Comprehensive Regional Water System Plan

For the Carson River Watershed

August 21st, 2013

Working Paper

The purpose of this Working Paper is to create a dialogue between the communities to enhance and protect our precious water resources and to use them wisely.

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Executive Summary

Nevada is an arid state; therefore, preserving water and avoiding waste is critical in balancing resources among agricultural users, environmental needs, and municipal and domestic demands. This is especially true in the Carson River Watershed, which has very limited surface water storage capacity in the upper Watershed. Effective use of our limited water resources is imperative for maintaining a healthy Watershed.

The purpose of this Comprehensive Regional Water System Plan is to evaluate future water demands and how these new water demands can be met by minimizing the impact on the environment and agriculture. The Plan will also touch on how changes to runoff patterns and flows in the Carson River may impact the current water supply picture and possible impacts on future supplies. Additionally, the report will look at some basic data related to available water rights in the hydrologic basins as determined by the State Engineer, which will relate to how much reliable water is actually available on a long term basis in different areas of the Watershed.

The Carson River Watershed encompasses approximately 3,965 square miles in California and Nevada. The Carson River begins as two separate tributaries, the East and West Forks, high in the Sierra Nevada in California. These forks join to form the main stem of the Carson River near Genoa, Nevada before continuing their journey to its terminus in the Carson Sink (Churchill County). The Carson River Watershed also encompasses five major groundwater basins: Carson Valley, Eagle Valley, Dayton Valley, Churchill Valley, and Carson Desert (Fallon Area). All the water in the Watershed, both surface and groundwater is fully allocated, so any new demands for water must come from existing sources.

Beginning in the late 1800s, various small communities began to develop up and down the Carson River Watershed. Because of the distance between the various communities, each developed their own water systems. Each of these water purveyors operates independently. Over time, many of these communities have grown to the point that they are now adjacent to each other and several water purveyors have begun linking their water systems together. These interties enable the water purveyors to enhance their water supply reliability, provide emergency backup, and better meet the new water quality standards.

All of the water systems evaluated currently have sufficient water supply and permitted water rights to meet current demands. Additionally, the projected growth for the Watershed is currently nominal enough to minimize the need for major changes at this time. However, with that said, a ramp up of growth above current estimates, changes in climate, decreases in aquifer supply and/or quality, and an expansion of treatment requirements could accelerate the need for more immediate action. By planning for the future, and laying the groundwork for a master plan of the Watershed, the water purveyors, tribes, ranchers and other users of the river can be better prepared to act when the need arises, or will already have the infrastructure in place to address the need. Further study and analysis will be needed to reference specific steps and work towards consensus on a master plan for the management of water within the Carson Watershed.

The report provides information on the various major water purveyors in the Watershed and how interconnections between those purveyors might be made. It is important to note that this report does not commit any purveyor or entity to any action and is only a tool for looking at some of the potential alternatives for water system coordination on a regional basis should the need or desire arise for such coordination. Each water system will need to determine how they choose to interact with their regional peers.

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Chapter 1 – Introduction

The Carson River Watershed (Watershed) encompasses approximately 3,965 square miles in California and Nevada. The Carson River begins as two separate tributaries, the East and West Forks, high in the Sierra Nevada in California. These forks join to form the main stem of the Carson River near Genoa, Nevada before continuing its journey to its terminus in the Carson Sink (Churchill County). The Carson River Watershed also encompasses five major groundwater basins: Carson Valley, Eagle Valley, Dayton Valley, Churchill Valley, and Carson Desert Valley (Fallon Area). All the water in the Watershed, both surface and groundwater is fully allocated, so any new demands for water must come from existing sources.

The largest surface storage on the Carson River is located two-thirds down the river. This storage facility, known as Lahontan Reservoir, provides water to the Newlands Project. The Newlands Project was the first U.S. Bureau of Reclamation (USBR) project in the United States and provides water to farmlands in Churchill and Lyon Counties. Water demands in the Newlands Project often exceed the available supplies coming from the Carson River. To augment the water needs of the Newlands Project water is diverted from the Truckee River through the Truckee Canal. This canal links the Truckee and Carson Rivers.

Upstream of Lahontan Reservoir there is very limited surface water storage. The water supply of the Carson River is almost entirely dependent upon the winter snow pack that accumulates in the Sierra Nevada Mountains. Most of the annual runoff is concentrated in a three or four month period in the spring. Today, municipalities within the Watershed typically utilize groundwater to meet their water demands. However, as growth continues in the Watershed many water purveyors may need to consider developing surface water supplies or linking to other purveyors who have available groundwater. The availability and timing of the water runoff may be further limited by the potential impacts of climate change. Warming by just a few degrees can impact how much precipitation falls as snow versus rain, snowpack accumulation, earlier spring runoff, and less water available in the summer. Climate change could mean agricultural users will be out of water earlier than they were historically, resulting in more groundwater pumping or less production for farmers. Water purveyors who have to use surface water to meet their water demands could have less available to meet their peak demands. One of the requirements of this grant was to consider ways to extend their surface water supplies by developing alternatives for off-stream storage, leasing, banking, or interties with other purveyors.

1.1 Purpose

With all groundwater and surface water fully allocated in the Carson River Watershed, any future municipal water demands will have to come from existing water rights. The purpose of this Comprehensive Regional Water System Plan (Plan) is to evaluate future water demands and how these new water demands can be met while minimizing the impact on the environment and agriculture. The Plan will also touch on how changes to runoff patterns and flows in the Carson River may impact the current water supply picture and possible impacts on future supplies. The report will also provide information on the various major water purveyors in the Watershed, look at potential interconnections between those purveyors, and present water rights information in the Carson River hydrologic basins as determined by the State Engineer. This basic water rights data will relate how much reliable water is actually available on a long-term basis in different areas of the Watershed.

1.2 Planning Area

The planning area consists of the entire Carson River Watershed, from the headwaters in Alpine County to Stillwater National Wildlife Refuge in Churchill County. The planning area is shown on Figure 1.1. Although the study looks at all water uses in the Watershed, the focus of the Plan is on municipal water uses.

1.3 Carson Water Subconservancy District

The Carson Water Subconservancy District (CWSD) was originally formed in 1959 to contract with the farmers in Douglas County and Lyon County to pay the Bureau of Reclamation for the construction of Watasheamu Dam, located in the upper Watershed. The purpose of the dam was to enhance water supply for agricultural development, meet future municipal demands, and provide flood control protection.

In the 1980s the Federal government abandoned the Watasheamu Dam Project. However, during this time period CWSD continued to play a key role in the study and management of the Carson River. In 1989, the Nevada Legislature charged CWSD with the responsibility of "management and development of the water resources in the upper Carson River to alleviate reductions and loss of water supply, the fragmented responsibilities for conservation and supply of water, and of any threats to the health, safety and welfare of the people of the upper Carson Watershed." The legislation also established a nine member board comprised of representatives from Douglas County, Carson City, and Lyon County.

In 1999, legislation was introduced to include Churchill County to become a member of CWSD with two board members. In 2000, through a Joint Resolution, Alpine County, California became a member of CWSD with two representatives on the board. At this point CWSD became a bi-state, multi-county organization. In 2009, Storey County joined as a non-voting member. The CWSD Board of Directors is now made up of 14 members. There is at least one elected official from each county, except for Storey County, and several agricultural representatives from several counties.

Granted no regulatory authority of its own, CWSD's mission is to work within existing government frameworks to promote cooperative action for the Carson River that crosses both physical and political boundaries. CWSD has served as an information resource for the Carson River Watershed and has overseen and funded numerous studies to better understand the complex dynamics of the region. Over 190 reports are currently catalogued in CWSD's library for use by the public.

After the flood in 1997, a group of community leaders, agriculture representatives, landowners, educators, and environmental groups held a Watershed-wide conference to discuss water resources issues. By the conclusion of the conference it was agreed that an integrated approach to Watershed management should be pursued. The Carson River Coalition (CRC) was formed, and CWSD was asked coordinate the process. The goal of an integrated approach to Watershed management is to incorporate all aspects of water resources: water quality, environmental concerns, municipal demands, agricultural needs, and flooding.

As a regional Watershed agency, CWSD works to support many types of projects throughout the Watershed. CWSD's involvement has many facets:

- CWSD acts as the 208 Water Quality Planning entity for the Carson River under the Clean Water Act since its appointment by Nevada's Governor in 2003.

