SOUTHERN NEVADA WATER AUTHORITY

2006 Water Resource Plan

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 seven water and wastewater 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

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 and the City of North Las Vegas. The City of North Las Vegas provides water service to its own residents and adjacent portions of Las Vegas and unincorporated Clark County. The Clark County Water Reclamation District provides wastewater service to unincorporated Clark County and Laughlin. The Las Vegas Valley Water District provides water service to Las Vegas and portions of unincorporated Clark County.

The SNWA is the wholesale water provider to municipal water agencies in the Las Vegas Valley and Boulder City. In addition to its wholesale water treatment and delivery responsibilities, the SNWA acquires and manages long-term water resources for Southern Nevada. From 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.

To support this work, the SNWA prepared its first Water Resource Plan in 1996. Since then, the plan has been reviewed annually and updated as needed. The 2006 Water Resource Plan represents the sixth revision in nine years.

This plan provides a comprehensive overview of water resources and demands in Southern Nevada. Chapter 1 provides a history of water resources and demands in the region from 1905 to present, highlighting various steps taken by state and local agencies to meet water needs over time. Chapter 2 discusses the SNWA approach to demand forecasts and demand management, highlighting the critical role that conservation plays in efforts to meet future demands. Chapter 3 describes the SNWA water resource portfolio, including resource options available to the SNWA to meet future water demands. Chapter 4 outlines projected near-term and long-term demands, and discusses the portfolio options available to meet those demands. Chapter 5 concludes the plan by discussing environmental issues that will influence future resource planning in Nevada and the Colorado River Basin.

To plan for various long-term uncertainties, the SNWA committed early on to identify new water resources and develop a portfolio of resource options to help meet potential future demands. The portfolio is comprised of the following:

Colorado River Water

- Nevada basic apportionment
- Return-flow credits
- Unused Nevada apportionment
- Arizona Water Bank
- Southern Nevada Water Bank
- California Water Bank
- Colorado River transfers/exchanges/surpluses
- Interim surplus

In-State, non-Colorado River Water

- Las Vegas Valley groundwater rights
- Las Vegas Valley shallow groundwater
- Muddy River surface water rights
- Virgin River surface water rights
- Groundwater rights and applications in Clark, Lincoln, White Pine and Nye counties
- Full consumptive use/recycled in-state water resources

As with previous plans, an underlying principle of the 2006 Water Resource Plan is to maximize the use of existing resources, while maintaining the ability to adjust planning as circumstances or conditions warrant.

The SNWA has worked diligently in this regard for over a decade. It acquired and consolidated all of Nevada's outstanding Colorado River apportionment, implemented a groundwater management and recharge program in the Las Vegas Valley, worked with other basin states to develop and implement interim surplus criteria and interstate banking agreements and acquired a significant number of in-state resources, such as Virgin and Muddy river water and Coyote Spring Valley groundwater rights. In addition, the SNWA has continued to pursue groundwater rights in various basins in northern Clark County and eastern Nevada.

While acquiring and developing these resources, the SNWA implemented aggressive conservation programs designed to extend the availability of existing supplies. To sustain and promote conservation in Southern Nevada, the SNWA and its member agencies launched a strategic-planning process in 2001. Around this time, the Colorado River Basin began to experience drought conditions that, over the next few years, quickly became one of the worst droughts in the basin's recorded history. As a result, the conservation strategic planning effort evolved in 2002 to address drought conditions, providing the framework for the development of the SNWA Drought Plan. The Drought Plan was adopted by the SNWA Board and member agencies in 2003.

The drought persisted through 2003 and 2004, resulting in substantial declines in Lake Mead and Lake Powell water levels. By the end of 2004, the combined storage capacity of Lake Mead and Lake Powell – the two primary reservoirs in the Colorado River system – was less than 50 percent. For the SNWA, one outcome of the drought is the reduced availability of some near-term resources, including interim surplus water.

Despite a slight improvement in conditions in the Colorado River Basin during 2005, the reduced availability of interim surplus water has influenced near-term planning by requiring continued emphasis on conservation and demand management in Southern Nevada. Because the availability of interim surplus water is difficult to predict from year to year, the 2006 Water Resource Plan does not rely on the use of interim surplus during the planning horizon. However, the SNWA will fully utilize any surplus water resources that may become available during the planning period.

More importantly, the impacts of the drought have required the SNWA to accelerate near-term development of groundwater rights, surface water rights, and groundwater applications in northern Clark County, as well as near- to long-term development of water applications in Lincoln and White Pine counties.

To help facilitate this effort, the SNWA launched an integrated water planning (IWP) process in 2004. The development of some or all of the in-state resources has potential implications for a wide range of operational issues, including treatment and delivery system capacity, return-flow credits, reclaimed water flows to Lake Mead, project funding and water quality – as well as for larger issues such as environmental protection and rural economic development. The IWP process included the formation of an Integrated Water Planning Advisory Committee (IWPAC) in August 2004. In September 2005, the IWPAC finalized 22 recommendations and presented them to the SNWA Board of Directors on November 17, 2005 **(Appendix 1)**. The IWPAC recommendations focused on conservation, resource development, resource management and funding.

The IWPAC recognized that Southern Nevada had achieved its previous goal of 25 percent conservation by 2010, originally established in the mid 1990s. In recognition that more could be done to reduce overall water use, the IWPAC recommended a new conservation goal of 250 gallons per capita per day (GPCD) by 2010 and 245 GPCD by 2035. The IWPAC also recommended that the SNWA move forward with the development of its in-state resources.

To support these efforts, the SNWA continues to work through the necessary state and environmental processes, as well as with the communities of origin to ensure that the development of in-state resources does not come at the economic or environmental expense of these communities.

The 2006 Water Resource Plan reflects the planning adjustments taken by the SNWA in response to latest conditions. As shown in **Figure 1**, water demands and resources are divided into two planning horizons: near-term (2006 – 2016) and long-term (2017 – 2055). The associated demand line projects that near-term and long-term demands will be higher than those previously projected. This increase reflects new population estimates that were provided by the Center for Business and Economic Research at UNLV in July 2005 **(Appendix 2)**. The 2006 demand line also reflects projected conservation as Southern Nevada begins working towards its new conservation goal.

The SNWA anticipates utilizing current resources to meet a portion of the demands for both the near-term and long-term planning horizons. Current resources include Southern Nevada's Colorado River allocation and associated return-flow credits, unused Nevada Colorado River apportionment, reclaimed water and Las Vegas Valley groundwater rights.

In addition to current resources, the SNWA anticipates that conservation, banked resources, and, if available, interim surplus, will be used to meet near-term demands. Some portion of in-state resources may also be required. To accomplish this, the SNWA will continue to focus on developing in-state water resources such as surface water from the Muddy and Virgin rivers, as well as groundwater rights and applications in Clark, Lincoln and White Pine counties.

Once developed, these in-state resources are expected to be utilized to meet long-term demands (2017-2055). To further maximize the use of these in-state supplies, the SNWA is working with the Colorado River Basin states and the United States Bureau of Reclamation to secure full consumptive use of these in-state resources The SNWA also projects the continued recovery of banked resources in the states of Arizona and California and anticipates that transfers and exchanges will be available in the latter portion of the long-term planning horizon.

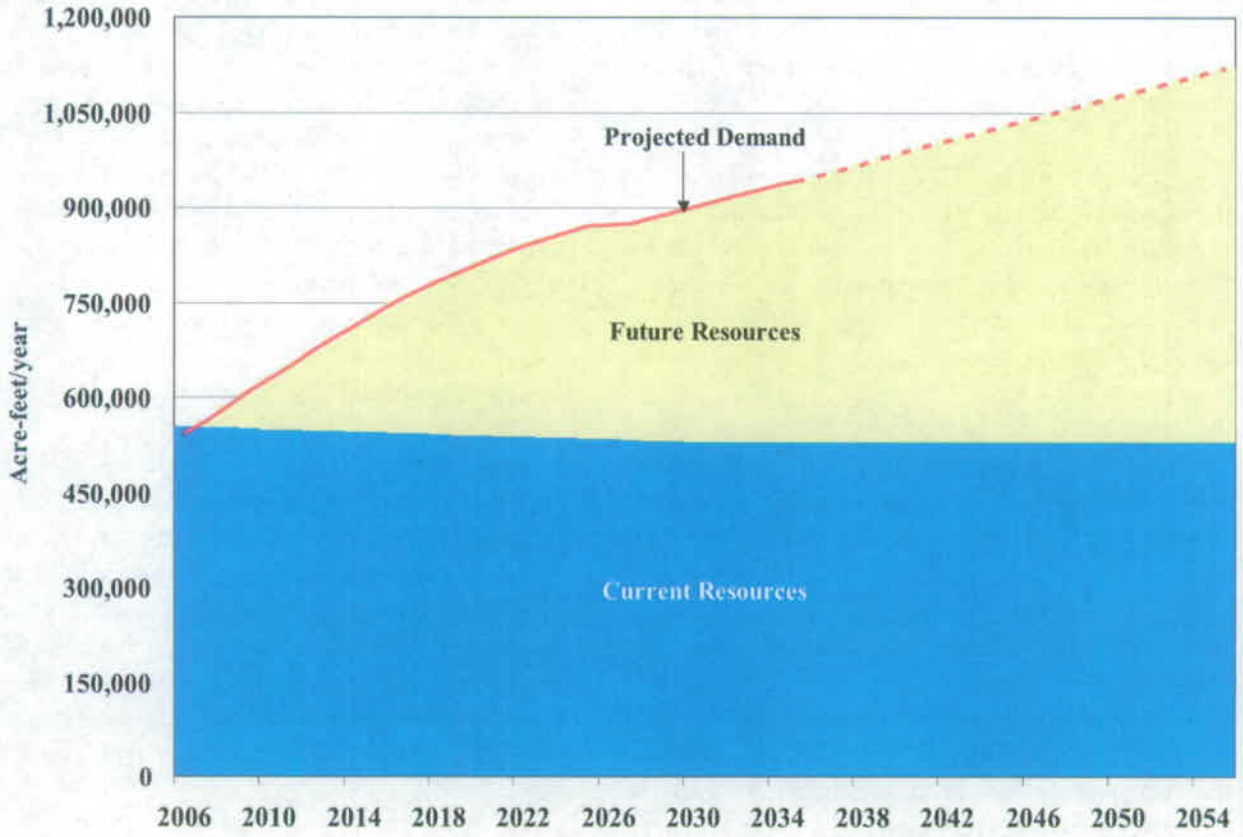
The SNWA's portfolio of resources is expected to meet local water needs through 2055. As discussed in Chapter 5, several factors affect the timing of when and how resources are brought on-line, including future agreements, cost and environmental concerns. As a result, having a portfolio of options gives the SNWA flexibility to accelerate some resources even if one or more of the subject resources proves insufficient or unavailable over the long term. Individual resources and their relationship to projected demands are described in Chapters 3 and 4.

Figure 1. SNWA Water Demand and Water Resources

Future Resources

2006 - 2016 - Bank Recovery (AZ, CA, & NV)
- Develop In-State Resources
- Interim Surplus (if available)

2017 - 2055 - Bank Recovery (AZ, CA, & NV)
- Develop In-State Resources
- Transfers and Exchanges



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 (1905-1945), History (1945-1990)** 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 demand forecasting, including demand management in Chapter 2; the SNWA water resource portfolio in Chapter 3; and how SNWA plans to meet future demands in Chapter 4. Chapter 5 discusses the environmental planning and compliance activities relating to the SNWA's 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 demand were often rapid and large, particularly in the latter half of the 20th century.

As the following sections illustrate, long-term forecasts of growth, 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. In Southern Nevada, past forecasts of population growth and water demands have typically underestimated the actual results, sometimes by large margins. This inherent uncertainty 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 events and the various constraints those events imposed over time on contemporary resource management.

HISTORY (1905-1945)

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 over 3,000 people resided in Clark County and there were approximately 100 wells in the Las Vegas Valley. In these early years and last-

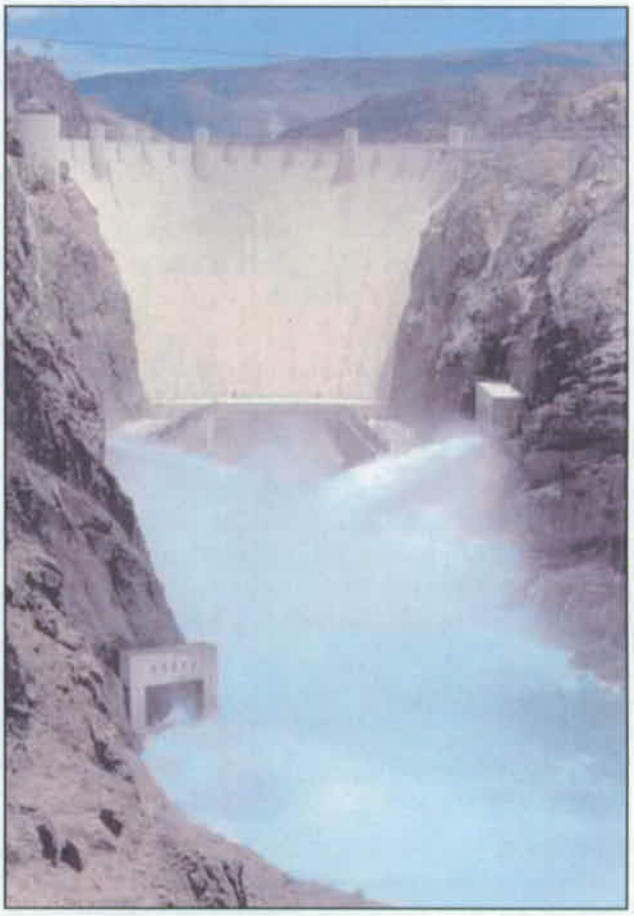
ing for the next several decades, the community viewed its supply of artesian water as virtually inexhaustible and more than adequate to meet the needs of any growth that might occur. By the mid-1920s, the population of Las Vegas would reach about 5,000.[1]

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 – Southern Nevada had no significant agricultural industry, groundwater seemed plentiful and no one foresaw the changes that would occur over the next 20 years.[2]

Figure 2. Colorado River, Basins, 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 officially 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]

Hoover Dam



While the Colorado River Compact and Hoover Dam made 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 (1945-1990)

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 (Water District). Over the next seven years, the Water District 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 forecast that the area's population would not exceed 100,000 until the end of the century.

The cities of Henderson and North Las Vegas were incorporated in 1953.[7] By the mid-1950s, the Water District had entered into agreements with the BMI complex 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 Water District owned and operated 13 wells out of approximately 500 to 1,000 wells in the Las Vegas Valley. Planners no longer expected this 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 one planning decision with long-term implications for overall resource management.

The Nevada Division of Water Resources (also known as "the State Engineer"), the state agency responsible for managing all surface water, groundwater and well permits in the state, 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.[8]

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 Water District instituted water metering. Beginning in 1955, meters were installed for any new construction connecting to the Water District's distribution system.[9]

Changes were also 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, until then an ephemeral stream that ran into the Las Vegas Bay portion of Lake Mead.[10]

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 Water District were receiving about 18,000 acre-feet of Colorado River water each year. Planners estimated that existing water supplies would be fully used in only 10 years, at most.

Given the astonishing pace of growth and existing limits to the BMI pipeline, the Water District 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 late 1967, construction began in 1968 on the Southern Nevada Water System.[11]

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 completed. It consisted of intake facilities and the Alfred Merritt Smith water-treatment plant 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 under way for a second stage that would increase this to 400 MGD. It was now forecast that available Colorado River water would meet local needs beyond 2020. Population for 2000 was forecast at 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 completed. 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 the limits on Colorado River water, the Water District 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 Water District 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.

