitlement is 120 AFY, which the Bureau of Reclamation currently has reduced to zero.
[4] Estimate; Boulder City's 1960 water delivery contract right was for 3,650 gallons-per-minute "maximum rate of delivery."

Appendix 4
CLARK COUNTY POPULATION FORECAST USED BY SNWA IN PREPARATION OF WATER RESOURCE DEMAND FORECAST IN SNWA 2009 WATER RESOURCE PLAN

Year	Population
2000*	1,428,690
2001*	1,498,274
2002*	1,578,332
2003*	1,641,529
2004*	1,747,025
2005*	1,815,700
2006*	1,912,654
2007*	1,996,542
2008	2,080,000
2009	2,166,000
2010	2,253,000
2011	2,336,000
2012	2,418,000
2013	2,498,000
2014	2,575,000
2015	2,649,000
2016	2,721,000
2017	2,790,000
2018	2,855,000
2019	2,917,000
2020	2,978,000
2021	3,036,000
2022	3,091,000
2023	3,144,000
2024	3,194,000
2025	3,243,000
2026	3,288,000
2027	3,332,000
2028	3,374,000
2029	3,414,000
2030	3,454,000
2031	3,492,000
2032	3,530,000
2033	3,569,000
2034	3,607,000
2035	3,646,000

*Historical Estimates

Source: "Clark County Nevada Population Forecast 2008-2035," June 2008, Center for Business and Economic Research (CBER) at the University of Nevada, Las Vegas.