- CWSD coordinates inter-agency and public projects to improve the environmental health and sustainability of water resources in the Carson River Watershed through the implementation of the Carson River Adaptive Stewardship Plan.
- CWSD explores alternative methods for guaranteeing adequate fresh water supply to meet the needs of the growing population within the Watershed.
- In 2008, CWSD, in conjunction with the counties, state, and CRC, developed the Regional Floodplain Management Plan. This plan was adopted by CWSD and all the counties located along the Carson River.
- CWSD is currently working with FEMA to update the floodplain maps along the Carson River from Alpine County to Lahontan Reservoir.
- In 2009, CWSD received federal stimulus money under the American Recovery and Reinvestment Act to hire people to combat noxious weeds to reduce wildfire fuels in the Watershed.
- CWSD currently administers several Nevada Division of Environmental Protection (NDEP) grants to promote non-point source (NPS) education and Watershed awareness and over the years, CWSD has been involved various water quality studies.

1.4 Carson River Coalition

The Carson River Coalition (CRC) was formed in 1998 to address Watershed issues on an integrated, coordinated basis within the Watershed. The CRC is not an entity but a process to bring individuals, groups, and entities together who have an interest in or concern about the Carson River Watershed. The CRC pursues broad representation from federal, state, located agencies, landowners, farmers, environmental groups, tribes, and any other interested individual. CRC working groups address specific issues within the Watershed. The CRC developed a Stewardship Plan that meets the nine EPA Clean Water Act required elements of a Watershed-based plan. The CRC worked on the development of the Regional Floodplain Management Plan and is working with CWSD and counties on the implementation of many suggested action projects identified in the plan. The CRC has over 500 stakeholders on its contact list.

1.4.1 Carson River Watershed Adaptive Stewardship Plan

The Carson River Watershed Adaptive Stewardship Plan is a "living document" that provides a holistic approach to Watershed management. The main purposes of this stewardship plan are to:

a) Provide an overview of the Watershed and its challenges;

b) Identify potential causes of nonpoint source pollution;

c) Discuss short- and long-term strategies and actions to address these potential sources;

d) Provide a tracking mechanism for projects and programs;

e) Identify future project and program opportunities; and

f) Address the nine criteria elements of the Clean Water Act Section 319 Program, qualifying CWSD to receive 319(h) grant funding.

The Comprehensive Regional Water System Plan will be incorporated into the Stewardship Plan.

1.5 Integrated Regional Planning

In 1988, Kennedy/Jenks conducted a Water Resource Analysis of the Upper Carson Watershed that evaluated water supplies and compared it to future water demands for a sixty-year period. In 2000, Brown and Caldwell updated the Water Resource Analysis for the entire Carson River Watershed. This report included water resources for Churchill County for a 50-year period.

The two reports mentioned above, when written, did not take into account the impact of new water quality standards on water supplies, climate changes potential runoff patterns, and water conservation's possible role to leverage water resources.

Since these two reports were written, the Watershed has seen significant growth. In addition, a regional pipeline is being constructed to connect the water systems of the Town of Minden, Indian Hills General Improvement District, Carson City, and Douglas County. Douglas County and Indian Hills General Improvement District systems are receiving water from the Town of Minden, and Carson City will be on-line to receive water in early 2014. The cooperative working relationships this regional system has fostered create a political blueprint for developing future regional projects. The Carson Valley Regional System along with the intertie previously created between Carson City and Lyon County, provides a backbone of interconnection for large population areas of the upper Watershed. An important part of any future water planning in the region will revolve around the decisions made by each individual water purveyor related to what level of participation they may want to have in further expansions of a regional system. This report illustrates some potential alternatives for future connections of the existing regional water system that each individual water system can evaluate as part of their decision making process.

Chapter 2 – Water Resources

This chapter describes the basic laws governing surface and groundwater within the Watershed. Additionally, a discussion of the sources of water available for use and potential management techniques utilizing water leasing and banking are provided in this chapter.

2.1 Laws, Regulations, Decrees

The basis for Nevada's water law developed in the early 1900's through a number of legislative actions which established the office of the State Engineer and granted the State Engineer the authority to provide for the appropriation, distribution, and use of water. It was also established that all water in Nevada is owned by the State with the State Engineer granting the authority to utilize water as applied for by a water user. While complex in many ways, the management of water rights within the State of Nevada by the State Engineer has worked for over a century with relatively little change since the creation of the system.

2.1.1 Alpine Decree

The Alpine Decree (Decree) has adjudicated the use of all surface water associated with the Carson River. The Decree divides the river into 8 different segments, with each segment regulated within itself. Per the Decree, water will not be delivered to a senior priority in one segment against a junior priority in another segment. For example, a senior priority in the Dayton segment will not receive water before a junior priority in the Carson Valley. This division of the river into segments and the management of the water as it moves downstream is one of the challenges in dealing with water management along the Carson Watershed. The ability to leave water in the river for transport downstream or upstream for use in a different segment is not unheard of; however, the amount and timing of when water can be used may be limited. Cooperation between surface water users will become more important as future growth strains available water resources. Developing agreements to move water through the river system could provide greater flexibility in meeting varying water demands as well as enhance flows in the river for habitat. Further research and development of a viable plan to manage water between segments of the Carson River is a significant task that will need to be evaluated and undertaken as part of an overall Watershed management system/plan.

2.1.2 Nevada Water Law

Nevada Water Law is based upon two fundamental theories of appropriation and beneficial use. This essentially means that water rights are based upon the state allowing individuals or entities the right to appropriate waters, both surface and groundwater, based on a priority system and availability. The priority is linked to the date of the first action taken to place water to a beneficial use. The earlier the priority date on a water right permit/certificate, the better its claim to utilize either surface or groundwater.

2.1.3 California Water Law

California Water law is administered by the State Water Resources Control Board (Control Board). Although all the surface water rights are included in the Alpine Decree, any water transfers, changes in use, changes in point of diversion, or purpose of use must be approved by the Control Board.

2.1.4 Other Adjudicated Streams

Other streams that feed into the Carson River that are not specifically adjudicated by the Alpine Decree are typically adjudicated by their own decrees for use along the streams. An example would

be Clear Creek located in Douglas County and Carson City. If a stream reaches the Carson River in theory an owner of rights along the adjudicated stream could place the rights into the Carson River for use downstream. However, this process is most likely to be challenged in court and may take years to resolve. Accumulation of rights from another decreed stream or surface water source for transmission along the Carson River may be viable; however, this again is a specific research task linked to the inter-segment management of water in the Carson River.

2.2 Sources of Water

2.2.1 Surface Water

A. Carson River: The Carson River is the primary surface water source for the Carson River Watershed. The Carson River begins as two separate tributaries, the East and West Forks, high in the Sierra Nevada in California. The average yearly flow (based on data from 1940 to 2011) on the East and West Forks are 266,373 acre-feet and 75,251 acre-feet, respectively. Once the Carson River flows into Nevada there are several small tributaries that only reach the Carson River during storm events. The exception to this is Clear Creek, which does flow year round except during very dry years. The average yearly flow at the Carson City gage and at the Fort Churchill gage are 293,408 acre feet and 275,961 acre feet, respectively. Irrigation diversions account for the reduction in flows as the water moves down through the Watershed. Over 95% of the surface water is used for irrigation. In the upper Watershed the total amount of surface storage, including Mud Lake, is less than 11,000 acre-feet. The largest surface water storage facility in the Watershed is the Lahontan Reservoir, which is located in the lower third of the Watershed. The Lahontan Reservoir is part of the Newlands Projects and can receive water from the Truckee River. Historically, the average amount of water that flowed into Lahontan Reservoir from the Truckee River (based on data from 1967 to 2010) was about 117,003 acre-feet. Because the Truckee River is a supplemental supply to the Carson River, less water was diverted during wet years and more water was diverted during dry years. A summary of minimum, maximum, average flow, and period of continuous records are shown on Table 2.1 which are based on analysis of the USGS gage data.

Table 2.1. Summary of Water Flows in the Carson River

Gage	Period of Record	Maximum		Minimum		Average Flow
		Year	Amount	Year	Amount	
Gardnerville East Fork	1940-2012	1983	619,888	1977	66,280	264,471
Woodfords West Fork	1940-2012	1983	176,263	1977	18,885	74,746
Carson City	1940-2012	1983	826,324	1977	42,329	291,007
Fort Churchill [1/]	1912-2012	1983	803,893	1977	26,266	269,374
Truckee Canal Hazen [2/]	1967-2012	1978	238,563	1999	1,679	113,897
Below Lahontan Res.	1967-2012	1983	771,332	1992	130,967	349,014

[1/] The Buckland Ditch is located just upstream of the Ft Churchill gage and diverted water around the gage which causes a skew in the Ft Churchill gage readings depending on actual diversion at any one time.