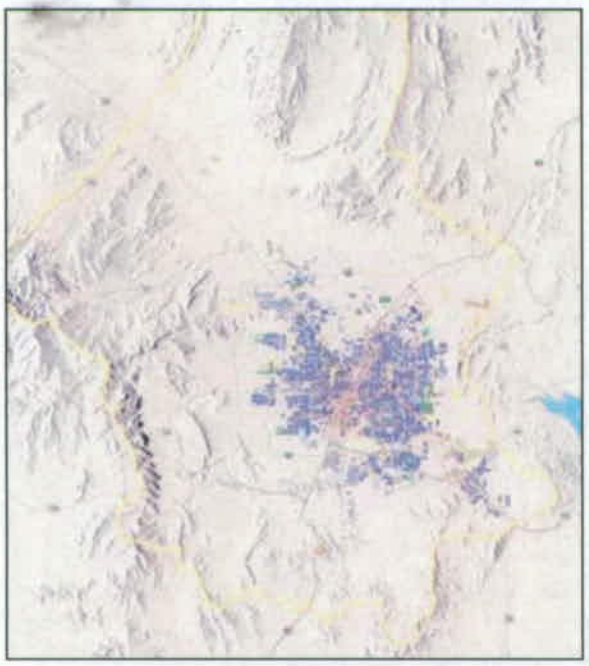
HISTORY (1990 to present)

In 1990, there were almost 750,000 people in the Las Vegas Valley and land use exceeded 71,000 acres, over 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.

Figure 3. Valley Land Use 1950 versus 1990

Las Vegas Valley Development 1950
6,906 Acres



Las Vegas Valley Development 1990
135,000 Acres

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."[12] Population forecasts were provided by the Center for Business and Economic Research at UNLV[13] and a conservation analysis was conducted by Planning and Management Consultants, Limited.[14] The results, published in early 1991, 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 efforts to conserve water. 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 Water District, 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 Water District 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:[15]

- Big Bend Water District
- 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. Las Vegas provides wastewater service to its residents and the City of North Las Vegas. North Las Vegas provides water service to its own residents and adjacent portions of Las Vegas and unincorporated Clark County. The Clark County Water Reclamation District provides wastewater service for unincorporated Clark County and Laughlin. The Water District provides water service to Las Vegas and portions of unincorporated Clark County.

The SNWA was formed 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 tradeoffs 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 **(Appendix 3)**. 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.[16] As part of a subsequent planning phase in 1996, recommendations were developed on how to pay for the new regional water facilities; specific proposals included a regional connection charge, regional water surcharge and sales tax increase.[17]

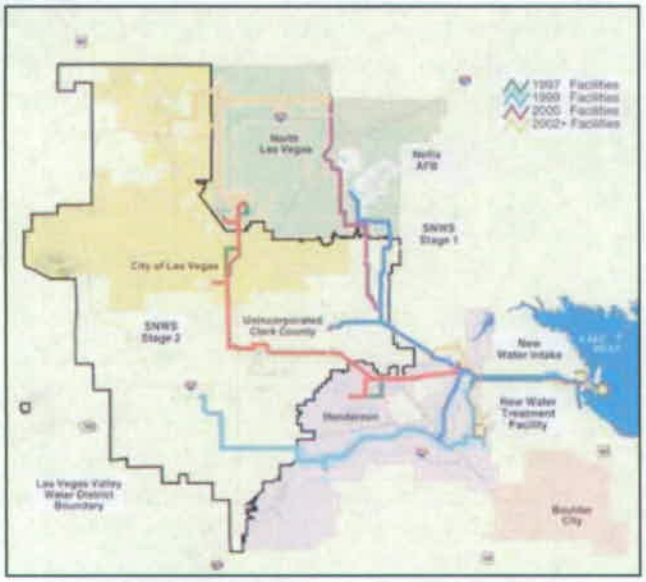
Expansion of Regional Facilities

The results of the SNWA integrated resource planning effort supported the expansion of the existing treatment and transmission facility for the Las Vegas Valley. The SNWA Board of Directors approved the proposal, and design and construction began in 1995. The phased expansion increased the Southern Nevada Water System to 480 million gallons per day by 1997 and to 600 million gallons per day by 1999.

To date, additional improvements have included a new raw water pipeline to Boulder City; major pipelines and pumping stations in and around the Las Vegas Valley; upgraded communications systems; a second regional water treatment facility located in the River Mountains area of eastern Henderson; and the addition of ozonation treatment to both the existing and new regional treatment facility. Today, the Southern Nevada Water System has a delivery

capacity of over 830 million gallons per day; when ultimately completed, the overall system will be able to treat and deliver up to 900 million gallons per day **(Figure 4)**.

Figure 4. Southern Nevada Water System



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 hydrographic basin.[18] The Las Vegas Valley 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 and permanent recharge programs to benefit existing and future well users. To pay for these activities, the SNWA assesses an annual fee of $30 per domestic well, or $30 per acre-foot of permitted water right, on well users in the Las Vegas basin.

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 2006 Water Resource Plan represents the sixth revision in nine years. As the 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, interim surplus and the drought).

In-State Agreements

In the late nineties, the SNWA and the Water District 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 3 in reference to the associated water resources, typify the approach that the SNWA is taking to the development of in-state water resources. In every instance, the SNWA is 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. 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 future demands while other resources in the SNWA resource portfolio are being developed.

Interstate Agreements

Beginning in the early nineties 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 in order 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 the state of Arizona. Provisions for the recovery of these stored resources are discussed in Chapter 3.

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 its unused Colorado River allocation in the state of California for SNWA's future use. Provisions for the recovery of these stored resources are discussed in Chapter 3.

Interim Surplus. In 1928, California was allocated 4.4 million AFY of water from the Colorado River. As time passed, the state routinely came to use much more than this basic allocation each year, using other lower basin states' unused allocation or surplus. This situation concerned other basin states interested in preserving the future availability of their own Colorado River allocations. To address the issue, California and the other basin states began to explore various proposals in the early nineties that could reduce California's use without unduly impacting its economy or residents.

After years of discussion, a proposal was developed that would allow California a fixed period of time to reduce its Colorado River water use, while providing Nevada and Arizona with the opportunity to access temporary surplus Colorado River water to meet demands through 2016. The guidelines for this proposal, known as "interim surplus," were approved by the Secretary of the Interior in January 2001.[19]

The guidelines also allow Arizona, California and Nevada to take additional water above their respective basic apportionments for domestic uses through 2016 if there is adequate water storage in Lake Mead. However, the ongoing drought in the Colorado River Basin has reduced the amount of interim surplus expected to be available to Nevada.

The Drought

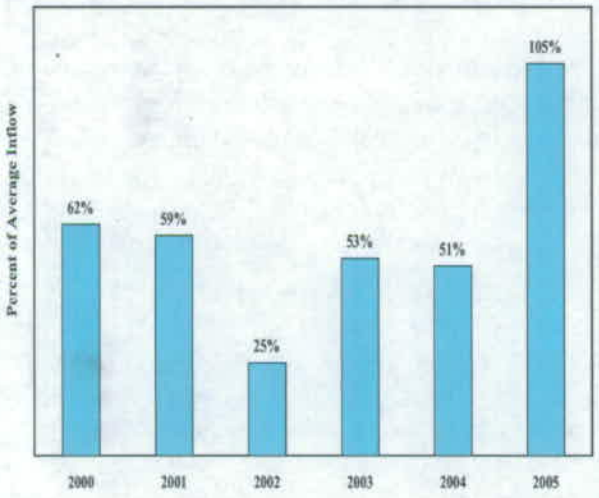
In simple terms, a drought exists when available water supplies cannot meet prevailing water demands. Southern Nevada's Colorado River allocation is dependent on flows of the Colorado River, which in turn are derived from snowmelt and runoff in the Rocky Mountains of the Upper Colorado River Basin.

In 1999, the Colorado River Basin began to experience drought conditions that, over the next few years, quickly became one of the worst droughts in the recorded history of the basin. Under the drought, 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 sixties. Over the next several years, snowfall and runoff in the basin

was well below normal, the worst year (thus far) being 2002 **(Figure 5)**, when runoff to Lake Powell was approximately 25 percent of average.[20]

Drought conditions continued through 2003 and 2004, resulting in the lowest five-year average runoff in recorded history. Runoff into the river system from 2000 through 2004 was about 50 percent of average. These levels were aggravated by several years of extremely dry soil conditions, which further reduced total runoff.

Figure 5. Lake Powell Annual Inflows, Water Years 2002 - 2005 [21]

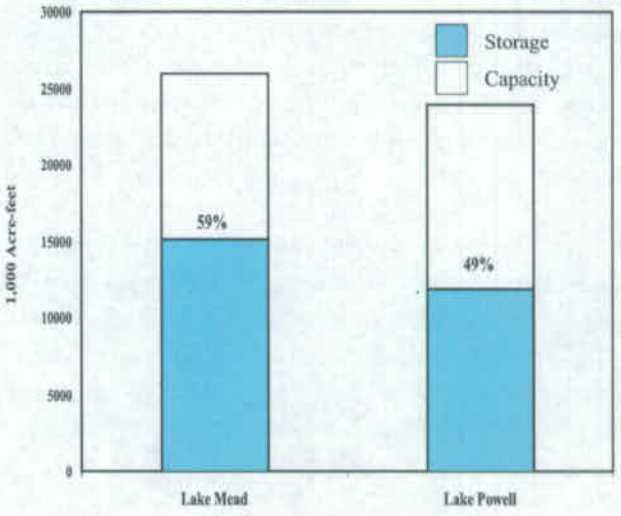


Reduced inflow to the Colorado River Basin resulted in a substantial decline in Lake Mead and Lake Powell water levels over the five-year period from September 1999 through September 2004. During this period, the elevation of Lake Mead dropped approximately 85 feet and the elevation of Lake Powell dropped roughly 120 feet. By the end of 2004, the combined storage of Lake Powell and Lake Mead – the two primary reservoirs in the Colorado River system – was less than 50 percent of capacity.

In 2005, drought conditions on the Colorado River improved somewhat. Inflows to Lake Powell were estimated to be about 105 percent of average, and tributary inflows to Lake Mead were estimated to over 200 percent of average.[22] In addition, precipitation during winter and spring of 2005 resulted in reduced water demands in the Lower Colorado River Basin during 2005. Above average inflows combined with reduced demands resulted in the first increase in year-end combined storage of Lake Powell and Lake Mead since 1998.

By the end of 2005, the combined storage of Lake Powell and Lake Mead is expected to be approximately 54 percent of capacity, an increase of only 8 percent over the prior year. As shown in **Figure 6**, Lake Mead is anticipated to be about 59 percent of capacity and Lake Powell is anticipated to be about 49 percent of capacity.[23] The improvement observed in 2005 is not an indication that the drought is over. Several years of above average runoff is needed to restore Lake Mead and Lake Powell water levels. For the SNWA, one outcome of low and declining water levels is reduced availability of some near-term resources (principally interim surplus water). Other, less obvious effects include potential impacts to SNWA intake facilities.

Figure 6. Expected Storage in Lakes Mead and Powell, December 31, 2005 [24]



According to projections by the Bureau of Reclamation, Lake Mead could decline to an elevation below 1,050 feet by 2011 if drought conditions persist. This is the operating depth of SNWA's upper intake. Given the unpredictable nature of the drought, the SNWA began investigating options for the development of a third intake in 2004. In 2005, the SNWA began the work necessary to begin construction of a third intake, roughly 200 feet deeper

than the SNWA's existing intakes. Once completed, this intake will help maintain the necessary water capacity and water quality if lake levels continue to decline. The project is scheduled to be completed in 2011.

Community Drought Response
To manage its response to the drought, the SNWA developed a comprehensive regional drought plan in 2002. The plan was approved by the SNWA Board of Directors in February 2003 and implemented by SNWA member agencies. The SNWA Drought Plan outlined a variety of measures intended to generate additional water savings to meet the current and potential challenges posed by drought. Several major elements of the plan are being permanently incorporated into the SNWA's overall demand management approach discussed in Chapter 2.

In-State Water Resource Development
Several non-Colorado River resources available within Nevada have long been part of the SNWA long-term water resource portfolio. These resources are available within our own state in the form of unused groundwater and surface water in neighboring counties. The Water District and SNWA have been working for 16 years on securing 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[25] and a work plan[26] 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 would increase our water supply's reliability during droughts or future shortages on the Colorado River and would also help to meet future demands.

Integrated Water Planning
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 integrated water planning is to identify the appropriate combination of in-state resources, facilities and conservation levels needed to provide greater drought protection to Southern Nevada, as well as meet future water demands. In this respect, it is focused on how best to integrate in-state resources into current SNWA planning and management activities.

Integrated Water Planning Advisory Committee
To assist in its long-range planning effort, the SNWA convened an Integrated Water Planning Advisory Committee (IWPAC) in August 2004. 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 over 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-nineties.

In September 2005, the IWPAC finalized 22 recommendations and presented them to the SNWA Board of Directors on November 17, 2005 **(Appendix 1)**. Principal among these recommendations are:

- Promote more aggressive water conservation and reduce the community's overall usage.
- Pursue the development of all resource options.
- Provide additional safeguards for communities and the environment.
- Work with Colorado River Basin states and the Bureau of Reclamation to implement full consumptive use of non-Colorado River resources.

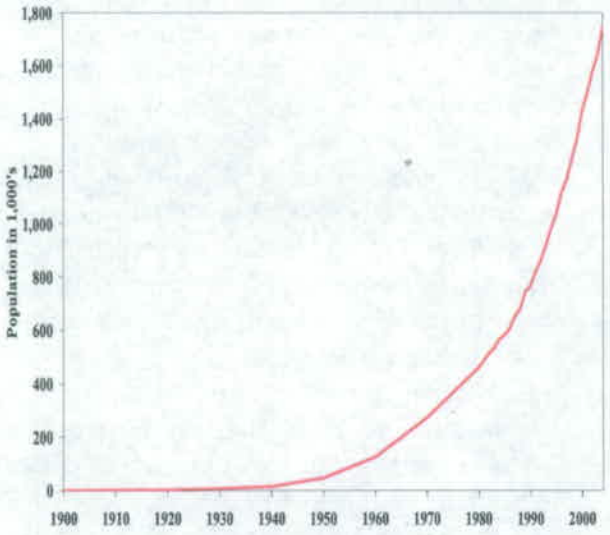
- Continue to support the use of diverse funding sources.

At this same meeting, the Board adopted a resolution in support of the development of in-state resources. This resolution was also adopted by all of the SNWA member agencies. Based on the IWPAC's recommendations regarding conservation, the Board agreed to hold a workshop in early 2006 to further discuss permanent implementation of the SNWA Drought Plan and establising a new conservation goal for the community.

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 across the United States. By 2004, Southern Nevada's population had increased to over 1.7 million people, most of whom reside in the Las Vegas Valley **(Figure 7)**. Water diversions had increased to about 500,000 acre-feet, almost all of which was Colorado River water.

Figure 7. Clark County Population, 2004



Since 1910, the annual population growth in Southern Nevada has averaged 7 percent per year, whereas growth in the United States over the same period has averaged about 1 percent **(Figure 8)**. From an initial reliance on groundwater that lasted well over half the last century, the Las Vegas Valley has moved overwhelmingly to Colorado River water as its primary water resource **(Figure 9)**.