[2/] Due to Flow Restrictions the Average Flow Over the Past 20 Years is 79,078 AF.

Over the years there have been some noticeable changes in the runoff patterns throughout the Carson River Watershed. Some of these changes can be attributed to an increase in temperatures over the past thirty years and some due to change in irrigation practice and reduction in the amount of land being irrigated. Some changes may only have a slight impact on flows, while others could have some significant impacts on flows. Small changes that could impact water flows are the discontinuation of Hope Valley irrigation in Alpine County, implementation of laser leveling on irrigated fields, installation of sprinkler systems in lieu of flood irrigation, and conversion of agricultural lands to development. Other changes have larger impact on the water system such as the restriction placed on water diverted in the Truckee Canal to 300 cfs. This restriction was imposed after the 2008 breach in the canal and will impact the amount of water diverted to Lahontan Reservoir from the Truckee River, especially during dry years.

2.2.2 Groundwater Basins

There are five primary groundwater basins located in the Carson River Watershed as designated by the Nevada State Engineer. (Figure 2.1 – Designated Groundwater Basins of Nevada). Each of the five basins is "a designated basin" which means that the ground water basin has been formally "designated" by the Nevada State Engineer and, except in minor isolated circumstances there will not be additional groundwater appropriations granted within the basin.

The Nevada State Engineer utilized the perennial yield as a part of his basis for allocating, or restricting water rights within a hydrographic basin. The perennial yield is the amount of usable water of a ground water aquifer that can be withdrawn, which does not exceed the sum of the natural and artificial recharge of the groundwater aquifers. Perennial yield is the greatest in Carson Valley and decreases in each downstream basin. This decrease is due to the rain shadow effects cause by the Sierra. The precipitation in the upper Watershed can be as high as 40 inches per year and decreases as you move east to as low as 4 inches per year in Churchill County. The decrease in perennial yield within the downstream groundwater basins is one of the primary reasons for trying to develop a regional plan to allow for growth in the downstream areas were groundwater supplies are more restricted than in the upper water shed. The plan must also recognize and provide for growth in the upper Watershed. In California, the California Water Resources Control Board only recognizes one groundwater basin in Alpine County and that is the Carson Valley groundwater basin.

The following tables show the perennial yield, amount of water appropriated, and average pumping for each of the five hydrographic basins. Although the amount of water appropriated in each basin is greater than each basin's perennial yield, this data can be misleading because the State Engineer includes the full water allocation for supplemental water rights (supplemental rights are groundwater rights that can be pumped when the primary groundwater or surface water rights to which the supplement right is linked are unavailable). Also, some water rights are grouped together and are limited to a combined duty that is less than the total individual amount of the grouped rights. A more accurate accounting of the water rights available for municipal use in each Basin is important to determine where growth in water production is feasible and if inter-basin transfers are potential elements in meeting future needs in the Carson Watershed. Inter-basin transfers of groundwater rights are allowed under State Law; however, they require more coordination and approval from the various governing agencies. There are also open to any interested party who may decide to protest the change place of use.

A. Carson Valley: This groundwater basin is bounded by the Sierra Nevada Mountains on the west and the Pine Nut Range on the east. The Carson River, via the west fork and the east fork, flow into

the south end of the valley and out the north end. The Town of Minden, Gardnerville Water Company, Gardnerville Ranchos GID, Douglas County, Indian Hills GID, and a small portion of Alpine County and Carson City are included in this basin. Groundwater appropriations and average water pumped for the Carson Valley Basin are provided in Table 2.2 as taken from the records of the State Engineer.

Table 2.2. Carson Valley Hydrographic Basin Number 105

Type of Right	Appropriation Amount (AF)	Average Pumped [1/] (AF)
Irrigation	51,567	10,301
Municipal/Quasi-Municipal	34,430	10,081
Stockwater	407	119
Commercial	194	61
Other/Env.	9,138	3,029
Domestic	33	3,759
TOTAL:	95,769	27,350

Perennial Yield: 49,000 AF

[1/] *average from 2002 to 2011*

Table 2.2 only relates to appropriations and pumping in Nevada. While part of the Carson Valley Groundwater Basin is located in Alpine County, there are currently no commercial, municipal, or irrigation wells located Carson Valley portion of Alpine County. The Washoe Tribe has four communities in the Carson River Watershed one of which is in the Upper Watershed. The Washoe Woodfords Community has two drinking water wells in Alpine County serving fifty-nine residences and four commercial buildings. The total number of domestic wells in Alpine County's portion of the groundwater basin is less than 100.

B. Eagle Valley: This groundwater basin is bounded by the Carson Range on the west and the Carson River on the East. The majority of the basin is located within Carson City. The Carson River does not flow through the Eagle Valley Basin. Groundwater appropriations and average amount of water pumped for the Eagle Valley Basin are provided in Table 2.3 as taken from the records of the State Engineer.

Table 2.3. Eagle Valley Hydrographic Basin Number 104

Type of Right	Appropriation Amount (AF)	Average Pumped [1/] (AF)
Irrigation	390	33
Municipal/Quasi-Municipal	7,124	5,622
Stockwater	7	1
Commercial	50	31
Other/Env.	355	49
Domestic	0	928
TOTAL:	7,926	6,664

Perennial Yield: 4,900 AF

System Yield: 9,000 AF (includes surface water that flows into the basin)

[1/] average from 2002 to 2011

C. Dayton Valley: This basin includes Moundhouse, Dayton, Virginia City, Stagecoach and small portions of eastern Carson City. The Carson River generally travels northeast through the center of this basin. Groundwater appropriations and average amount of water pumped for the Dayton Valley Basin are provided in Table 2.4 as taken from the records of the State Engineer.

Table 2.4. Dayton Valley Hydrographic Basin Number 103

Manner of Use	Appropriation Amount (AF)	Average Pumped [1/] (AF)
Mining/Milling/Industrial	1,397.2	261.3
Commercial	200.1	61.9
Recreation/Stockwatering	10.1	6.1
Quasi-Municipal	14,698.2	4,374.9
Irrigation	7,269.5	2,533.4
Other	0.0	0.4
Domestic	495.6	1,471.6
TOTAL:	24,070.7	8,709.6

Perennial Yield: 8,000 - 20,000 AF

[1/] average from 2003 to 2011

D. Churchill Valley: The Churchill Valley Basin encompasses the Lahontan Reservoir, Silver Springs, and the surrounding areas. The Carson River feeds into Lahontan Reservoir within this basin. Groundwater appropriations and average amount of water pumped for the Churchill Valley Basin are provided in Table 2.5 as taken from the records of the State Engineer.

Table 2.5. Churchill Valley Hydrographic Basin Number 102

Manner of Use	Appropriation Amount (AF)	Average Pumped [1/] (AF)
Mining/Milling/Industrial	310	1.4
Commercial/Recreation	77	28.7
Stockwatering	57	30.1
Quasi-Municipal	6,461	671.4
Domestic	2	1,125.6
Irrigation	3,938	368.9
TOTAL:	10,845	2,226.1

Perennial Yield: 1600 AFA

[1/] average from 2004 to 2011

E. Carson Desert Valley: The Carson Desert Valley Basin encompasses the Fallon area and the surrounding agriculture and desert areas including the Carson Sink. Groundwater appropriations for the Carson Desert Valley Basin are provided in Table 2.6 as taken from the records of the State Engineer. The State Engineer's office does not prepare a pumping inventory report but it does collect municipal pumping data for the Churchill Desert Valley Basin, which is the reason for the blanks in Table 2.6. In Orders 722 and 1116 the State Engineer recognized that groundwater recharge is dependent on precipitation and irrigation using surface water; however, Order 1116 reflects the decline in irrigation recharge due to improvements in the delivery system and irrigation practices.

Table 2.6. Carson Desert - Hydrographic Basin Number 101

Manner of Use	Appropriation Amount (AF)	Average Pumped [1/] (AF)
Mining/Milling/Industrial	3,185	
Commercial/Recreation	677	
Stockwatering	877	
Quasi-Municipal	10,904	2,836 [1/]
Domestic	19	
Irrigation	3,925	
Other	104	
TOTAL:	19,692	

Perennial Yield: 2500

[1/] average from 2011 to 2012

2.2.3 Reclaimed Water

Reclaimed water, or effluent, developed from the multiple regional wastewater facilities along the Carson River can play an important role as a viable water source to help reduce the consumption of surface or ground water. The Carson Watershed also benefits from the export of effluent from the Tahoe Basin. Incline Village GID, Douglas County Sewer Improvement District, and South Tahoe Public Utility District all export their effluent via pipelines to discharge locations within the Carson Watershed. The effluent is utilized for irrigation of agriculture fields, golf courses, parks, and green belts.

Currently, there are no direct discharges to the Carson River as there are no wastewater facilities in the river corridor that treat to a high enough level to be utilized for augmentation of the river itself. However, Carson City does have a discharge permit for water that leaks out of the Brunswick Reclaimed Water Storage Reservoir. In a related example, Churchill County's Moody treatment plant is permitted to discharge treated effluent to the USFWS/Stillwater NWR. As development continues and more areas along the river are shifted from septic systems to municipal waste treatment facilities, more effluent will become available to meet irrigation needs for parks, schools, irrigation, golf courses and other facilities. Additionally, if treatment of the effluent is enhanced to provide for the removal of phosphorus, nitrogen, and other constituents, the effluent could potentially be utilized to augment river flows. Alternately, effluent can be utilized to substitute and/or supplement surface water for irrigation uses. As an example, in the Carson Valley, Bently Ranches and the Park

Ranch utilize the effluent from Minden Gardnerville Sanitation District's (MGSD) and Douglas County Sewer Improvement District (DCSID) to irrigate agricultural fields. MGSD alone supplies nearly 1.8 million gallons per day of treated effluent to the ranching entities. This equates to approximately 2,000 acre-feet per year.

Further information on the potential for the use of reclaimed water and quantities produced by the various wastewater plants in the Watershed is provided in the "Reclaimed Water Use Analysis – Carson River Watershed" report developed by Walker and Associates for the CWSD, a copy of which is in Appendix A.

2.3 Water Leasing

Water leasing, while not a new concept is still not widely utilized within the Carson River System. There are multiple ways in which water leasing might occur with some mechanisms being relatively easily while others may require significant legal interpretation.

- The concept of water leasing has been utilized to a limited extent within the Carson River System. Upstream water storage has been leased historically, including water rights held by CWSD. Carson City, for example, has leased water rights owned by CWSD in Mud Lake. Among ranchers and irrigators Alpine Reservoir shares are frequently bought and sold as well as leased within the Carson Valley area. Generally, these types of leases and exchanges are able to be done on a year-to-year basis without major administrative issues because the Carson River Decree allows flexibility in the distribution of storage waters and the Water Master has a long history of coordinating and facilitating such exchanges among water users.

- More formal leasing of surface and ground waters is another possible activity which could be very useful in providing flexibility for users to react to dry water years, extended but not permanent periods of non irrigation use or partial use for lands held by individuals or groups of farmers or ranchers. Such exchanges would require formal changes with regard to decreed or ground water rights, but there is potential for leasing to be a very useful mechanism to help maintain irrigation and the associated benefits of open space, visual beauty, and important recharge to the groundwater basin through existing ditch systems. As an example, a group of irrigators or other surface right holders could organize an area within which water might be rotated among properties that may otherwise not be able to receive irrigation water in certain years or seasons. If water was short, one owner with the ability to grow a higher value crop might use water on his land while others left their land fallow or only irrigated early in the season.

- The Carson River Decree creates a river regulation and distribution system, which is regulated by River Segments. With coordination and agreements among users, it might be possible to create a leasing program where water could cross segment boundaries and benefit a wider range of properties than an immediate ditch system or local area.

- As land is taken out of production for urbanization and development it will become increasingly important to consider and provide for maintenance of the irrigation ditch and distribution systems, particularly in the portions of the Carson River above Lahontan Reservoir. A water-leasing program could be one method of helping to insure that water remained available to keep ditches active in the face of fewer irrigators.

- Another potential aspect of water leasing involves the leasing of groundwater. This is more complex than surface water leasing because of the need for wells to supply the source water. However, the basic concepts have many similarities to surface water. A single party lease to another individual could be accomplished through a groundwater Application to Change the well site (Point of Diversion) and place of use to reflect the lessee's source and area of use. The use of Temporary Permits for a single year may be a mechanism to accomplish a short-term lease. Longer term leasing under the water law would require a permanent Application to Change.

Leasing of groundwater for non-irrigation uses is also a possibility, but that process is frequently done through Water Banking agreements.

Further development of water leasing mechanisms including legal concerns will need to be explored beyond this preliminary review.

2.4 Water Banking

Water Banking is a process by which water is transferred to another party who uses the water or holds it for future use. Typically, this is done with municipal water purveyors who often have a better ability to hold and maintain a water right in good standing. Under the Nevada Revised Statutes, water purveyors have some advantages for being granted Extensions of Time to place water to beneficial use. One approach is for a water purveyor to allow a water right holder to relocate the holder's right to a municipal well of the purveyor for future use within the purveyor's service area. With limited groundwater resources in many basins, there is a significant value in keeping existing water permits in good standing rather than allowing them to be lost for nonuse. With the potential for improved economic activity and increasing needs for municipal and industrial water in the basin, water banking is a valuable tool to support effective resource management. An example of water banking is the current agreement in place between Vidler Water Company and Carson City were Vidler has placed certain water permits within Carson City Wells in order to preserve them from non-use. Vidler still retains ownership of the water rights but by placing them in Carson City's well and Carson City is able to keep the rights in an active status to prevent loss of the right from inactivity. The actual terms of such an agreement would have to be specific to the needs of the water system and the entity wanted to bank water but the basic premise is the same.

Water Banking might also be a consideration for surface waters, particularly in areas such as the Truckee Carson Irrigation District where a structure is in place that could be utilized to create a banking program. In other areas of the Carson Watershed, a banking program for surface waters might be more difficult than a leasing approach.

Water banking could be in the form of either actual physical water being banked such as proposed above with surface water being held in a reservoir, or a paper banking of the water were ground water rights are held in a well without the physical movement of the actual groundwater from a previously permitted well to the new well the water rights are being banked in.

Further development of water banking mechanisms will need to be explored beyond this preliminary review.

2.5 Water Quality

While not specifically addressed in more detail in this report, the protection of water quality (both groundwater and surface water) from contamination from outside sources or from degradation through

over pumping are important considerations that need to be included in future master planning of the water resources of the Watershed.

2.5.1 Surface Water

The Clean Water Act requires that each state set water quality standards for water bodies throughout their state. The Lahontan Water Board is the responsible entity for water quality standards in the California portion of the Watershed. The Nevada Division of Environmental Protection is responsible for water quality standards in the Nevada portion of the Watershed. Currently there are only two water purveyors in the Watershed that treat surface water, Carson City and Virginia City. The biggest water quality concerns for these agencies are turbidity and color.

There are two Superfund Sites located in the Carson River Watershed. Leviathan Mine Superfund Site is located in the upper portion of the Watershed in Alpine County. Leviathan Mine is an old open pit sulfur mine. Sulfuric acid produced at the open-pit mine when water, such as rain, snowmelt or groundwater interacts with the waste rock. This sulfuric acid leaches contaminants from surrounding rock, such as arsenic, copper, nickel, zinc, chromium, aluminum, and iron. The goal of this superfund site is to mitigate for these contaminants, which enter the East Fork Carson River system via Leviathan Creek.

The other Superfund Site is the Carson River Mercury site located in Carson City, Storey, Lyon, and Churchill Counties. The Carson River Mercury Site includes mercury-contaminated soils at former mill sites, mercury contamination in waterways adjacent to the mill sites, and mercury contamination in sediments, fish and wildlife over more than a 50 mile length of the Carson River, beginning near Carson City, Nevada and extending downstream to the Lahontan Valley. Contamination at the site is a legacy of the Comstock mining era of the late 1800s, when mercury was imported to the area for processing of gold and silver ore. Ore mined from the Comstock Lode was transported to mill sites, where it was crushed and mixed with mercury to amalgamate the precious metals. The mills were located in Virginia City, Silver City, Gold Hill, Dayton, Six Mile Canyon, Gold Canyon, and adjacent to the Carson River between New Empire in Carson City and Dayton. During the mining era, an estimated 7,500 tons of mercury were discharged into the Carson River drainage, primarily in the form of mercury-contaminated tailings.

2.5.2 Groundwater Quality

Since most water purveyors get their water supplies from groundwater sources, groundwater contamination can have a huge impact on water supply. There are several groundwater constituents that impact the water quality. Most of the water quality concerns are naturally occurring. The most common natural water quality issues are arsenic and uranium. The most common man-made water quality issues have to do with nitrates from septic tanks.