Figure 8. Average Annual Percentage Change in Population

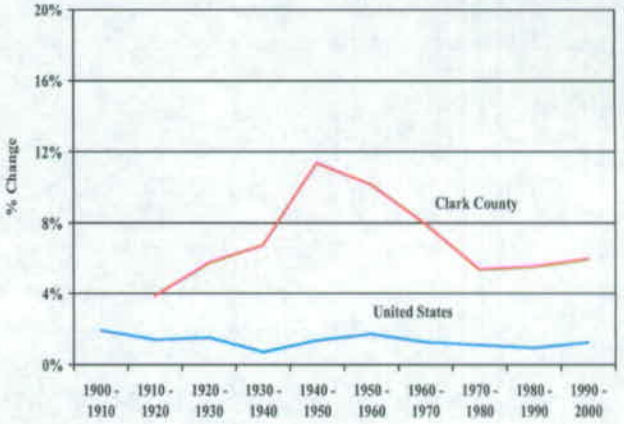
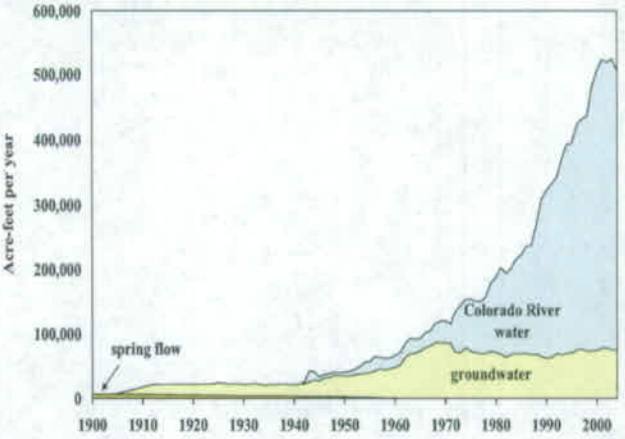


Figure 9. Water Use by Source, 2004



This situation is not expected to change for the foreseeable future. As a result, Southern Nevada must continue to maximize the use of its available Colorado River water. In addition, existing in-state resources and other alternatives must be further developed to bridge or supplement Nevada's Colorado River resources in the near term and provide sustainable resources for the long-term.

In many respects, the challenges of the future for Southern Nevada are not dissimilar to the challenges of its past. Regardless of these challenges, however,

the SNWA and its member agencies will continue to work diligently to anticipate, manage and meet the future water demands of the region. As Chapter 3 indicates, Southern Nevada 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.

ENDNOTES

1 "Water: A History of Las Vegas, Volume I," 1975, Florence Lee Jones and John F. Cahlan.

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

3 "Water: A History of Las Vegas, Volume I," 1975, Florence Lee Jones and John F. Cahlan.

4 Ibid.

5 Ibid.

6 Ibid.

7 Ibid.

8 Ibid.

9 Ibid.

10 "Las Vegas Wash Comprehensive Adaptive Management Plan," January 2000, Southern Nevada Water Authority.

11 "Water: A History of Las Vegas, Volume II," 1975, Florence Lee Jones.

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

13 "Economic and Demographic Projections for Major Water Purveyors in Southern Nevada: 1990-2030," January 1991, published October 1992, prepared for Las Vegas Region Water Utilities by Center for Business and Economic Research at UNLV.

14 "Las Vegas Region Water Demand Forecasts and Assessment of Conservation Savings," "LVR-MAIN Water Use Forecasting System, Version 1.0: User's Manual and System Description," "LVR-MAIN Water Use Forecasting System, Version 1.0: Supplement," January 1991, published February 1992, prepared for Las Vegas Region Water Utilities by Planning and Management Consultants, Ltd.

15 "Southern Nevada Water Authority 1991 Cooperative Agreement," between Big Bend Water District, City of Boulder City, City of Henderson, City of Las Vegas, City of North Las Vegas, Clark County Water Reclamation District and Las Vegas Valley Water District. The agreement was amended in 1994 and 1996.

16 "Southern Nevada Water Authority Integrated Resource Plan Phase 1 Progress Report," June 1995, prepared for Southern Nevada Water Authority by Barakat & Chamberlin; "Integrated Resource Plan Advisory Committee Phase 1 Report," June 1995, Southern Nevada Water Authority; "IRP: A case study from Nevada" in the Journal of the American Water Works Association, Gary Fiske and Anh Dong, June 1995; "Integrated Water Resource Planning in Las Vegas" in the "Integrated Water Resources Planning for the 21st Century" Proceedings of the 22nd Annual Conference of the American Society of Civil Engineers (Cambridge, Massachusetts), Susan (Robinson) Selby, May 1995.

17 "Southern Nevada Water Authority Integrated Resource Planning Advisory Committee Report on Regional Facilities Charges," December 1995, Southern Nevada Water Authority.

18 Nevada Revised Statutes, Chapters 349, 533, 534, and 572.

19 "Record of Decision Colorado River Interim Surplus Guidelines Final Environmental Impact

Statement, January 2001," signed 1/16/2001 by Bruce Babbitt, secretary of the Department of the Interior.

20 "Precipitation Summary for October 2001 - May 2002; Seasonal Precipitation October 2001 – May 2002," National Weather Service, Colorado Basin River Forecast Center.

21 Lake Powell inflows reflect the percent of average unregulated inflow to Lake Powell, various dates, United States Bureau of Reclamation.

22 "Draft Annual Operating Plan for Colorado River Reservoirs 2006," September 15, 2005, United States Bureau of Reclamation.

23 Storage figures for Lake Powell and Lake Mead obtained from "Operation Plan for Colorado River System Reservoirs" various dates, United States Bureau of Reclamation. "Operation Plan for Colorado River System Reservoirs," September 14, 2005 shows December 31,2005 storage of 11.745 million AFY in Lake Powell and 15.109 million AFY in Lake Mead. This is a combined storage of out of approximately 50 million AFY of storage capacity or approximately 54 percent.

24 "Draft Annual Operating Plan for Colorado River Reservoirs 2006," September 15, 2005, United States Bureau of Reclamation.

25 "Concepts for Development of Additional In-State Water Resources," February 2004, Southern Nevada Water Authority.

26 "Work Plan for Integrated Water Planning Process," April 2004, Southern Nevada Water Authority.

27 "Integrated Water Planning Advisory Committee Recommendations Report," September 2005, Southern Nevada Water Authority.

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CHAPTER 2
CONSERVATION AND DEMAND MANAGEMENT

In simple terms, water demand management focuses on balancing water demands against available supplies. Demand management involves a number of tools that work together to achieve the desired results, including education, pricing, regulation and incentives. Meeting demands through 2055 will require both the development of additional water resources (see Chapter 3) and the more efficient use of existing and future supplies. This chapter discusses anticipated demands for the region through 2055 as well as the critical role conservation has and continues to play in Southern Nevada's overall water resource picture.

Demands in the 2006 Water Resource Plan cover the SNWA member purveyor service area, including the Mohave Generating Station, since the intent of the plan is to focus on resources available to the region as a whole. The 2006 SNWA Water Budget, a companion document to the Resource Plan, provides more detailed forecasts by purveyor through the year 2008.

WATER DEMAND FORECAST

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.

As shown in **Figure 10**, near-term and long-term demands are anticipated to be higher than those previously projected. This increase reflects a new population forecast that was provided by the Center for Business and Economic Research at UNLV in July 2005 **(Appendix 2)**.

Figure 10. Projected Water Demands

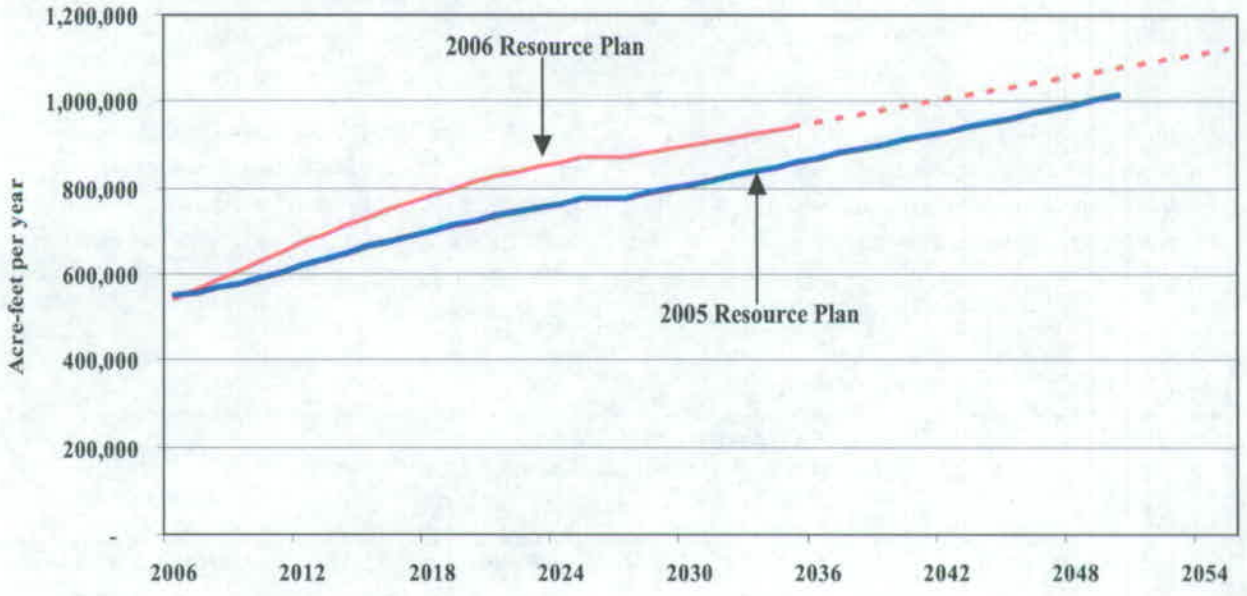


Table 1 shows the forecast numbers for the 2006 demand line through 2035.

The 2006 demand line also reflects expected conservation as Southern Nevada begins working towards its new conservation goal. In 2004, Southern Nevada achieved its goal of 25 percent conservation by 2010 originally established in the mid 1990s. This is equivalent to roughly 280 gallons per capita per day (GPCD). Based on the recommendations of the IWPAC, the SNWA is evaluating adopting a new conservation goal of 250 GPCD by 2010 and 245 GPCD by 2035. The SNWA Board is planning on holding a workshop in early 2006 to evaluate the proposal in more detail.

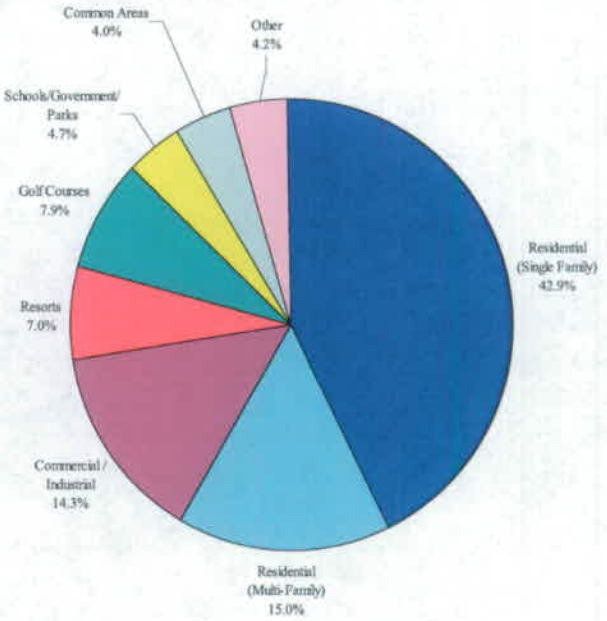
As evidenced by Southern Nevada's history, numerous factors can impact demands over long periods of time, as well as from year to year. The farther in the future that demands are projected, the greater the uncertainty in the forecast. While projections of near-term demands are more accurate than projections of long-term demands, they are not exact. This underscores the need for constant reassessment and refinement. As the SNWA continues its resource planning efforts, the outlook for future demands will be examined as part of the annual resource plan process and adjusted accordingly.

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.

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 use approximately 58 percent of the overall water supply **(Figure 11)**. Most of that water is used consumptively for outdoor landscaping. Business and commercial customers use a substantially smaller portion of the community's overall supply. As a result, Southern Nevada's conservation efforts have focused on reducing overall demands in these areas.

Figure 11. Municipal Metered Water Consumption, 2004



Over the past decade, a series of conservation efforts has promoted an increased water-savings ethos throughout the community, emphasizing reductions in outdoor consumptive uses. This section describes the evolution of Southern Nevada's conservation goals and achievements.

Table 1

SNWA ANNUAL DEMAND FORECAST
(Potable and non-potable, volumes in acre-feet*)

Year:	2006	2010	2015	2020	2025	2030	2035
Demand:	544,000	630,000	734,000	814,000	872,000	902,000	944,000

** Includes Fort Mohave Generating Station water demands, which will terminate in 2026.*

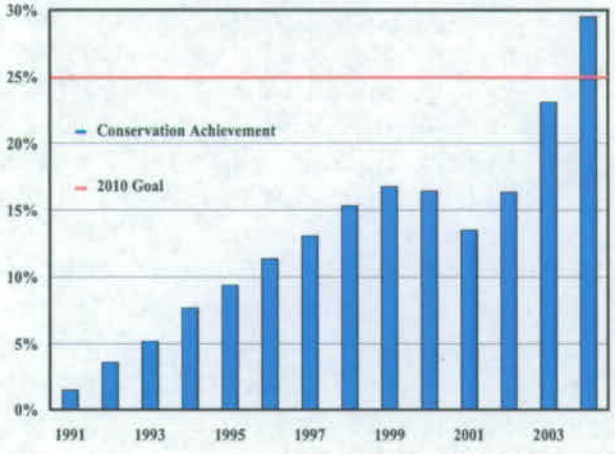
Conservation Goals

With the formation of the SNWA in 1991, the first long-term, coordinated conservation efforts began among local purveyors. Using 1990 as a base year and building on a recommendation from its integrated resource planning process of the mid-nineties, the SNWA established a goal of 25 percent conservation by 2010. Progress toward this goal was estimated annually, an approach that provided continual monitoring and allowed adjustments to be made without severe impacts to businesses or residents.

At that time, the SNWA purveyor members also agreed to follow a series of conservation "best management practices" published by the Bureau of Reclamation. The agreement was an important first step in implementing more consistent conservation measures across the service boundaries of SNWA purveyor member agencies. The agreement was updated in 1999 and a comprehensive five-year conservation plan was approved by the SNWA Board of Directors. An update to the conservation plan was submitted to and approved by the Bureau of Reclamation in summer 2004.[1]

Southern Nevada made consistent progress towards its conservation goal throughout the 1990s **(Figure 12)**. However, beginning in 2000 and lasting through 2002, levels of conservation began to decline, falling short of the interim goals needed to reach 25 percent conservation goal by 2010.

Figure 12. Conservation Achievement, 1991-2004



Strategic Planning and Drought Response

In response to declining levels of conservation achievement, the SNWA and its member agencies launched a conservation strategic planning process in 2001. The goal of this process was to bring together key decision makers within the community to coordinate strategies, brainstorm ideas and identify further opportunities to involve local stakeholders in crafting and implementing additional sustainable conservation for the Las Vegas Valley.

In 2002, as drought conditions in the Colorado River Basin became more severe, the SNWA member agencies recognized that a more immediate and actionable community response was necessary. As a result, the conservation strategic planning effort evolved to address drought conditions and ultimately set the stage for development of the SNWA Drought Plan. The Drought Plan was approved by the SNWA Board of Directors in February 2003 and implemented thereafter by SNWA's member agencies.

Current Conservation Objectives

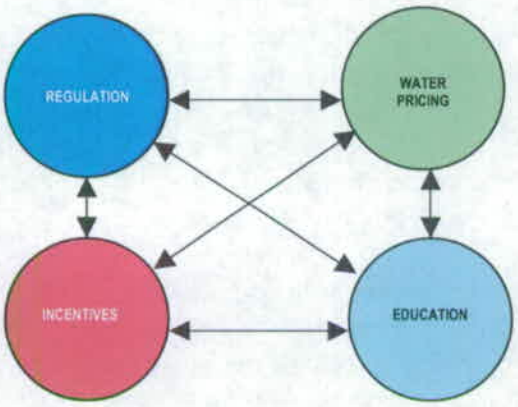
Following the implementation of the Drought Plan in 2003, conservation and drought savings rebounded with a 23.1 percent savings for that year. A year later, the community surpassed the 25 percent conservation goal set in 1996 - a full six years ahead of schedule. The SNWA anticipates conservation will remain above the 25 percent conservation goal for 2005.

In an effort to maintain and build upon this success, the IWPAC explored opportunities for more aggressive conservation achievements. The IWPAC recommended that the SNWA pursue a strategy to decrease total water demand from about 272 GPCD (2004 per capita usage) to 250 GPCD by 2010 and to 245 GPCD by 2035. The IWPAC members felt that one of the most effective means to meet this new goal would be to work with the SNWA member agencies to make the major demand reduction tools identified in the "Drought Alert" stage of the SNWA Drought Plan permanent. These measures include landscape watering restrictions, landscape development codes, golf course water budgets and increased water waste fines and enforcement **(Appendix 4)**.

DEMAND MANAGEMENT TOOLS

In order to achieve its conservation goals, the SNWA and its member agencies utilize a variety of demand management tools to reduce overall water usage and promote conservation. These include a combination of regulation, water pricing, incentives and education to elicit the necessary community response to reduce demands **(Figure 13)**. Each demand management tool is related to the community's total conservation effort - used in concert they maximize the water conservation potential in the community.

Figure 13. Demand Management Tools



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. As a result, the major demand management tools that are implemented are designed to achieve results in these areas.

Regulation

During the past 15 years, city and county governments have adopted a variety of land use codes and ordinances to promote more effective 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. Other ordinances limited the amount of turf at public facilities, golf courses and similar venues (prohibited water waste, imposing penalties when it occurs).

Additional ordinances were implemented in 2003 by the SNWA member agencies as part of the Drought Plan implementation. These measures include the adoption of assigned watering days, prohibitions on turf at new businesses and restrictions on turf at new homes. Other provisions include surcharges and water budgets for golf courses and increased penalties for water waste. As recommended by its latest advisory committee process, the SNWA is currently evaluating making these measures permanent in cooperation with its member agencies.

Water Pricing

One of the most effective conservation tools is tiered water rates. Tiered rate structures charge higher rates for each teir of water used - the more water used, the higher the rate for each subsequent teir. The SNWA member agencies have all adopted tiered pricing structures for water. These rate structures encourage efficiency, while ensuring the affordability of water for essential uses.

Incentives

Where regulation and water pricing are considered more traditional 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 its overall demand management strategy.

Water Smart Landscapes Rebate Program. This program provides incentives for residential and commercial property owners to replace ornamental (that is, aesthetic as opposed to functional) turf with water-efficient landscaping. Participants are encouraged to keep grass only in those areas where it will be used. In 2003, the incentive was increased to $1 per square foot of turf converted for qualifying participants. In 2004, more than 26.8 million square-feet of landscaping was converted under this program. Since program inception, over 64 million square-feet have been replaced, saving an estimated 3.5 billion gallons of water annually.

Irrigation Clock Rebate Program. This program encourages residential and commercial customers to replace inefficient irrigation clocks with more-efficient models. The incentive is offered as a cash rebate.

Water Efficient Technologies. Business customers who show that new technology will save them at least one million gallons of water annually can receive a rebate of up to $50,000. Participants have saved over 130 million gallons annually of water through this program to date.

Water Smart Car Wash. The Water Smart Car Wash is a public-private partnership that encourages residents to use commercial car wash facilities where water is recycled on-site or sent to a water treatment facility. Water used at these facilities is 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 helps residents save thousands of gallons of water annually by offering a coupon to pool owners who purchase water-saving pool covers. There are currently seven participating pool companies with over 25 locations in Southern Nevada.

Water Smart Contractor Program. The Water Smart Contractor Program requires contractors to complete at least eight hours of SNWA water efficiency training, maintain good standing with the Nevada State Contractors Board and be licensed and insured.

Water Smart Homes. Launched in 2005, the Water Smart Home program certifies new homes and neighborhoods as water smart, ensuring that homeowners are purchasing a home that can save as much as 75,000 gallons of water per year. These savings are achieved through highly efficient appliances, fixtures and builder-installed water efficient landscaping.

Education

An integral element of the SNWA water demand management 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. Originally known as Coalition 2000, this is a partnership between the SNWA and local business leaders who support and promote water-conservation efforts. The coalition has helped fund such initiatives as the "Water Smart Calendar" and the "Water Upon Request" program.

Conservation Helpline. The Conservation Helpline is an information line that customers can call to obtain conservation information or report water waste. In 2004, the SNWA received more than 50,000 calls to the Helpline, up from an average of 30,000 per year prior to 2003. 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 television news-and-information show called Water Ways, and produces and distributes dozens of publications to help customers conserve water, including a landscape watering guide. In 2003, the SNWA expanded its conservation messaging by launching its first fully dedicated Hispanic outreach campaign.

Xeriscape Demonstration Projects. Through the combined efforts of the SNWA and its member agencies, there is a demonstration garden in every jurisdiction. The SNWA promotes visits to The Gardens at the Springs Preserve, a 2.5-acre facility that offers hundreds of examples of water-efficient landscaping, as well as free classes by master gardeners and horticulturists. Advice from the garden's staff is available seven days a week and admission is free. The SNWA

also promotes the development of smaller xeriscape demonstration projects throughout the Las Vegas Valley to show the public that xeriscape is attractive and the most water efficient landscaping choice for Southern Nevada.

H2O University. The SNWA is committed to educating the next generation on the importance of water resources and conservation. Toward this end, the SNWA manages a comprehensive education program 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 (YAC) that allows select students to pursue an interest in water-related issues and further develop leadership skills.

CONCLUSION

Additional conservation and demand management will be an important element in planning and balancing the various resource and infrastructure needs in Southern Nevada. Continued achievement in demand management, coupled with the acquisition and development of additional water resources, will allow SNWA to meet resource demands through 2055.

ENDNOTES

[1] "Memorandum of Understanding Regarding the SNWA's Water Conservation/Efficiency Programs 1999-2004," Southern Nevada Water Authority.

CHAPTER 3
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.

A portfolio approach allows the SNWA to assess its overall resource options and make appropriate decisions regarding the best resource to bring on-line when necessary. In determining the priority of resources, some of the factors considered include availability, accessibility, cost and need.

The 2006 Water Resource Plan provides for enhanced flexibility in resource planning and helps to illustrate the dynamic nature of Southern Nevada's water resource portfolio. This flexibility is essential in responding to drought and the limited availability of interim surplus water, both of which are discussed later in this chapter.

The SNWA water resource portfolio includes a variety of Colorado River and in-state resources. As discussed in Chapter 2, various demand management tools (education, pricing, regulation and incentives) are utilized to maximize the use of these resources over time.

Colorado River water resources include:

- Nevada's basic apportionment
- Return-flow credits
- Unused apportionment
- Arizona Water Bank
- California Water Bank
- Southern Nevada Water Bank
- Colorado River transfers/exchanges/surpluses
- Interim surplus

In-State water resources include:

- Las Vegas Valley groundwater rights
- Las Vegas Valley shallow groundwater
- Three Lakes Valley (North and South) and Tikaboo Valley South groundwater rights
- Coyote Spring Valley groundwater rights
- Groundwater applications in Indian Springs
- Groundwater applications in Lincoln, Nye and White Pine counties
- Virgin River surface water rights
- Muddy River surface water rights
- Reclaimed Colorado River water
- Full consumptive use/recycled in-state water resources

This chapter describes each of the water resources available to Southern Nevada over the 50-year planning horizon. The priority of specific water resources to meet near- and long-term demands is discussed in Chapter 4.

It is important to note that while many resources are already quantified, such as Nevada's Colorado River allocation, others are still being assessed, developed or are pending action by the state. A few resources discussed as possibilities for the future will depend on factors including potential rulings by the Nevada State Engineer, interpretations of Colorado River law, improvements in technology, and other factors.

Consistent with its approach to capital improvement planning, the SNWA considers phasing when assessing the timing and use of resources. By securing future water resources and building infrastructure in advance of the time needed, the SNWA remains adaptive to changing demand and supply conditions.

The resources currently available or under development to meet Southern Nevada's long-term water demands are described in the following sections.

COLORADO RIVER WATER

A series of laws and court cases 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 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[1] **(Figure 13)**.

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. With return-flow credits, Nevada can actually divert more than its 300,000 AFY apportionment, as long as the net use is no more than 300,000 AFY.

Nevada Basic Apportionment

Under 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.

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

Figure 13. Colorado River Basin States

Colorado River contracts (pre-SNWA). Prior to the SNWA's creation in 1991, total entitlements for all Colorado River users in Nevada equaled 417,116 AFY **(Appendix 5)**. 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, the SNWA entered into a water delivery contract with the Secretary of Interior, which gave SNWA a right to the remainder of Nevada's consumptive-use apportionment that was not allocated under other contracts.[2] This unallocated 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). Southern California Edison operates the Fort Mohave Generating Station in Laughlin. In 1993, 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 generating station with up to 19,000 AFY through July 2026.[3]

The SNWA purveyor members intend to meet the generating station's needs from now through 2026 with unused and surplus Colorado River water available to Nevada, or with water that the Las Vegas Valley Water District (Water District) is storing for SNWA purveyor members in the Southern Nevada Water Bank.[4] Recently, the station has encountered substantial difficulties maintaining compliance with Clean Air Act standards with respect to its scrubbers and slurry line, and it is unclear if the station will remain operational through to 2026. Unless these issues are resolved, the plant could be closed much sooner than anticipated.

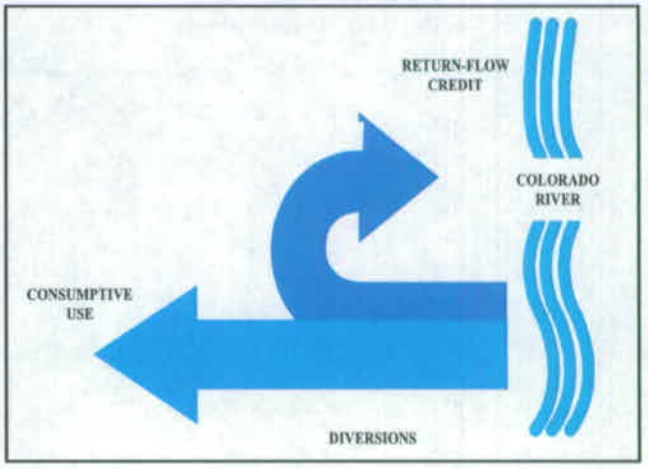
Additionally, uncertainty regarding water supply for the coal slurry line could threaten the continued operation of the plant. If the plant is decommissioned, the water originally reserved for operating the plant will become available to the SNWA member agencies for future use.

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 above and shown in **Figure 14**, 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 about one third 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 14. Return-Flow Credits



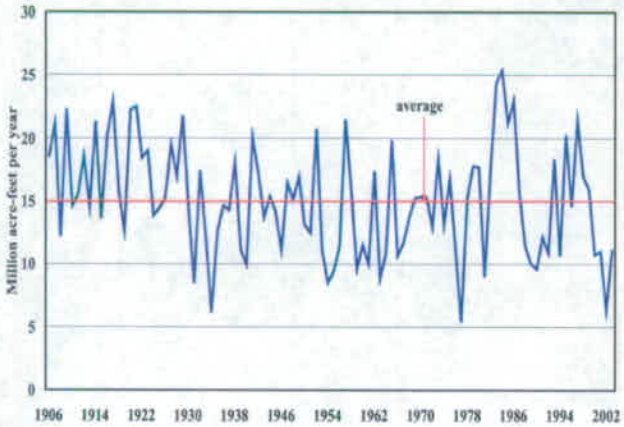
Surplus Water

It is important to understand the concept of surplus water and how it has been used historically on the Colorado River. 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* defined "surplus" as follows: "If sufficient mainstream water is available for release, as determined by the Secretary of the Interior, 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."

Every year, the Bureau of Reclamation determines its "Annual Operating Plan for the Colorado River Reservoirs" and 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.

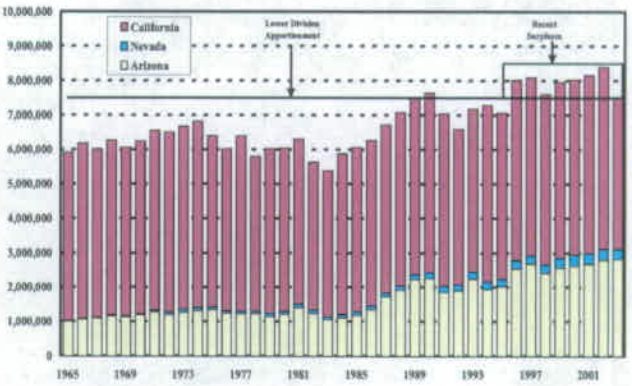
Surplus conditions are typically a function of Colorado River reservoir storage and weather conditions, primarily snowmelt and the resulting runoff in the Upper Colorado River Basin. Over the period of record beginning in 1906, the average flow of the Colorado River has been 15 million AFY **(Figure 15)** at Lees Ferry, including flows from the Paria River just downstream of Lees Ferry.[7] However, the respective annual flows are highly variable – much higher or lower from year to year than the average.

Figure 15. Colorado River Historical Flow



Although the Secretary of the Interior declared a surplus every year between 1996 and 2004 **(Figure 16)**, it is difficult to know in which future years a surplus will occur and what the specific volumes available to Southern Nevada will be.

Figure 16. Colorado River Water Usage [8]

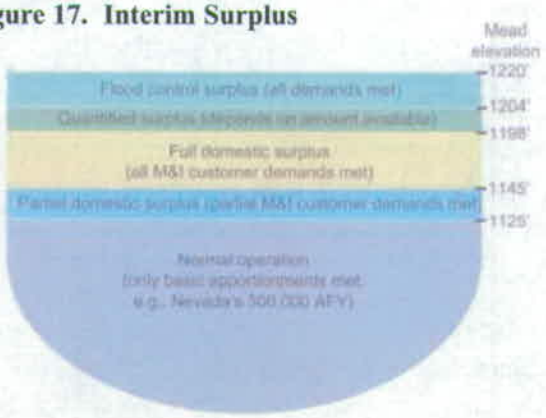


Interim Surplus

As discussed in Chapter 1, the Interim Surplus Guidelines allow Arizona, California, and Nevada to take additional water above their respective basic apportionments for uses through 2016, if there is adequate water storage in Lake Mead.

The following describes the water uses that will be allowed, assuming Lake Mead water levels are at the indicated elevations **(Figure 17)**:

Figure 17. Interim Surplus



Flood-control surplus

(Approximately 1,204 feet sea level and above):

- All beneficial uses in the United States (municipal/industrial and agricultural).
- Additional 200,000 acre-feet to Mexico.

Quantified surplus
(Approximately 1,198 – 1,204 feet sea level):

- Divided among the states with 4 percent to Nevada, 46 percent to Arizona and 50 percent to California.
- Priority of use is (1) domestic, (2) off-stream banking, and (3) agriculture.