Chapter 3 – Water Purveyors and Other Water Providers

Beginning in the late 1800s, various small communities began to develop up and down the Carson River Watershed. Because of the distance between the various communities, they each developed their own water systems. Over the years, thirteen major water purveyors and several small water providers were formed in the Watershed. Each of these water purveyors operates independently and maintains their own water system's water rights. Over the years, many of these communities have grown to the point that they are now adjacent to each other (e.g., Town of Gardnerville and Town of Minden). Over the past 15 years several water purveyors have begun linking their water systems together. These interties enable the water purveyors to enhance their water supply reliability, provide emergency backup, and better meet the new water quality standards. Since 2001, CWSD has provided funding to various water purveyors to upsize regional water systems and interties. These regional water system connections enable water purveyors to meet their water demands in a more cost effective manner.

3.1 Public Water Purveyors

There are thirteen major water purveyors in the Carson River Watershed. The systems with general information are listed in Table 3.1 with summary information provided below:

1. Gardnerville Ranchos GID

    - Gardnerville Ranchos GID (GRGID) is located in the southern part of the Carson Valley. The GID is the largest single water system within the Carson Valley and services primarily residential use and light commercial development. GRGID has approximately 4,400 connections and serves a population of 11,300. The system has 8 active wells, some of which are utilized for emergency backup, and two water tanks comprised of 4.5 million in storage capacity (1.5 MG and 3.0 MG). GRGID does not currently treat their water and they potentially will have difficulties locating well sites with low arsenic levels as the need for future supplies become necessary. Additionally, the USGS groundwater studies show declining water levels in the area of the Carson Valley occupied by GRGID due to ongoing and future pumping.

2. Gardnerville Water Company

    - The Gardnerville Water Company provides water to the Town of Gardnerville within the central portion of the Carson Valley. Gardnerville Water Company is regulated by the Public Utilities Commission (PUC) in regards to their service area only and is the only water utility in the Carson Valley to be regulated to any degree by the PUC. Gardnerville does not currently treat their water and currently has excess capacity (the capacity is regulated by the PUC and may not be available for outside entities). Gardnerville Water has approximately 2,300 connections and serves a population of 5,600. The system has 7 active wells, two pressure zones, and two water tanks comprised of 4.1 million in storage capacity (2.6 MG and 1.5 MG). Gardnerville Water Company is a potential area for future regional supply growth with its current good water quality and ability to find good well production areas. Expansion of the Gardnerville Water system as a source would need to be approved by the Board of the Gardnerville Water Company.

3. Town of Minden

   - The Town of Minden provides retail water to the Town of Minden, the Bently Science Park, and wholesale water to Douglas County, Indian Hills GID, and in 2014 to Carson City. The Town of Minden produces more water than any entity with the Watershed, with the exception of Carson City. The Town of Minden currently does not treat their water. The Town of Minden is working on creating more production capacity to offset recent increases in wholesale demand and to provide redundancy in production. The Town of Minden has approximately 1,550 connections and serves a population of 3,000. The system currently has 6 active wells, two pressure zones, and one water tank comprised of 2.5 million gallons in storage capacity. The Town of Minden is a potential area for future regional supply growth with its current good water quality and ability to find good well production areas. Further expansion of the Town as a source would need to be approved by the Town Board.

4. Douglas County Utilities

   - Douglas County Utilities manages multiple water systems within the Carson Valley as follows:

     - North Valley System: The North Valley System is primarily the Walmart commercial area and future planned development along the north boundary of the County between Carson City and Douglas County. The system will receive wholesale water from Minden by 2014 but also has its own limited production ability. The North Valley system serves approximately 31 connections, which are primarily commercial in nature. The North Valley System has 2 active wells and a single 2.0 MG storage tank. This system has interties with Sierra Estates GID and Indian Hills GID for emergency water needs. The North Valley area is not currently viewed as an area for future regional production due to limited well production in the area. A future connection to Carson City is also planned for the North Valley system to improve interconnections and provide redundancy for water deliveries for both entities.

     - East Valley System: The Douglas County East Valley System encompasses the Johnson Lane area north of the Douglas County airport. The system receives 100% of its water from Minden. The East Valley System has approximately 1,750 total connections and serves a population of 4,000 or more. The system has no active wells, but has one well as an emergency backup. This system has multiple pressure zones, and 4 water tanks comprising of 4.2 million gallons in storage capacity (1.5 MG, 1.5 MG, 0.5 MG, and 0.6 MG). The East Valley area is not currently viewed as an area for future regional production due to impaired water quality in the areas existing wells.

     - West Valley System: The Douglas County West Valley System encompasses Genoa, Walley's Resort, and the developed areas along the Jack's Valley Road golf courses. Ultimately the plan for this system is to tie into the North Valley system. The West Valley System has approximately 400 connections

and serves a population of 1,000. The population served in the West Valley in difficult to pinpoint, as many of the connections are commercial (e.g. Walley's). The system has 5 active wells, multiple pressure zones, and five water tanks comprised of 2.94 million gallons in storage capacity (0.41 MG, 0.73 MG, 0.3 MG, 1.0 MG, and 0.5 MG). The West Valley area is not currently viewed as an area for future regional production due to limited transmission main capacity in the area.

- Fairgrounds/Sunrise Estates: These two systems located in the southeast portion of the Carson Valley provide water for the county's fairgrounds and a small residential development located north of the county fairgrounds. These systems combined provide service to approximately 45 connections and 100 people. There are 3 active wells within the two systems and one 0.2 MG storage tank associated with the Fairgrounds system. These systems are connected. This area is not currently viewed as an area for future regional production due to limited well production in the area.

- Sheridan Acres/Jobs Peak: These two systems are located in the southwest portion of the Carson Valley and are adjacent to residential areas located off of Foothill Road Directly west of the Gardnerville Ranchos GID. These systems have approximately 142 connections and serve a population of 300. These system have 3 active wells, multiple pressure zones, and 2 water tanks comprising of 0.866 million gallons in storage capacity (0.555 MG and 0.311 MG). These two systems are interconnected with water able to flow from the Jobs Peak system to the Sheridan Acres system. However, water cannot currently be transferred from the Sheridan Acres system to the Jobs Peak System. This area is not currently viewed as an area for future regional production due to limited well production in the area and the remote location of the system with currently no transmission mains to transport water to other portions of the Carson Valley.

5. Indian Hills GID

   - Indian Hills GID (IHGID) is located south of Carson City and primarily serves residential customers. IHGID is interconnected with Minden and the Douglas County East and North systems and received 80-90% of their water from this interconnection. IHGID has approximately 2,008 connections and serves a population of 4,400. The system has 3 active wells, two pressure zones, and five water tanks comprised of 1.8 million in storage capacity (0.2 MG, 0.2 MG, 0.4 MG, 0.4 MG, and 0.6 MG). The IHGID area is not currently viewed as an area for future regional production due to limited water quality in the higher production areas, and limited well capacity in the areas with water quality meeting drinking water standards.

6. Carson City

   - Carson City is the single largest water supplier within the Carson River Watershed and accounts for 40% of the total demand of the major water purveyors. Carson City has approximately 18,500 connections and serves a population of 55,000. The system has 30 active wells, multiple pressure zones, and 14 water tanks comprised of 24.5 million gallons of active storage capacity. Carson City also received water

from the Marlette Water System managed by the State Public Works Board, and an existing intertie with Lyon County Utilities. The Carson City area is not currently viewed as an area for future regional production due to limited water quality and/or limited well capacity in areas of the City.

7. Lyon County Utilities

   - Lyon County Utilities like Douglas County maintains a variety of systems spread along the Carson River corridor including Mound House, Dayton, and the Mark Twain Area. These systems are all interconnected. Additionally, Carson City and Lyon County are interconnected via a 16" pipeline and tank located at the County boundary. The Lyon County Utilities interconnected systems serve approximately 5,300 connections and serves a population of 10,700. The systems have 12 active wells, multiple pressure zones, and 13 water tanks comprised of 12.2 million gallons of active storage capacity. The Lyon County Utility area is not currently viewed as an area for future regional production due to limited production and transmission capacity, as well as limited perennial recharge capacity.

8. Virginia City

   - Virginia City is served by the historic Marlette Water System, which also provides water to Carson City. Part of the Marlette system was built in the late 1870's and is still being used today. The Marlette system is the sole source of water for Virginia City and Gold Hill. It also supplies water to Silver City in Lyon County. Developing a secondary source to provide water to this system as an emergency contingency would be a prudent consideration.