Full domestic surplus
(1,145 –1,198 feet sea level):

- All of Nevada's customer demands are met, even if greater than its 300,000 AFY basic apportion ment.
- Metropolitan Water District of Southern California (MWD) receives 1.25 million acre-feet, minus any conserved water.
- All of Arizona's contracted domestic demands are met.

Partial domestic surplus
(1,125 – 1,145 feet sea level):

- Half of Nevada's customer demands are met greater than its 300,000 AFY.
- MWD receives 1.212 million acre-feet, minus any conserved water and recovered in-state banked water.

Normal demands
(1,125 feet sea level and below):

- All states receive only their basic apportionment (for example, Nevada's 300,000 AFY).

The Interim Surplus Guidelines will expire on December 31, 2016. After that, there will continue to be years of unusually high and low snowmelt in the Upper Colorado River Basin. When the Interim Surplus Guidelines expire, the Bureau of Reclamation and basin states will have long-term criteria or guidelines to manage any resulting surplus conditions.

The Secretary of the Interior is expected to declare a partial domestic surplus for 2006, allowing the lower basin states to access additional water, if a states' demand exceeds its allocation. Southern Nevada is not expected to exceed its consumptive use allocation of Colorado River water during 2006. This is the result of the communities' overall conservation efforts. In the future and until 2016 when the guidelines expire, the SNWA will utilize interim surplus water when it is available and needed to meet customer demands. Because the availability of interim surplus water is difficult to predict from year to year, the 2006 Water Resource Plan does not rely on the use of interim surplus during the planning horizon.

Unused Apportionment
Under the Law of the River, particularly the 1964 Supreme Court decision, lower-division 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, Nevada and California can use the unused portion.

The SNWA has a right to 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 other entities has been unused, and the SNWA may utilize 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. Arizona's usage is in large part a function of weather, as are surplus Colorado River flows. Since predicting the weather over a number of years is difficult, none of the SNWA planning charts includes other lower basin state's unused apportionment. However, if this resource is available, the SNWA will use it to meet demands, including groundwater recharge.

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 the existing agreement with the AWBA, assuring Southern Nevada access to 1.25 million acre-feet of water in the Arizona Water Bank. As part of this agreement, SNWA can recover 20,000 AFY in 2007 and 2008, and 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 utilized.

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

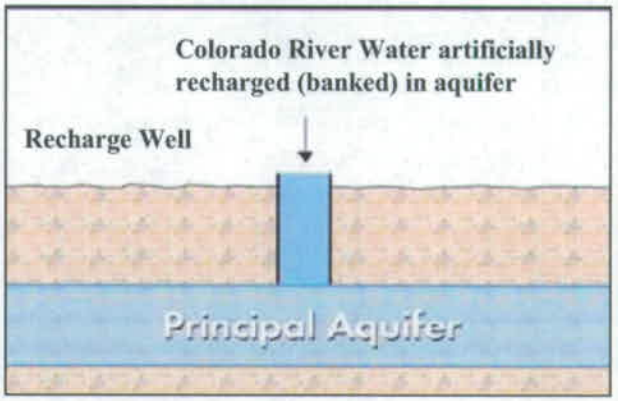
In October 2004, the SNWA and Nevada Colorado River Commission entered into agreements with Metropolitan Water District of Southern California and the Bureau of Reclamation to store a portion of Nevada's unused Colorado River water in Southern California until it is needed. Under the agreements, Nevada can recover up to 30,000 AFY from the storage account, with six months notice provided to MWD. The SNWA banked 10,000 acre-feet in 2004 and anticipates banking another 10,000 acre-feet in the California Water Bank by the end of 2005.

Southern Nevada Water Bank

Within the Las Vegas Valley groundwater basin, the Water District and the City of North Las Vegas artificially recharge unused Colorado River water into the primary aquifer using recharge wells during the winter months **(Figure 18)**. Since the program began in 1987, Southern Nevada has stored about 290,000 acre-feet of water in the local groundwater basin for future use. The SNWA purveyor members have the ability to bank Colorado River water in the future, utilizing unused and surplus Colorado River water as available.

In December 2004, the State Engineer issued an order creating an *in lieu* recharge program for the Las Vegas Valley groundwater basin.[9] This program applies to the Water District and the City of North Las Vegas. The in lieu recharge program allows the Water District and North Las Vegas to obtain credit for refraining from pumping non-revocable groundwater rights. Up to 85 percent of the credits earned by not pumping established under the program are recoverable, with 15 percent remaining in the aquifer in perpetuity. These in lieu recharge credits will be available for use from the Southern Nevada Water Bank. At the end of 2005, the Water District and North Las Vegas had established about 15,000 acre-feet of in lieu recharge credits.

Figure 18. Artificial Recharge



In addition, the SNWA performs recharge on behalf of the Las Vegas Valley Groundwater Management Program. This recharge is not intended for recovery by the SNWA purveyor members, but to assist in managing the groundwater aquifer for the benefit of well users. As of 2004, the SNWA has provided about 9,000 acre-feet of recharge under this program.

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, interstate, groundwater, surface water, conserved water, water rights, short-term, long-term, etc. However, interstate discussions of transfers/exchanges generally describe lower basin, interstate transfers of Colorado River water.

Full-scale transfers/exchanges as an option for SNWA are still in the distant future. Current transactions that are considered positive steps include short-term water and public transfers at cost. Examples have been highlighted in this chapter, including interstate water banking.

Seawater desalination exchanges. Advances in technology may alleviate 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 to construct and operate desalination facilities in exchange for an equivalent portion of California's Colorado River water at Lake Mead.

Transfer of conserved water or Tribal 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. This conserved water would be leased, with the terms and conditions to be negotiated at the time of the lease. There is also an opportunity for interstate transfers of Tribal water, but the topic still needs considerable discussion and agreement. Likewise, the concept of a verifiable conservation program needs further definition, as do issues surrounding the accounting and management of this resource.

While Colorado River transfers/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 demands on the river and make their supplies more drought tolerant.

IN-STATE WATER

The SNWA has acquired and continues to develop a significant number of in-state water 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. For the purposes of this plan, these in-state resources are divided into two categories – groundwater and surface water.

Nevada Water Law

Unlike the water of the Colorado River, which is managed 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 under the jurisdiction of the state. The Office of the State Engineer in the Nevada Department of Conservation and Natural Resources is the state entity that regulates groundwater and surface water resources (other than the Colorado River).

This office 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 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.[11]

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 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 State Engineer act on the application, and then issuing the permit or denying the application.

Groundwater

As indicated in Chapter 1, groundwater was the first and most critical resource for Southern Nevada for much of the last century. Groundwater 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 Water District, but others are the result of specific SNWA efforts that were initiated in the mid to late nineties. This section discusses the SNWA in-state groundwater resources.

Las Vegas Valley. Until large scale importation of Colorado River water was achieved in the early seventies, the area 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.[12] More recent analysis in the 1990s indicates the yield is approximately 57,000 AFY.[13]

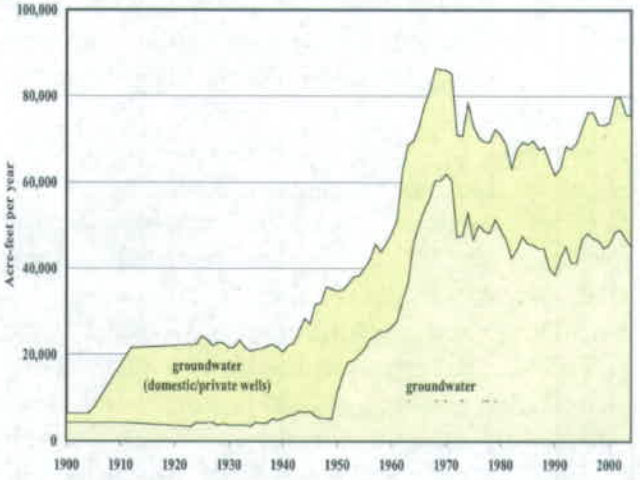
As part of its effort to manage the excessive demands, the State Engineer designated a portion of the Las Vegas Valley as an underground artesian water basin in 1941. The designated area was expanded in 1944 and 1946, and a portion of the basin was closed to new irrigation rights in 1949. In 1955, the 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.[14]

In the years that followed, the 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.[15]

Of the seven SNWA member agencies, the Water District and North Las Vegas have permanent groundwater rights totaling 40,612 acre-feet and 5,711 acre-feet, respectively. The two entities operate about 100 permitted municipal wells in the Las Vegas Valley **(Figure 19)**.

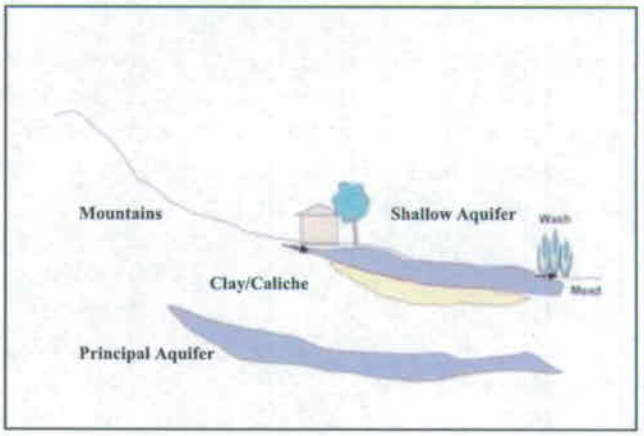
Although Southern Nevada's primary supply is Colorado River water, and the municipal groundwater rights of the SNWA member agencies are among the most senior groundwater rights in the Valley, groundwater remains a critical component of the area's resource picture. In particular, groundwater is instrumental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

Figure 19. Groundwater Use by Type of User



Las Vegas Valley Shallow Groundwater. Over time, a shallow perched aquifer system has developed in the Las Vegas Valley, primarily as the result of excess irrigation water which has not been consumed in the root zone, but which has traveled downward until being stopped by an impermeable layer of clay or caliche. Shallow groundwater remains near the land surface, where portions evaporate or transpire to the atmosphere, or it migrates generally toward the Las Vegas Wash, where a portion becomes a part of Nevada's return-flow credits **(Figure 20)**. In the lower elevations of the Las Vegas Valley, this shallow system has caused damage to structures and is considered a nuisance **(Figure 21)**.

Figure 20. Shallow Groundwater System



The location and extent of this shallow groundwater system has been fairly well determined from monitoring wells throughout the valley.[16] Recent groundwater modeling shows that over 100,000 acre-feet of irrigation water may be accumulating in this shallow zone each year. In terms of quality, the shallow aquifer water is poor, with total dissolved solids exceeding acceptable drinking water standards in most locations.[17]

Figure 21. Nuisance Water

In 1995, as part of its integrated resource planning, the SNWA adopted a policy to maximize use of the shallow system, when and where practical. In 1999, the SNWA completed a preliminary cost analysis of extraction and treatment feasibility at a site in the southeastern Las Vegas Valley.[18] In 2002, the SNWA conducted a pilot study to confirm the preliminary cost estimates and define its technical approach to treating this resource.[19] The results indicate that treatment of shallow groundwater for potable use is technically possible, but costs are still relatively high.

As technology improves and other sources of water become more expensive, the development of shallow groundwater may become more viable. However, as the community continues to reduce its outdoor water use and associated runoff, the amount and accessibility of this resource will decline substantially.

Three Lakes Valley (North and South) and Tikaboo Valley (North and South). In 2003, the SNWA requested that the 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). In May 2003, the SNWA submitted a report detailing the results of hydrologic investigations in these groundwater basins to the Nevada State Engineer in support of the applications.

In March 2004, the State Engineer held an administrative hearing on SNWA's applications in Tikaboo and Three Lakes valleys. On January 4, 2005, the Nevada State Engineer issued Ruling 5465, approving permits totaling 8,905 AFY.

Ruling 5465 also identified an additional 1,700 AFY of unappropriated water in Three Lakes Valley North. In March 2005, the SNWA requested the State Engineer grant the 1,700 AFY under an existing SNWA application from 1989 that was not considered in Ruling 5465. In September 2005, the State Engineer issued Ruling 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 May 2005, the SNWA filed change applications to move the points of diversion for 8,018 AFY of water rights from Tikaboo Valley South and Three Lakes Valley North and South, to proposed production well sites. The State Engineer scheduled a hearing for November 2005 to consider these change applications. A ruling on the change applications is not expected until early 2006.

Pending receipt of necessary state and environmental approvals, SNWA plans to drill a series of production wells to deliver water to the northwest part of the Las Vegas Valley. In addition, a series of monitoring wells will also be implemented to monitor the groundwater basins to ensure the long-term viability of the resources in these valleys.

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

Coyote Spring Valley. Coyote Spring Valley is located in northern Clark County. In 1998, the SNWA purchased 7,500 AFY of water rights in Coyote Spring Valley, along with five one-acre parcels of land for placement of future wells to develop the water rights.[20] Another 1,500 AFY was purchased in 2002, for a total of 9,000 AFY. In addition, the Water District has 27,512 AFY in applications, filed in 1989.

In 1996, the SNWA signed an agreement with the Moapa Valley Water District outlining various water management strategies.[21] As part of that agreement, the SNWA agreed to assign up to half of the Water District filings in Coyote Spring Valley to the Moapa Valley Water District.

In late 2000, the State Engineer set a public hearing date for the remaining groundwater applications in Coyote Spring Valley. The Water District 1989 applications were heard in July 2001, followed by Coyote Spring Investment applications totaling more than 108,000 AFY in August 2002. The Coyote Spring Investment, LLC applications were filed after the Water District applications in 1989.

In March 2002, the SNWA, Water District, Coyote Spring Investment 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 State Engineer above 3,750 AFY will be divided on a percentage basis between the Water District 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 for the long-term benefit of the Moapa Valley Water District.

The State Engineer also issued Order No. 1169 regarding the Water District's groundwater applications for 27,512 AFY of water rights in Coyote Spring Valley in March 2002. Per the State Engineer's ruling, the SNWA is conducting extensive monitoring, including the construction of eight monitoring wells, and is in the process of implementing a five-year study mandated by the ruling in conjunction with other stakeholders. The study includes a two-year aquifer test to identify potential impacts to existing water right holders and regional springs in adjacent basins.

The SNWA is working with the United States Fish and Wildlife Service, Coyote Springs Investment, LLC, the Moapa Valley Water District and the Moapa Band of Paiutes to establish conservation measures, and management and monitoring criteria for the future development of regional groundwater resources in the area.

Options to support the two-year aquifer test mandated by Order No. 1169 are being pursued. Plans include the construction of a 15 mile pipeline that will tie into the Moapa Valley Water District's conveyance system. Once the test is complete, the SNWA will provide a hydrological report to the State Engineer, detailing the results of the test. It is anticipated that following the submittal of the report, the State Engineer will determine the volume of water to be permitted under the Water District applications.

Groundwater Applications in Clark, Lincoln, Nye and White Pine Counties. In addition to the groundwater rights and applications previously noted, the SNWA has a number of other applications for groundwater located in eastern Nevada. In 1989, the Water District filed 147 groundwater applications with the State Engineer to appropriate unallocated groundwater water in 30 basins. Because of potential environmental concerns and existing appropriations, the Water District eventually withdrew some applications, limiting potential diversions to 19 basins in four Nevada counties, including Clark, Lincoln, Nye and White Pine **(Figure 22a)**. This includes between 125,000 and 200,000 AFY of groundwater that could be developed from applications within Clark, Lincoln, Nye and White Pine counties. The amount of water ultimately permitted will be determined through the state water right process as described earlier in this chapter.

Figure 22a. Groundwater Applications

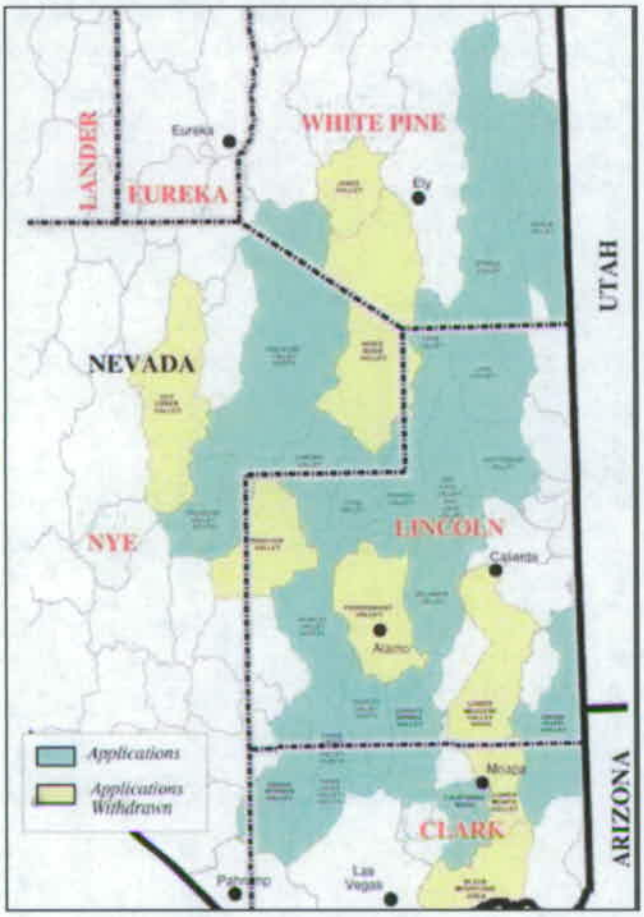
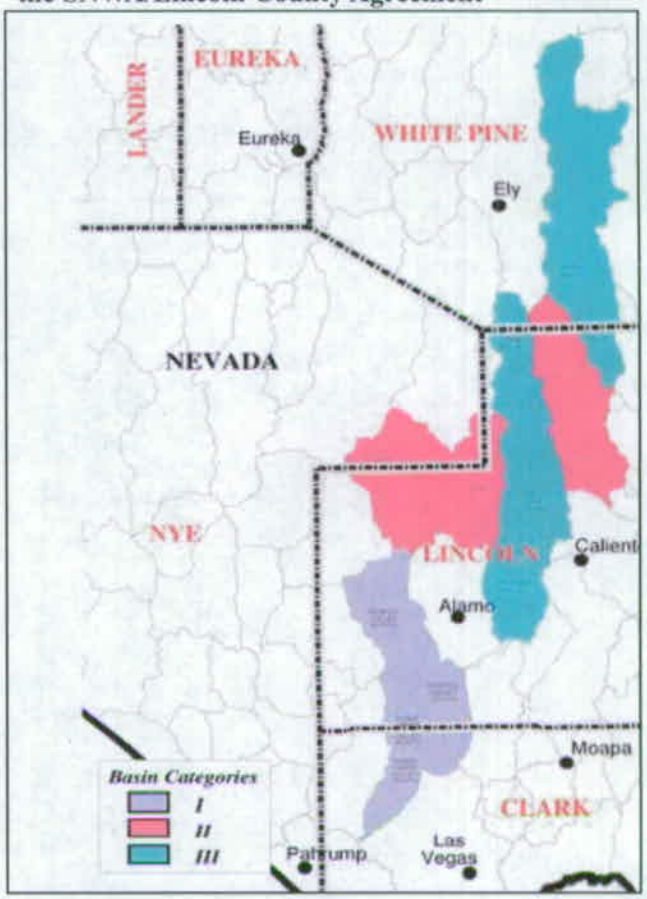


Figure 22b. Groundwater Basins Addressed in the SNWA/Lincoln County Agreement



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: Category I basins are allocated to the SNWA and/or the Water District; Category II basins are allocated to Lincoln County; and Category III basins are shared, where Lincoln County is entitled to the first 3,000 AFY of any water granted in each of the basins **(Figure 22b)**.

Additionally, the agreement establishes a cooperative relationship between Lincoln County, the Water District and SNWA that will include sharing of resources and data during the development of groundwater in eastern and central Nevada. A similar relationship is being pursued with White Pine County.

Since 1989, the Water District and/or the SNWA have withdrawn, transferred or otherwise declined to pursue development of 49 of its original applications. **Figure 22c** displays basins in which the SNWA currently has applications.

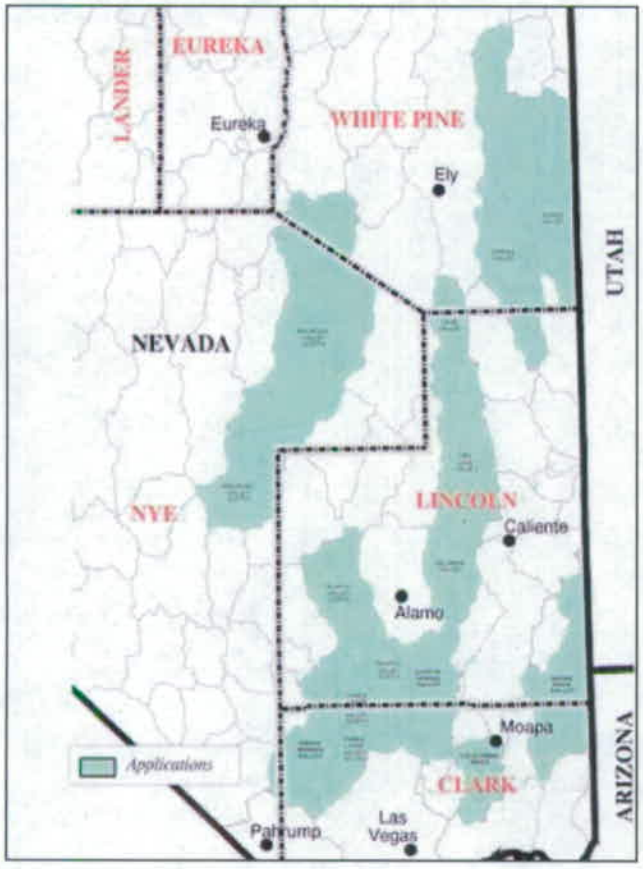
Surface Water Resources

In addition to in-state groundwater rights and applications, the SNWA is developing in-state surface water rights on the Muddy and Virgin rivers.

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 23).** The majority of the flow is currently used for agriculture and power generation. In 1996, an agreement was signed by the SNWA and Moapa Valley Water District, limiting the amount of water that the SNWA could transfer out of Moapa Valley to

100 AFY plus unused water until 2020, after which a maximum of 5,000 AFY can be transferred.[22] The SNWA and the Muddy Valley Irrigation Company signed a similar agreement in 1997.

Figure 22c. Remaining Groundwater Basins with SNWA Applications



The 1996 agreement between the SNWA and Moapa Valley Water District includes provisions for the SNWA to acquire more Muddy River water if the Moapa Valley Water District acquires additional water resources other than Muddy River water. The SNWA is working with the district in its acquisition of additional water rights, to cooperatively increase the allowable transfers from Moapa Valley.

Currently, the SNWA has acquired about 7,000 AFY of Muddy River water rights. These rights were acquired under Requests for Proposals to Muddy Valley Irrigation Company shareholders between 1997 and 2005 under separate agreements.

Virgin River. The Virgin River originates in southwestern Utah, flows through the northwestern corner of Arizona and moves into Nevada, where it joins the Colorado River at Lake Mead **(Figure 23)**. In 1994, the State Engineer granted to the SNWA the annual maximum diversion rights to Virgin River surface flows – 190,000 AFY with a long-term average annual diversion of 113,000 AFY.

Figure 23. Muddy and Virgin Rivers

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, the SNWA agreed to limit the amount of Virgin River water that will be purchased and transferred from Virgin Valley to 5,000 AFY (in addition to SNWA's existing 113,000 acre-foot average annual diversion of Virgin River rights).

In addition, for each acre-foot of Virgin River water it acquires, the SNWA will convey one acre-foot of its Virgin River rights to 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 Virgin Valley Water District.

In July 2005, the SNWA entered into an agreement for the purchase of 350 shares in the Bunkerville Irrigation District (3,710 AFY). Pursuant to the 2000 agreement, the SNWA transferred 3,710 AFY of its 1994 Virgin River rights to the Virgin Valley Water District. Acquisition of water rights from the Mesquite and Bunkerville Irrigation Companies is desired because these water rights have a priority date that precedes the Colorado River compact, thus giving the SNWA greater flexibility in how it uses these water resources.

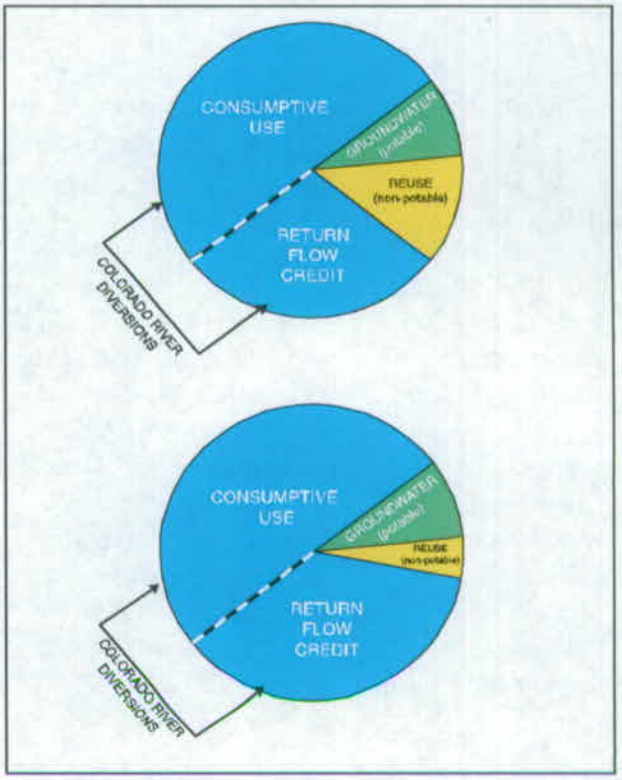
Reclaimed Water Resources

Southern Nevada currently reclaims all of its wastewater, either through return-flow credits or direct reuse. The following sections describe the southern Nevada's efforts to maximize its use of both Colorado River and In-State water resources.

Reclaimed Colorado River water. While reclaimed Colorado River water has distinct advantages in terms of environmental sustainability and lower costs, additional reuse does not extend Southern Nevada's Colorado River allocation. **Figure 24** shows that the size of the total resource "pie" does not change, whether more wastewater is used to meet a reuse demand or to meet a potable demand. As wastewater reuse increases, the area's return-flow credits will decrease. However, the overall supply of consumptive use, return-flow credits and reclaimed water will not.

Full consumptive use/recycled in-state water resources. The future development and use of in-state resources outside the Las Vegas Valley will create additional wastewater that if treated and reused have the potential to increase their yield by approximately 70 percent. The SNWA will reclaim in-state, non-Colorado River water to maximize the use of these resources, either through direct reuse, approval to discharge treated non-Colorado River water into Lake Mead and withdraw this resource again until it is consumptively used, or a combination of the two.

Figure 24. Reclaimed Water



Current reclaimed water resources

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

Big Bend Water District. In Laughlin, the Big Bend Water District is the potable water purveyor and the Clark County Water Reclamation District provides reclaimed water. Currently, the Clark County Water Reclamation District is supplying reclaimed water for dust control at a local landfill.

Boulder City. Boulder City is both the potable and reclaimed water provider within its municipal boundaries. Currently 60 percent of its treated effluent is sold and used at sand and gravel operations (about 500 acre-feet in 2004).

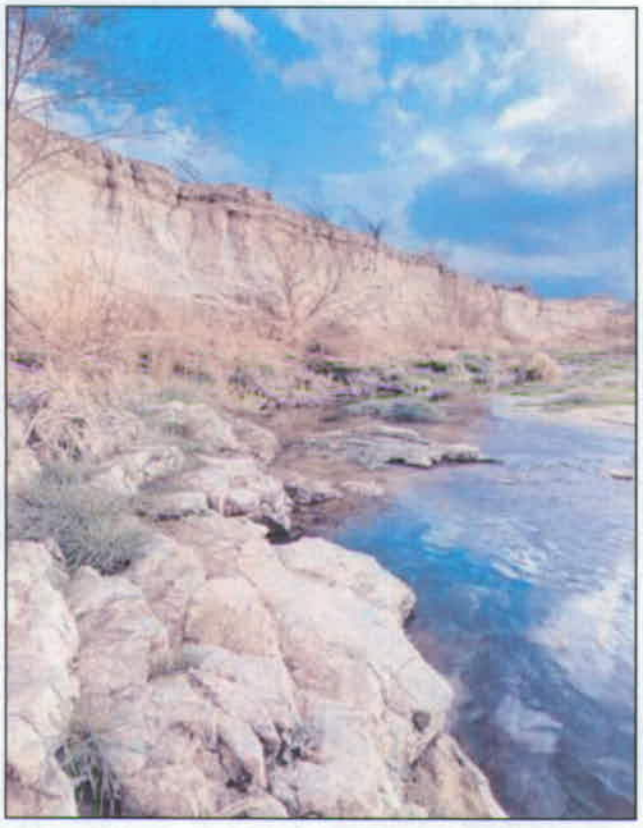
City of Las Vegas. In the Las Vegas Valley Water District service area, the City of Las Vegas provides reclaimed water within its municipal boundaries and unincorporated Clark County. The Water Pollution Control Facility (WPCF), the city's 91 million-gallon-per-day (MGD) main treatment plant, is located 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 to golf courses, schools and parks. Total reuse for the City of Las Vegas in 2004 was about 5,400 acre-feet.

Clark County Water Reclamation District. In the Clark County portion of the Water District 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.

Las Vegas Wash



The Desert Breeze Water Resource Center, completed in January 2003, is currently a 5 MGD facility. When all phases are complete, the facility will provide up to 10 MGD of reclaimed water, which is equivalent to 11,200 AFY, of reclaimed water, to golf courses, schools and parks.

In addition, the Clark County now requires new golf courses and nearby landscape areas to utilize reclaimed water, when applicable. Currently, Clark County Water Reclamation District is completing an In-Valley Water Reclamation Facilities Master Plan to increase the use of reclaimed water. This study, when implemented, will meet the reclaimed water needs in the entire Clark County Water Reclamation District service area. Total Clark County Water Reclamation District reuse in 2004 was approximately 9,900 acre-feet.

City of Henderson. Henderson is both the potable-water and reclaimed-water provider within its boundaries. The city has a water-reclamation facility capable of generating 23,500 AFY of treated wastewater available for reclaimed water. Customers currently utilizing reclaimed water for irrigation include seven golf courses, highway landscaping and a mortuary. Total reclaimed water in 2004 was approximately 7,900 acre-feet.

Valley-Wide Reuse Plans. The cities of Las Vegas, North Las Vegas and Henderson, the Clark County Water Reclamation District and the Water District 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 Water District. 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 and Henderson.

In 2004, the City of North Las Vegas began exploring construction of a 20 MGD water reclamation facility. North Las Vegas currently receives wastewater treatment through agreement with the City of Las Vegas. Upon completion, the facility is expected to provide about 8,000 AFY of reclaimed water.[24]

ENDNOTES

1 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.

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 Banking Water Among Southern Nevada Municipal Water Purveyors," effective January 1, 1993; between Big Bend Water District, City of Boulder City, City of Henderson, City of North Las Vegas and Las Vegas Valley Water District.

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 United States Bureau of Reclamation.

7 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.