9. Stagecoach GID

   - Stagecoach is a small GID located northeast of the Dayton area. The Stagecoach area along with Silver Springs has a large potential for growth with the completion of the USA Parkway project. The availability of sustainable groundwater in the Stagecoach area may be limited. Stagecoach GID has approximately 554 connections and serves a population of 1,870. The Stagecoach system has 2 active wells, and five water tanks comprised of 1.27 million gallons in storage capacity (0.5 MG, 0.1 MG, 0.25 MG, 0.29 MG, and 0.13 MG). The Stagecoach area is not currently viewed as an area for future regional production due to limited production and transmission capacity as well as limited perennial recharge capacity.

10. Silver Springs Mutual Water Company

    - Only a portion of the developed area around Silver Springs is served by the municipal water company. This area near Lahontan Reservoir has a large potential for growth with the USA Parkway completion. The availability of sustainable groundwater in the Silver Springs area may be limited. Silver Springs Mutual Water Company has approximately 1083 connections and serves an estimated population of 3,000. The system has 3 active wells, and three water tanks comprised of 3.0 million gallons in storage capacity. The Silver Springs area is not currently viewed as an area for future regional production due to limited production and transmission capacity, as well as limited perennial recharge capacity.

11. Churchill County

    - Churchill County manages a small water system located to the west of the City of Fallon. There are multiple private systems surrounding the City of Fallon that may need to be taken over by the County to ensure water quality is maintained to the area's residents. The Churchill County system has approximately 260 connections serving a population of 300 customers. The system has 1 active well and a 1 MG in water storage capacity. The Churchill County system is not currently viewed as an area for future regional production due to limited transmission capacity.

12. City of Fallon

    - The City of Fallon provides water to only those areas annexed to the City and meeting their requirements for annexation. The City of Fallon currently treats water pumped from the Naval Air Station. This water is treated and then pumped back to the air station. The City of Fallon system has approximately 3350 connections serving a population of 8600 customers. The system has 4 active wells and 4 water storage tanks comprised of 6.2 million gallons of storage capacity (0.4 MG, 1.0 MG, 1.8 MG, and 3.0 MG). The Fallon system is not currently viewed as an area for future regional production due to limited transmission capacity.

13. Fallon NAS

    - The Naval Air Station located southeast of the City of Fallon has a separate water system, which provides water to the base and base housing. The Naval system serves a population of approximately 700 customers/users. The system has 3 active wells and a single 1.2 million gallon storage tank. The Naval system is not currently viewed as an area for future regional production due to limited transmission capacity.

14. Other Water Users and Domestic Wells

    - Washoe Tribe of Nevada and California

        - The Washoe Tribe has four communities in the Carson River Watershed. One community is in Alpine County and the other three are located in Nevada. Each of these communities has two public drinking water supply wells. As an example, the Washoe Woodfords Community has two drinking water wells in Alpine County serving fifty-nine residences and four commercial buildings.

    - Fallon Paiute Shoshone Tribe

        - The Fallon Tribe has a sizable water system in the Carson Desert Valley Basin that serves an estimated 330 connections. The system has 2 active wells (320 gpm each) and 2 storage tanks with a combined capacity of 405,000 gallons. The Tribe's system also has an arsenic treatment plant with a treatment capacity of 320 gpm.

    - Currently there are over 8,000 wells in the Watershed. It is anticipated that over the next 30 years, many of these domestic wells may need to connect to a municipal

system due to decreasing water quality (example: high nitrates from septic system) or declining ground water levels which may require a significant amount of infrastructure. Therefore, obtaining actual numbers of domestic wells within each hydrographic basin and generating realistic usage from these wells along with how or if they will need to be connected to a municipal system should be included with future reports and analysis. An additional item of consideration in future studies would be the determination of potential quantities of domestic well credits available for connecting domestic wells to municipal systems. The value of the water rights associated with the domestic well credit may become valuable enough in the future that it becomes worthwhile for a municipal water purveyor to connect domestic wells. The incorporation of domestic wells into the future Master Plan development is important.

- Small Water Entities (trailer parks, small private systems, etc.) were also not considered in any great detail as part of this report as their contributions to water usage are again a small percentage of the whole. However, similar to domestic well users, if the need arose to be connected to a municipal system due to declining water quality or ground water levels a significant amount of infrastructure may again be required and will need to be planned for. Therefore, obtaining actual data on the smaller water users within each hydrographic basin and generating realistic usage from these entities along with how or if they will need to be connected to a municipal system should be included with future reports and analysis.

Table 3.1 lists the current customers, annual demand, peak demands, average EDU use, available production supply, and storage for these water purveyors.

Table 3.1. Current customers, annual demand, peak demands, average EDU use, available production supply, and storage for these water purveyors.

Entity	Population	Connections	Total Usage (1000-gallons)	Ave Day Demand (gpd)	Ave Day Demand per Connection (gpdc)	Max Day Demand (gpd) [1/]	Estimated Peak Hour Demand (gpm) [2/]	Well Production Capacity (gpm)	Storage Volume (gallons)
Gardnerville Ranchos GID	11312	4400	1,034,501	2,834,249	644	5,953,774	8,269	5,525	4,500,000
Gardnerville Water Company	5656	2,309	471,145	1,290,809	559	2,386,675	3,315	7,525	4,100,000
Minden (**)	3001	1,548	459,124	1,257,874	812	2,850,000	5,050	9,300	2,500,000
Douglas County East Valley	4020	1757	367,587	1,007,088	671	2,077,871	2,886	0	4,200,000
Douglas County North Valley	*	31	26,463	72,501	363	103,871	144	400	2,000,000
Douglas County West Valley	793	305	185,994	509,573	679	1,044,806	1,451	1375	2,947,800
Douglas County Fairgrounds-Sunrise	91	45	12,978	35,556	711	81,581	113	450	200,000
Douglas County Sheridan Acres	237	91	22,964	62,915	629	129,387	180	100	311,000
Douglas County Jobs Peak	159	61	24,369	66,764	668	145,839	203	367	555,000
Indian Hills GID	4400	2008	309,550	848,082	422	1,747,419	2,427	300	1,896,000
Carson City	55274	18500	3,510,163	9,616,885	520	19,000,000	26,389	19,401	24,500,000
Lyon County - Dayton	8964	4,533	698,520	1,913,753	422	3,357,290	4,663	4,195	12,183,000
Lyon County - Moundhouse	1769	780	87,137	238,732	306	312,161	434		
Stagecoach	1874	554	76,172	208,690	377	478,129	664	1,025	1,270,000
Silver Springs	5296	1083	188,839	517,368	478	1,009,226	1,402	2200	3,000,000
Churchill	787	300	49,400	135,195	450	341,000	537	750	1,000,000
City of Fallon	8606	3355	647,222	1,773,211	529	3,190,645	4,431	5700	6,200,000
NAS Navy	705	-	116,725	319,795	533	614,935	854	2700	1,400,000

[1/] MDD - estimated on max month if no other data

[2/] PHD - estimated peaking factor based on surrounding systems 2008 is a high point for many entities as demand has fallen off in recent years

* Douglas County North Valley System is primarily commercial use.

** Minden data for 2010 is for retail system, Minden actual peak production and maximum day are a factor of Indian Hills GID usage and Douglas County East Valley usage.

Population based on Census Data, All other data provided by the individual systems via Carson Water Subconservancy District

Chapter 4 – Runoff Pattern Changes & Climate Change

The Desert Research Institute (DRI) recently completed a report evaluating possible changes to the runoff pattern over the past 70 years. A copy of the report is included in Appendix B. The following is a brief summary of the report.

Over the past 30-40 years there has been a small, yet noticeable shift in the timing of runoff patterns for the Carson River as compared to the previous 30-40 year time span. The challenge in comparing changes in flow patterns by using the observational records is the large variability in the duration, consistency, and inter-annual changes that mask and marginalize trends. Although there is large variability in the data there is a statistically significant shift of the spring runoff portion of stream flow, i.e. both beginning and ending earlier. Additionally, some areas of the Sierra's are receiving less snow and more rainfall due to small temperature increases. While these shifts are small at this point, a continuing trend of earlier and higher runoff down the Carson River will begin to have a significant impact on agriculture and other use in both the upper and lower reaches of the river.

Understanding and planning for this shift is critical since higher runoff in the earlier months of the year, when irrigation demands are lower, will result in more water flowing downstream and ultimately being lost to the upper Watershed. Planning for a means to capture and store this early runoff via aquifer recharge or upper Watershed reservoirs may become a necessity that outweighs the cost of such endeavors. Any new upper Watershed storage would need to be considered carefully and balanced with reductions in lower basin storage (Lahontan Reservoir) particularly in light of artificially imposed Truckee Canal capacities being contemplated by the USBR which will reduce deliveries to Lahontan Reservoir.