8 "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.

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

10 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.

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

12 "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.

13 "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.

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

15 Ibid.

16 "Extent and Potential Use of the Shallow Aquifer and Wash Flow in Las Vegas Valley, Nevada," 1996, Southern Nevada Water Authority.

17 Ibid.

18 "Research and Development of the Saline Shallow Aquifer in the Southeastern Las Vegas Valley, Final Report," August 1999, Black and Veatch.

19 "Las Vegas Valley Shallow Groundwater Treatment Study," August 2004, Black and Veatch.

20 "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.

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

22 Ibid.

23 "Area Wide Reuse Study Las Vegas Valley Area." July 2000, prepared by Black and 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.

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

CHAPTER 4
MEETING FUTURE DEMANDS

This chapter discusses resource options available to meet future water demands given current conditions on the Colorado River and in Nevada. For the purposes of the SNWA Water Resource Plan, demands and resource planning are organized into two horizons:

- Near-Term (2006 through 2016)
- Long-Term (2017 through 2055)

All demand and resource planning is dependent on conditions that may change in unpredictable ways. To address this uncertainty, the SNWA has taken a portfolio approach to water resource development and demand management. The portfolio approach emphasizes acquisition and development of diverse resources (Colorado River and Nevada in-state resources), both surface water and groundwater, in an effort to offset the 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 3.

Once a portfolio of resources and 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 or 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 by the SNWA Water Resource Plan to meet those demands.

This is why demand management, conservation and banked water are of paramount importance to Southern Nevada. Conservation and demand management help to reduce overall demands, thus extending the use of existing developed resources over time. This helps to reduce not only the potential for gaps between existing resources and demands, but also the extent of such gaps if they do occur. Banked water, in turn, is intended to supplement these efforts, providing a bridge until permanent long-term resources are developed.

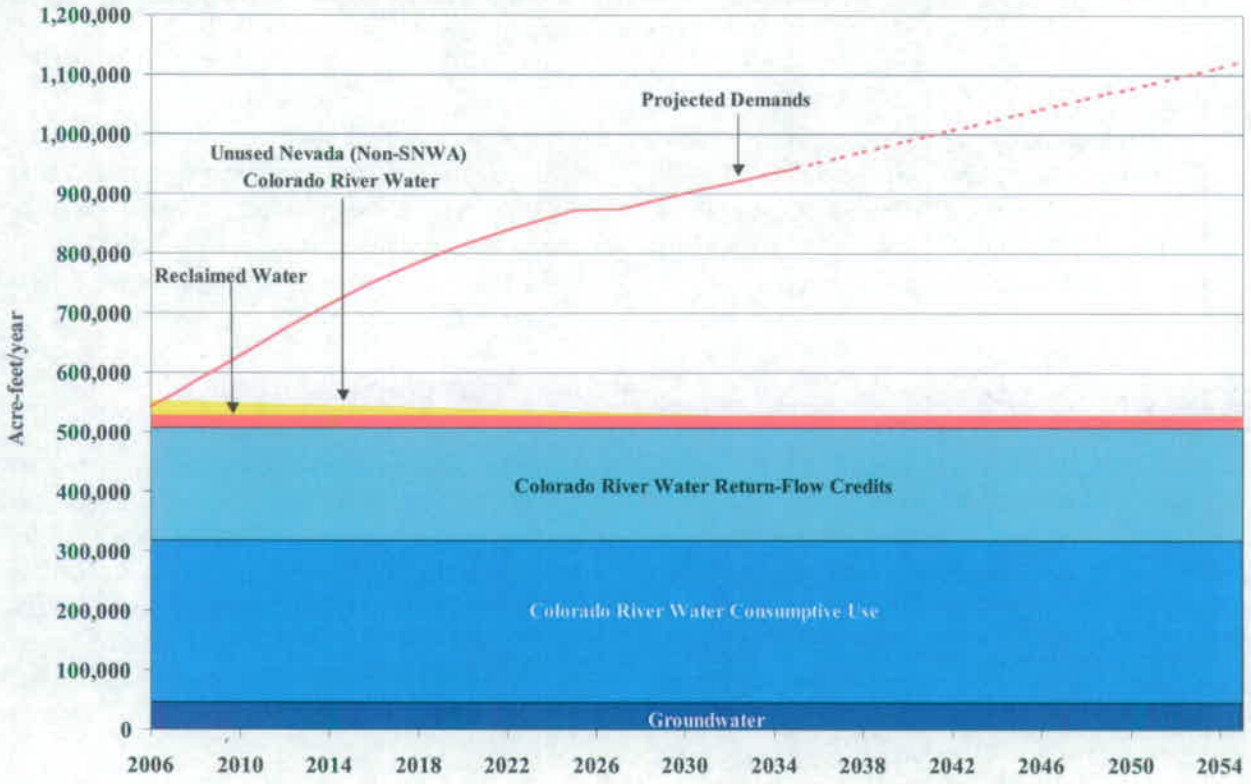
CURRENT WATER RESOURCES

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 50-year planning horizon, and the resources anticipated for meeting those demands. The 2006 Plan forecasts demands through 2055.

To meet its near-term and long-term demands, the SNWA intends to utilize a combination of current and future resources. As discussed in this chapter, "current resources" 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 25** depicts these current resources, as well as the demand forecast described in Chapter 2.

Nevada basic apportionment and return-flow credits. The first priority to meet near-term demands is to use Nevada's basic consumptive apportionment from the Colorado River, along with associated return-flow credits. Nevada is allocated 300,000 acre-feet 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.

Figure 25. Summary of Projected Water Demands and Existing Resources



Las Vegas Valley groundwater rights. As its next priority, the SNWA will use a total of 46,323 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 summer peaking 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 current resources, including Colorado River and groundwater resources that are currently being used to meet the water needs of the SNWA. As with Nevada's consumptive-use 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 near- and long-term demands as appropriate. However, this water is expected to gradually decline in the long-term.

MEETING NEAR-TERM DEMANDS

In addition to the current resources just described, the following options are anticipated for use to meet water demands from 2006 through 2016:

- Conservation
- Arizona Water Bank
- California Water Bank
- Southern Nevada Water Bank
- Interim surplus (if available)

The following in-state water resources are presently in development and the SNWA anticipates some portion of one or all of them may be available to meet demands in the latter part of the near-term horizon:

- Coyote Spring Valley groundwater rights
- Three Lakes Valley (North and South) and Tikaboo Valley (South) groundwater rights
- Muddy River water rights
- Virgin River water rights
- Groundwater rights and applications in northern Clark, Lincoln and White Pine counties
- Full consumptive use/recycled in-state water resources

As discussed in Chapter 2, achieving its conservation goal is critical to meeting demands in the near-term and long-term planning horizons. If the conservation goal is not achieved, additional resources may be required. **Figure 26** depicts one possible scenario for meeting near-term demands. In this example, near-term water demands in excess of Nevada's basic Colorado River apportionment, return-flow credits, reclaimed and unused Nevada apportionment, and permanent Las Vegas Valley groundwater rights may be met with a combination of banked water and interim surplus, if available.

The following sections briefly discuss the additional resources anticipated for use in meeting projected near-term demands.

Banked resources. Banked water includes storage credits in the States of Arizona and California, as well as water stored in the Southern Nevada Water Bank. The amount of banked resources that the SNWA ultimately uses will depend on the extent to which demand management continues to be effective in meeting near-term demands, along with the progress achieved by the SNWA in its ongoing development of in-state resources.

Interim surplus. Until the Interim Surplus Guidelines expire at the end of 2016, the SNWA may utilize this resource, providing there is adequate storage in Lake Mead.

As noted in previous chapters, drought conditions on the Colorado River have affected storage on the river system. The Secretary of the Interior declared a normal operating condition for 2005 and is expected to declare a partial domestic surplus for 2006. However, the SNWA does not anticipate that Colorado River demands will exceed its 300,000 AFY consumptive use allocation in 2006. If demands for Colorado River water exceed 300,000 AFY in the near-term planning horizon and interim surplus water is available, it will be used to the fullest extent possible.

In-state resources. In-state 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 resources are comprised of rights and applications for groundwater and surface water as discussed in Chapter 3.

Depending on how water demands and development of these supplies evolve in the near-term (2006 through 2016), the SNWA plans to develop portions of these resources to meet near-term demands, while preparing other portions for use in meeting long-term water resource needs.

Full consumptive use/recycled in-state water resources. As described in Chapter 3, the SNWA currently reclaims all of its wastewater. The SNWA is currently pursuing full consumptive use of non-Colorado River water pursuant to the recommendation of the IWPAC. If approved, full consumptive use or recycling of these resources will help maximize the use of in-state resources.

Conclusion

It is still unclear how long the drought affecting the Colorado River Basin will last, but based on current conditions, the SNWA has sufficient resources available to meet near-term water demands. Beyond Nevada's basic apportionment and Las Vegas Valley groundwater rights, the highest priority resources to meet these demands are continued conservation achievements and development of in-state, non-Colorado River resources. If necessary, banked reserves will be accessed while the SNWA brings other permanent in-state resources online.

MEETING LONG-TERM DEMANDS

In addition to the current resources described at the beginning of the chapter, the following resource options are anticipated for use to meet long-term water demands from 2017 to 2055 **(Figure 26)**:

- Arizona Water Bank
- California Water Bank
- Southern Nevada Water Bank
- In-state, non-Colorado River water resources
  - Groundwater rights and applications
  - Surface water rights
  - Full consumptive use/recycled in-state water resources
  - Colorado River transfers/exchanges/surplus

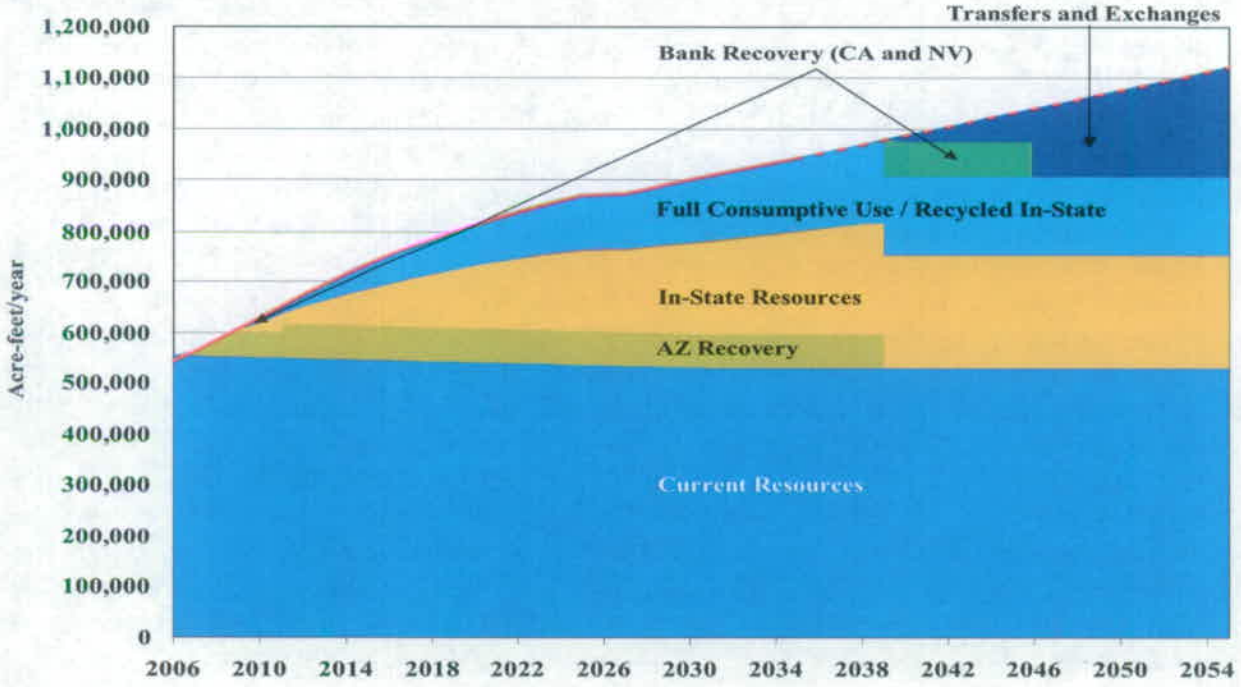
Except for interim surplus, all SNWA near-term resource options are available to serve as long-term resources to meet projected demands. This includes Nevada's basic Colorado River apportionment, associated return-flow credits, Las Vegas Valley groundwater rights, reclaimed water, unused Nevada Colorado River water, banked resources, as well as in-state groundwater and surface water rights.

Banked water. Banked resources in Arizona, California and Southern Nevada will also be used to meet long-term demands. During the period between 2003 through 2005, Southern Nevada's Colorado River demands were well below the state's 300,000 AFY consumptive use apportionment, a trend that is expected to continue through 2006. As a result, available unused water will be transferred to either the Southern Nevada or California Water Bank, allowing Southern Nevada to maximize the use of Nevada's Colorado River water and providing additional water resources to meet future needs.

In-state resources. In-state resources are long-term, permanent resources that the SNWA will develop over time and manage in conjunction with Colorado River water supplies. These resources are comprised of rights and applications for groundwater and surface water. At the recommendation of the IWPAC, the SNWA is pursuing development of all of these resources.

Groundwater. In addition to Nevada's Colorado River apportionment and return-flow credits, a substantial long-term resource available to the SNWA is

Figure 26. Summary of Projected Water Demands and Future Resources*



* Interim surplus will also be used to meet demands if available and needed during the period 2006 through 2016.

its in-state groundwater rights, applications and any related future appropriations. The resource and demand scenario in this section reflects use of 125,000 acre-feet of in-state groundwater, which corresponds with the SNWA's applications for between 125,000 to 200,000 acre-feet of groundwater in Clark, Lincoln and White Pine Counties.

Surface water. The SNWA anticipates utilizing its surface water rights on the Virgin and Muddy rivers in conjunction with development of the groundwater resources previously noted, to meet long-term water demands in Southern Nevada. The resource and demand scenarios in this section reflect use of up to 80,000 acre-feet of in-state surface water.

Full consumptive use/recycled in-state water resources. The future development and use of in-state resources will create additional wastewater. Obtaining full consumptive use of these resources has the potential to significantly increase the amount of water available in Southern Nevada's resource portfolio. For the purpose of long-term resource planning, the SNWA estimates that this resource would be up to 70 percent of the non-Colorado River in-state resources brought on-line in the future.

Colorado River transfers/exchanges. The SNWA anticipates that transfers and exchanges will be used to meet demands in the distant future. For Southern Nevada, this may involve seawater desalination exchanges, transfers of conserved water or Tribal water, or agricultural to municipal water conversions.

CONCLUSION

While certain long-term resource options will remain fixed in nature (for example, Nevada's basic Colorado River allocation), variable options such as water transfers or exchanges, banked water, and in-state non-Colorado River resources are expected to be available. These options will create additional opportunities to maximize available resources for managing Southern Nevada's long-term water demands.
As discussed in Chapter 3, 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 gives the SNWA flexibility to accelerate some resources if other resources are delayed or revised. The near- and long-term projections in this chapter will be revised and refined annually, based on existing conditions and anticipated outcomes regarding the issues discussed above and in Chapter 5.

Should demands in Southern Nevada significantly decrease from those projected in this plan, additional resources might not be necessary. 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 moved to lower priority for development.

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CHAPTER 5
ENVIRONMENTAL PLANNING AND COMPLIANCE

Development of water resources often requires a variety of state and federal regulatory approvals, permits or other forms of compliance with major environmental laws and regulations. Because these processes can be lengthy and complex, it is critical to consider these issues when evaluating and pursuing resource options for future development.

As part of its current resource development projects, the SNWA is working with federal, state and local agencies to prepare environmental compliance documents. These environmental compliance documents are required prior to obtaining approval to construct facilities on federal lands.

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

The following sections briefly describe the environmental planning and compliance activities relating to SNWA's water resource planning and development.

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

Four native Colorado River fish are federally listed as endangered: the razorback sucker (*Xyrauchen texanus*), the bonytail (*Gila elegans*), the humpback chub (*Gila cypha*) and the Colorado pikeminnow (*Ptychocheilus lucius*). In 1994, major portions of the Colorado River were designated as critical habitat for these endangered fish. This 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 (such as reservoirs).

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 December 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 SNWA, oversees program implementation, which will provide ESA compliance for federal and non-federal operations on the lower river for the next 50 years.

In addition to the MSCP, the SNWA participates in species 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.

Las Vegas Wash

The Las Vegas Wash plays an important role in the environmental and water-resource issues facing Southern Nevada. The Las Vegas Wash is the primary drainage channel for all stormwater flows, landscape and surface-street runoff, treated wastewater flows and shallow groundwater flows in the Las Vegas Valley. These flows represent less than 2 percent of the Colorado River flow into Lake Mead, but are an important component since they provide return-flow credits associated with Nevada's Colorado River allocation. Historically, wetlands in the Wash have served as a polishing mechanism as urban flows pass into the Colorado River system. However, since the 1970s, erosion has 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 28 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. The plan provides a comprehensive set of management actions for stabilizing and enhancing the Wash and improving water quality. The plan made three main recommendations – erosion control, environmental monitoring, and wetlands restoration and enhancement. The SNWA continues to coordinate with other agencies to implement these important recommendations, which will reduce erosion and address water-quality concerns in the Wash.

In 2000, the SNWA was designated the lead agency 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 has constructed eight grade control structures, installed 17,000 lineal 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 50 acres with native plants, and performed archeological studies.

In addition, the Clean Water Coalition (CWC), comprised of the City of 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 (CAC). The CAC was initiated to address alternatives to protect water quality in the Las Vegas Wash and Las Vegas Bay of Lake Mead before conditions might degrade or result in regulatory action. On February 19, 2004, the CAC's recommendations were approved by the CWC Board. A Draft Environmental Impact Statement was released on September 23, 2005. A final EIS is anticipated to be completed sometime in 2006. Given the nexus between water and wastewater in Southern Nevada, the SNWA is working closely with the CWC to coordinate various activities.

Salton Sea Restoration

Addressing environmental issues at the Salton Sea is a critical component to ensuring that surplus water on the Colorado River might be available under the Interim Surplus Guidelines. Although the Colorado River Basin is currently in a drought, surplus Colorado River water is still a potential future resource in SNWA's resource portfolio.

The Salton Sea is a highly saline terminal lake that is a very productive fishery and important habitat for bird species. Water transfers are being implemented within California to reduce its overuse of the Colorado River, which forms the basis for the Colorado River Interim Surplus Guidelines. These transfers may reduce drainage into the Salton Sea, and have been a major concern among federal, state, and local agencies, as well as local residents and environmental organizations. The SNWA is monitoring this issue by attending regular meetings and symposia concerning Salton Sea restoration and management activities.

Colorado River Delta

The Colorado River Delta in Mexico is a regionally significant wetland and estuarine ecosystem supporting a diverse array of plant and animal species, including several that are listed as endangered in both the United States and Mexico. The construction of dams and subsequent diversion of water from the Colorado River in the United States and Mexico have reduced water and sediment flows to the Delta, substantially reducing the amount of riparian and wetland areas in the Delta from pre-dam levels. 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 United States and Mexican governments have developed a conceptual framework for cooperation on studies and recommendations regarding environmental issues in the Colorado River Delta.

With the regional drought and increased pressures on Colorado River water resources, the issue of the Colorado River Delta will likely become more complex. The SNWA continues to gather information and ensure that other stakeholders are well informed of the many issues concerning the Delta. By continuing to engage this issue, the SNWA will be prepared in the event the Delta affects Colorado River policy.

CLARK COUNTY

Clark County Multiple Species Habitat Conservation Plan

After the listing of the desert tortoise (*Gopherus agassizii*) under the ESA in 1989, local agencies in Clark County recognized the need to address concerns about other listed or sensitive species that could affect development in the county. Beginning in 1998, the Clark County Multiple Species Habitat Conservation Plan (MSHCP) was developed to address an entire range of biological resources within Clark County. In addition to the desert tortoise, the plan addresses 232 species. The key purpose of the MSHCP is to achieve a balance between the conservation and recovery of sensitive and listed species in Clark County, and the orderly and beneficial use of land in order to meet the needs of the growing population in Clark County. In other words, the MSHCP serves as an insurance policy to cover future federal listings of species that, if not protected, could halt urban growth in areas where they live.

In the first phase of the plan, the USFWS issued a "take" permit for 79 species in 2001. As part of the first phase, the MSHCP is currently developing conservation management strategies for the Virgin and Muddy Rivers, Meadow Valley Wash, low elevation springs and several other important resource areas in the county. The next phase of the MSHCP is slated to address conservation needs of additional species and ecosystems, which may provide a framework for comprehensive watershed-based management planning to deal with the complex issue of aquatic species, habitats and land uses along the Muddy and Virgin Rivers. The SNWA actively participates in the MSHCP to ensure that mutual benefits are maximized for both Clark County and the SNWA.

Three Lakes Valley Water Development

In April 2004, the SNWA applied to the Bureau of Land Management (BLM) for rights-of-way to construct facilities to develop groundwater resources in Three Lakes Valley. An Environmental Assessment (EA) is being 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 hydrologic effects from groundwater pumping on sensitive springs, including Ash Meadows and Corn Creek, and the community of Indian Springs are being analyzed. The EA is anticipated to be completed in 2006.

SURFACE WATER DEVELOPMENT

In October 2004, the SNWA applied to the BLM for rights-of-way to construct facilities to develop SNWA's existing water rights on the Virgin and Muddy Rivers. The BLM has determined that it is necessary to prepare an Environmental Impact Statement (EIS) to evaluate the environmental impacts of its right-of-way decision. The SNWA has conducted environmental research on the Virgin and Muddy Rivers since 1993, and will provide this data to the BLM for consideration during the EIS process. This includes population and habitat surveys for fish, birds, mammals, amphibians, and sensitive plants. The EIS is anticipated to be completed in 2007.

Virgin River

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 (*Rallas 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. Much of the available biological information concerning this river system has been collected as a result of efforts by the SNWA. 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.

A number of environmental programs exist in the upper and lower Virgin River. In the upper Virgin River (within 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 is providing environmental compliance for water development and flood-control projects by using resource-management agreements aimed at recovery of listed species, conservation of native species and protection of the river corridor.

The lower Virgin River (Arizona and Nevada) has only recently faced the same development pressures as the upper Virgin River, and as a result has only recently been the subject of large scale environmental planning efforts. The City of Mesquite has taken steps to initiate the development of the Virgin River Habitat Conservation Plan (VRHCP), with the goal of providing ESA compliance for impacts to listed species resulting from land development activities along the river. This program should be completed and begin implementation by the end of 2007. The Lower Virgin River Recovery Implementation Team is working to develop a conservation action plan for woundfin and Virgin River chub. This team is also conducting research and implementing interim conservation measures for these listed fish. Clark County is developing a conservation management strategy for the Virgin River under the MSHCP, which will be done in conjunction with development of the VRHCP. 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 effects like the VRHCP. 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.

Muddy River

The upper Muddy River (Warm Springs) is a highly sensitive area that provides habitat for a unique suite of species that are considered rare and sensitive. The mainstem of the river, tributaries and springs in the Moapa area provide habitat for two federally endangered fish, the Moapa dace (*Moapa coriacea*) and Virgin River chub (*Gila seminuda*). The USFWS manages the Moapa National Wildlife Refuge in this area for conservation of the Moapa dace. Additional sensitive species on the river include three fish, two snails and two insect species. Conservation of the Muddy River species is a high priority for local, state and federal agencies.

In an effort to address the needs of the listed and sensitive species, federal and state agencies, environmental organizations and local stakeholders are working together in several capacities to implement conservation and recovery actions. The Muddy River Recovery Implementation Team, which is composed of federal and state environmental resource managers, scientists and local stakeholders, was formed in 1998 by the USFWS to focus on recovering the Moapa dace and Muddy River population of Virgin River chub. In addition, the MSHCP is working with the Nature Conservancy and other stakeholders to identify private lands that are ecologically important and acquire them from willing sellers. The SNWA works closely with the various agencies on these environmental efforts to improve the knowledge of the species and identify needed conservation actions.

Examples of SNWA activities include participation in annual species population surveys and implementation of habitat restoration projects. The knowledge and benefits gained from these efforts are important to resource planning and environmental compliance.

The SNWA is also cooperating with the USFWS and other agencies to ensure that groundwater pumping in Coyote Spring Valley does not adversely affect the Moapa dace and other sensitive species in the Muddy River springs area. SNWA is funding habitat restoration projects, a Recovery Implementation Plan for the endangered fish, and an ecological model of the aquatic system, and is cooperating on research and biological studies with the agencies and efforts to enhance stream flow for fish habitat.

CLARK, LINCOLN AND WHITE PINE COUNTIES GROUNDWATER DEVELOPMENT

Eastern Nevada lies within the Great Basin, which is a high desert area that supports a suite of unique and sensitive plant and animal species. Some of the species that are a concern include the greater sage grouse (*Centrocercus urophasianu*), pygmy rabbit (*Brachylagus idahoensi*), White River spinedace (*Lepidomeda albivallis*) and ferruginous hawk (*Buteo regalis*). Many of these species depend upon springs and small streams that are scattered throughout this area.

In August 2004, the SNWA applied to the BLM for rights-of-way to construct facilities to develop groundwater resources in several hydrologic basins. The BLM has determined that it is necessary to prepare an EIS in order to evaluate the environmental impacts of its rights-of-ways decision. The SNWA has conducted hydrologic and environmental research in this region since the early 1990s, and will provide this data to the BLM for evaluation during the EIS process. The EIS is anticipated to be completed in 2008.

As part of its effort to analyze potential effects from groundwater development in this area, the SNWA is conducting studies to characterize physical and biological conditions in more than 70 springs across the project area. These studies include evaluating the current level of disturbance, describing the biological community present, measuring flows and characterizing water chemistry. Hydrologic conditions and potential effects are being analyzed through a comprehensive analysis, including characterization of current groundwater, spring, phreatophyte, and hydrogeologic conditions and development of a groundwater flow model. By conducting these studies, SNWA will be able to better predict potential impacts from groundwater development, and develop hydrologic monitoring and management to reduce or avoid those impacts.

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. These processes are a critical component of SNWA planning, and will assist the SNWA in maintaining and developing the portfolio of water-resource options described in Chapter 3.

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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. Permanently implement major Drought Alert demand reduction tools identified in the SNWA Drought Plan, including landscape watering restrictions, landscape development codes, golf course water budgets and increased water waste fines 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 hydrologi cal effects, sustain the resource and protect the surrounding environment.

Appendix 1 cont'd

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 flexible 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 cannot 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.

Appendix 1 cont'd

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
CLARK COUNTY POPULATION FORECAST USED BY SNWA IN PREPARATION OF WATER DEMAND FORECAST IN SNWA 2006 WATER RESOURCE PLAN

Year	Population
2003*	1,641,529
2004*	1,747,025
2005	1,833,500
2006	1,923,420
2007	2,012,215
2008	2,103,275
2009	2,192,447
2010	2,281,340
2011	2,367,952
2012	2,452,825
2013	2,534,696
2014	2,612,657
2015	2,687,055
2016	2,757,719
2017	2,824,689
2018	2,887,097
2019	2,945,254
2020	2,999,953
2021	3,051,144
2022	3,099,231
2023	3,144,571
2024	3,187,352
2025	3,228,140
2026	3,266,627
2027	3,303,652
2028	3,339,758
2029	3,375,368
2030	3,410,332
2031	3,444,402
2032	3,479,012
2033	3,513,467
2034	3,547,328
2035	3,580,908

* Historical estimates.

Source: "Clark County Nevada Population Forecast 2005 - 2035," 07/27/2005, Center for Business and Economic Research at the University of Nevada, Las Vegas.

Appendix 3
SOUTHERN NEVADA WATER AUTHORITY
INTEGRATED RESOURCE PLAN ADVISORY COMMITTEE
RECOMMENDATIONS
(Adopted June 1995 by SNWA Board)

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.

Appendix 3 cont'd

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 input to the IRP process.

5.4 Continue to update water demand projections as needed.

Appendix 4
IWPAC and the Drought Plan

The Integrated Water Planning Advisory Committee (IWPAC) evaluated resource and conservation options to meet future water demands. As part of this process, the committee considered a demand projection that includes a gallons-per-capita-per-day (GPCD) reduction from 280 GPCD by 2010 (equivalent to SNWA's current goal of 25 percent conservation by 2010) to 250 GPCD by 2010 and 245 by 2035.

To achieve this, the following major demand reduction measures identified in the SNWA Drought Plan would need to be implemented permanently throughout the planning horizon.

Landscape Watering Restrictions	Mandatory seasonal watering scheduled and time-of-day restrictions for sprinklers: • 3 assigned days/week (Mar. - Apr. and Sept. - Oct.) • 1 assigned day per week (Nov. - Feb.) During the months of Sept. through Apr., a 30-day exemption on watering day restrictions will be made for new turf installation. Parks, schools and governmental facilities are required to abide by mandatory landscape watering restrictions. If more than 5 acres of turf are present, a self-assessment of water conservation potential must be conducted and a plan to maximize outdoor water use efficiency must be implemented.
Landscape Development Codes	New turf installations are prohibited in residential front yards (except where jurisdictions provide provisions allowing the substitution of turf that would otherwise be allowed in back yards). New turf installation allowed in residential back yards up to a maximum of 50 % of landscapable area. Multi-family residences allowed new turf up to 50% of the turf limitations under non-drought conditions. No new turf installation in non-residential developments except by issuance of permit by a governing jurisdiction. No permit will allow for over 50% of the turf allowed under non-drought conditions. Installation of warm-season grasses is permitted during the summer months. The planting of cool-season grasses is prohibited May through August.
Golf Course Water Budgets	Subject to water budgets. Budgets are calculated based on the current irrigated acreage. Increased overuse surcharges shall apply. Required to develop and implement a plan to maximize outdoor water use efficiency.
Water Waste Enforcement	Mandatory violation/penalties after first warning. Active enforcement. Increased water waste penalties.

Achieving and maintaining these reductions also requires that water pricing signals be sustained by water rates and that levels of participation in the SNWA Water Smart Landscapes Program through 2010 are equal or greater to the participation levels in 2004.

Appendix 5

NEVADA COLORADO RIVER ENTITLEMENTS **PRIOR TO 1991/PRE-SNWA**
(ACRE-FEET PER YEAR)

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
Pacific Coast Building Products	1965	Contract	928
CRC for Nellis AFB portion Southern Nevada Water System (SNWS)	1967/77	Contract	4,000
U.S.	1992	Secretarial Reservation	300
Nevada Wildlife Division	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	Perfected right	5,876
Las Vegas Valley Water District	1969	Contract	15,407
CRC for Southern Nevada Water System (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 Southern Nevada Water System (system loss)	1967/77	Contract	9,000
TOTAL NEVADA ENTITLEMENTS (prior to 1991/pre-SNWA)			**417,116**

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 Reclamation currently has reduced to zero.
4 Estimate; Boulder City's 1960 water delivery contract right was for 3,650 gpm "maximum rate of delivery."