Chapter 5 – Water Conservation Plan (CWSD)

Nevada is an arid state; therefore, preserving water and avoiding waste is critical in balancing resources among agricultural users, environmental needs, and municipal and domestic demands. This is especially true in the Carson River Watershed, which has very limited surface water storage capacity in the upper Watershed. Effective use of our limited water resources is imperative for maintaining a healthy Watershed. This report focuses on residential water conservation programs as a way of enhancing the Watershed's water resources.

In the Carson River Watershed, water conservation is not used to promote or inhibit growth but to make sure water resources are used efficiently. The importance given to good stewardship is reflected in Water Waste Ordinances that have been adopted by all water purveyors within the Watershed. In southern Nevada, water conservation has been implemented to accommodate the thirsty needs of development. However, the purpose of this regional water conservation plan for the Carson River Watershed envisions water efficiency as a means of reserving water for drought periods, enhancing supply reliability, meeting peak demands without procuring additional supply, reducing treatment costs, and extending the life of existing water and wastewater treatment facilities. Although current water supplies in the Carson River Watershed are adequate to meet current municipal demands, there is the ever-present danger of drought shortages. Water conservation is an important element in drought planning. Consideration of regionally cooperative planning and implementation could bring "economies of scale" to water conservation programs, making them truly effective tools in drought emergencies.

For the last couple of years Carson Water Subconservancy District (CWSD) worked with various water purveyors in the Watershed on ways to enhance water conservation. This included developing educational material on ways homeowners could save water and reduce water waste. CWSD staff also conducted several water conservation pilot projects to evaluate how well these projects would work in this Watershed.

The pilot projects included:

- Installing Evapotranspiration (ET) controllers at various institutional sites,
- Providing irrigation audits and assessments for HOAs, parks, and schools,
- Providing residential landscape surveys,
- Evaluating irrigation efficiency using different types of sprinkler heads,
- Installing water conserving stream rotor sprinkler heads, and
- Creating a Demonstration Garden for various low water use alternatives at the Dayton Valley Utility's office.

The goal of the Regional Water Conservation Report is to provide the water purveyors in the Carson River Watershed with information on ways they can enhance their existing water conservation programs. The report also identifies various projects and programs that CWSD will pursue to enhance water savings.

A copy of the Regional Water Conservation Report is included in Appendix C.

Chapter 6 – Future Municipal Water Demands & Wastewater Flows

This chapter focuses on the current and estimated future water demands for the major water purveyors within the Carson Watershed. Additionally, a discussion of supply deficiencies within these purveyors is also provided.

6.1 Population Forecast Alternatives

The 2010 census data was utilized as a baseline for populations within the service areas for the various water utilities. Growth scenarios were developed based upon State Demographer estimates for each County. The use of a constant growth rate throughout the Watershed does not provide realistic estimates for populations, as it is extremely conservative for some areas and grossly underestimates the growth in others. As more detailed planning is developed the individual growth estimates for each entity should be factored in to enhance the accuracy of the demand projections.

Predicting the timing of development and how various economic and social factors will guide or control growth is another difficulty in estimating future populations. Tables 6.1 lists the estimated populations for each area through 2040 based on utilizing the State Demographers estimates. A copy of the growth rates utilized is provided in Appendix D.

Table 6.1. Estimated Population - State Demographer Growth Rates

Water System	2010	2020	2030	2040
Gardnerville Ranchos GID	11,312	11,400	11,721	12,947
Gardnerville Water Company	5,656	5,700	5,860	6,474
Town of Minden	3,001	3,024	3,109	3,435
Douglas County - East Valley	6,490	6,541	6,725	7,428
Douglas County - North Valley [1/]	0	500	1,000	1,500
Douglas County - West Valley	939	946	973	1,075
Douglas County - Fairgrounds/Sunrise Estates	150	151	155	172
Douglas County - Sheridan/Jobs	500	504	518	572
Indian Hills GID	4,400	4,434	4,559	5,036
Carson City	55,274	55,605	59,550	65,780
Lyon County - Mound House	1,769	2,108	2,349	2,595
Lyon County - Dayton	8,964	10,683	11,905	13,150
Stagecoach	1,874	2,233	2,489	2,749
Silver Springs	5,296	6,311	7,033	7,769
Churchill County [2/]	787	924	1,037	1,145
City of Fallon	8,606	10,105	11,337	12,523
Fallon NAS	705	828	929	1,026

[1/] The Douglas County North County System is currently comprised of commercial use only.
[2/] Water system growth.

6.2 Projected Water Demands and Maximum Day Requirements for each Service Area

Associated with the projected population growth for the various water purveyors is the estimate for an increase in water supply demands. Table 6.2 itemizes the estimated annual water demands for each purveyor in million gallons (MG) and acre-feet annual, while Table 6.3 provides the estimated maximum day requirements for each of the water purveyors through 2040 based upon the population growth as estimated by the State Demographer. The maximum day demand shown in Table 6.3 is not a true maximum day as that specific data was not available from the majority of the water purveyors. The maximum day shown in Table 6.3 is an averaged daily demand during the peak month for each water purveyor. Actual maximum day/peak day demands for each system should be determined to better refine the needs for the systems. Table 6.4 shows the current available pumping capacity for each entity. As an additional note, utilizing a single year as a base line to estimate system usage such as 2010 versus a 3 or 5-year average can also provide a skewed sense of actual demands. A high or low annual usage for a single year can skew demand projection. As future planning is conducted an average of the most recent years for each systems usage should be evaluated to ensure a more accurate reflection of the systems usage is identified.

In considering future demands, the information in the Table 6.3 as it relates to available pumping capacity is often based on the design capacity of wells versus their realistic capacity. Additionally, sources that are not viable year round or inhibit one another are included in the total. For example, Carson City has induction well capacity of approximately 2,300 gpm included in their supply capacity. During dry years the flows in the Carson River can drop below the induction well capacity, causing a reduction in the amount of water than can be pumped in late summer when demand is the highest so the actual available production capacity during the maximum day demand period for Carson City can be substantially lower than it appears based on total production capacity. Carson City is not alone in this phenomenon as each system has its own unique system characteristics. Additionally, the pumping capacity may include wells that are technically available but are reserved for emergencies due to water quality issues that make the well unsuitable for long-term use.

Based on the projected water demands, which are based upon the state demographer's estimates for population growth, and current available pumping capacity, the only area that may need additional water supplies to meet peak needs would be Carson City by the year 2040. However, this is extremely misleading since, as earlier stated, the available production capacity of each entity may not reflect their actual delivery capacity in the summer when induction wells and surface water supplies are not available. Additionally, water quality issues with available wells or changes to water quality standards can impact the true available pumping capacity of an entity. Interconnections between water purveyors further change the picture. For example Carson City will be able to take up to 3,500 gpm of flow from the Minden system, which provides Carson City with a buffer in terms of available pumping capacity.

The growth estimates do not reflect new development on a large or even moderate scale within the Watershed as was seen in many local areas prior to 2008. If development were to begin pushing higher growth in parts of the Watershed, the availability of peak and annual water supplies in many water systems would be pushed to the limit much sooner than shown with state demographer estimates of population growth.

To develop a solid basis for the future needs of the region for water, each system needs to be carefully evaluated based on the system's actual available supply during high use periods, supply that requires treatment, and the ability to realistically drill additional wells within the immediate area of a system.

The available water rights for a region or utility are also important in the analysis of each system. A region may have the ability to drill wells and find ground water; however, if the annual recharge to the aquifer and water rights are not available, there will not be the ability to pump water for the long term. If ground water tables are showing major impacts from pumping, the State Division of Water Resources may regulate pumping in basins that cannot support it.

Water has always been a precious commodity in Nevada and as time passes it will only become more and more critical to craft long term plans to allow the available water to be efficiently put to use. It cannot be stressed enough how vital it is for a more in-depth analysis of the water systems within the Carson River Watershed and their associates water resources to allow for that long term planning to be developed.

Table 6.2. Annual Usage Estimates (MG – Million Gallons; AFA – Acre-ft Annual)

	2010		2020		2030		2040	
Entity	Total Usage (MG)	Total Usage (AFA)	Total Usage (MG)	Total Usage (AFA)	Total Usage (MG)	Total Usage (AFA)	Total Usage (MG)	Total Usage (AFA)
Stagecoach	76.17	234	90.78	279	101.16	310	111.74	343
Silver Springs	188.84	580	225.05	691	250.79	770	277.03	850
Minden	459.12	1,409	462.70	1420	475.72	1460	525.49	1612
Gardnerville Water Company	471.15	1,446	474.81	1,457	488.17	1,498	539.25	1,655
Carson City	3,510.16	10,772	3,531.18	10,837	3,781.71	11,606	4,177.36	12,820
Gardnerville Ranchos GID	1,034.50	3,175	1,042.56	3,199	1,071.89	3,290	1,184.03	3,634
Fallon	647.22	1,986	759.95	2,332	852.63	2,617	941.83	2,890
NAS Navy	116.73	358	137.06	421	153.77	472	169.86	521
Indian Hills GID	309.55	950	311.96	957	320.74	984	354.29	1,087
Churchill	49.4	152	58.0	178	65.07	199.7	71.88	220.6
Douglas County East Valley	367.59	1,128	370.45	1,137	380.87	1,169	420.72	1,291
Douglas County North Valley	26.46	81	26.67	82	27.42	84	30.29	93
Douglas County West Valley	185.99	571	187.44	575	192.72	591	212.88	653
Douglas County Fairgrounds	12.98	40	13.08	40	13.45	41	14.85	46
Douglas County Sheridan Acres	22.96	70	23.14	71	23.79	73	26.28	81
Douglas County Jobs Peak	24.37	75	24.56	75	25.25	77	27.89	86
Lyon County - Dayton	698.52	2,144	832.46	2,555	927.68	2,847	1,024.73	3,145
Lyon County - Moundhouse	87.14	267	103.85	319	115.72	355	127.83	392

All 2010 data provided by the individual systems via Carson Water Subconservancy District. Estimates are based on 2010 data and could be skewed based on if 2010 was a high or low usage year for the water purveyor.

Table 6.3. Estimated Maximum Day Demands Based on Population Estimates Provided as GPM (gallons per minute) over 24 hours

Water System	2010	2020	2030	2040
Gardnerville Ranchos	4,135	4,167	4,284	4,732
Gardnerville Water Company	1,657	1,670	1,717	1,897
Town of Minden	3,232	3,257	3,349	3,700
Douglas County - East Valley	1,443	1,454	1,495	1,652
Douglas County - North Valley	72	200	400	600
Douglas County - West Valley	726	731	752	831
Douglas County - Fairgrounds/Sunrise Estates	57	57	59	65
Douglas County - Sheridan/Jobs	191	193	198	219
Indian Hills GID	1,213	1,223	1,257	1,389
Carson City	13,194	13,273	14,215	15,702
Lyon County - Mound House	217	258	288	318
Lyon County - Dayton	2,331	2,779	3,096	3,420
Stagecoach	332	396	441	487
Silver Springs	701	835	931	1,028
Churchill County	237	278	312	344
City of Fallon	2,216	2,602	2,919	3,224
Fallon NAS	427	502	563	621

All 2010 data provided by the individual systems via Carson Water Subconservancy District.

Table 6.4. Estimated Available Pumping Capacity

Water System	Pumping Capacity (gpm)
Gardnerville Ranchos	5,525
Gardnerville Water Company	7,525
Town of Minden	9,300
Douglas County - East Valley	[1/]
Douglas County - North Valley	400
Douglas County - West Valley	1,290
Douglas County - Fairgrounds/Sunrise Estates	450
Douglas County - Sheridan/Jobs	400
Indian Hills GID [3/]	300
Carson City	14,932
Lyon County - Mound House	[2/]
Lyon County - Dayton	4,195
Stagecoach	1,025
Silver Springs	2,200
Churchill County	750
City of Fallon	5,700
Fallon NAS	2,700

[1/] East Valley receives 100% of flow from Minden
[2/] Mound House pumping capacity is combined with Dayton
[3/] IHGID receives 1400 gpm from the Town of Minden
Data provided by the individual systems via Carson Water Subconservancy District.

6.3 Water Balance

As part of the management of the Watershed a water balance for the area will need to be developed. This would include the annual groundwater recharge of the various basins, the current groundwater pumping, available groundwater rights of water purveyors, decreed surface water and averaged actual river/stream flows, effluent availability, etc. These inputs would be utilized to help develop a plan to manage and sustain water resources and future water demands in the various parts of the Carson River Watershed.

Based on a very broad look at the available water supplies in the various Carson River hydrographic basins there are sufficient ground water rights for current and near future uses. However, balancing water sources, water quality, local water availability and water rights with growth in the Carson Watershed will require more detailed and specific planning to create a Watershed master plan for supply, storage, and delivery of water for municipal use.

If the Carson Watershed does not create such a blue print for the future, there is a much greater potential for pressures and litigation to move water outside the basin or to restrict and dictate water uses and resources within the basin.

Chapter 7 – Regional Water Systems and Interties

Within the six Counties of the Carson River Watershed (Alpine, Douglas, Carson, Lyon, Storey, and Churchill), there are twice as many water systems and each has their own unique water issues. With low population and remote location, Alpine County is essentially a stand-alone area that is not included in this portion of the report. The primary areas of interest are:

- Douglas County – focused on the Carson Valley area
- Carson City
- Lyon County – focused on Dayton, Stagecoach and Silver Springs and the proposed Highlands development above Silver Springs
- Storey County – Virginia City and Gold Hill
- Churchill County – focused on the City of Fallon and surrounding Churchill County, NAS, and private water systems.

As a general rule of thumb, the aquifer recharge and availability of groundwater sources decreases as you move downstream through the counties.

Over the past 3-4 years Carson City, Minden, Indian Hills GID, and Douglas County have partnered in developing and constructing a regional pipeline system that allows for Minden to deliver water into Carson City. This linkage has long been envisioned but until recently was not viable for a variety of reasons.

Part of the difficulty with a plan of this nature is dealing with the unknowns of population growth, development, and timing. As an example, we can project for a 7,000 unit development in the Storey County Highlands but we don't know if it will take 10 years or 40 years to come to fruition. This raises the question as to whether near term water facilities should be sized to account for such a development or wait for that development to occur or reach a certain size before taking it seriously. Another way to approach things could be the build it and they will come attitude. If we create a transmission system to delivery water to areas for future development that will most likely help generate the development itself as the unknown of water service is taken out of the equation for future developers. We have endeavored to plan for a conservative estimate of usage growth out 20 to 30 years based on growth rates but have also included the development of the Highlands as part of the total usage as this has a large bearing of the overall demand near the terminus of the regional system.

In looking at line sizing for potential regional interconnections, a maximum flow velocity criteria of 5 ft/s was utilized. The flow velocity is a critical component of water line sizing from the standpoint of power costs and system pressure. The higher the flow velocity the more pressure loss in a line. Conversely, the lower the flow velocity the lower the pressure loss in a line. Pressure loss is important from the standpoint of power costs for operating the system as well as the capital cost to install more booster pump stations to mitigate pressure losses. A flow velocity of 5 ft/s is a reasonable balance point above which friction losses may become unreasonable and impact the operation of the system over the long term. Table 7.1 lists the flow capacities of various pipe diameters with an assumed velocity of 5 ft/s along with an approximate pressure loss over a 1-mile stretch of the pipe. It is important to note that these flow capacities are based on perfect situations. In reality the available capacity or realistic capacity of the lines will be dictated by required and available system pressures between connection points, friction losses over long runs, and the cost benefit of a booster station versus a large line size to mitigate

head losses. As an example, it may be cheaper in the long run to upsize to a 30-inch main in lieu of a large booster station which will require large power costs over its lifespan as well as pump replacement costs 2 or 3 times before the 30-inch main would reach the end of its design life. There and many other factors need to be evaluated when determining the final design size, alignment, and the design of transmission components to ensure the most cost effective long-term alternative.

Table 7.1. Flow Capacity in Pipes at Velocity of 5 ft/s

Pipe Diameter (inches)	Flow Capacity (gpm)	Pressure Loss (psi), 1 mile of PVC pipe at 5 ft/s
12”	1,773	14.7
16”	3,142	10.4
18”	3,972	9.1
24”	7,050	6.5
30”	11,019	5
36”	15,863	4.1

Figures 7.1, 7.2, 7.3 were developed to illustrate the potential regional infrastructure for more detailed future consideration with projected growth and the associated water demands placed on the water purveyors in the area. Figure 7.1 focuses on the Carson Valley and Carson City area. Figure 7.2 focuses on the Lyon County and Silver Springs area. Figure 7.3 focuses on the Fallon area.

A brief summary of the information in Figures 7.1 – 7.3 is provided below. Further more detailed information can be found in Appendix E. Appendix E looks at potential infrastructure improvements that might be contemplated as part of further regional improvements to the Carson Valley and Carson City water systems. The sizes and alignments shown and discussed are preliminary in nature and a full engineering analysis and design would be required before any of these improvements could be constructed. Additionally, prior to any actual engineering design of these improvements the political agreements and/or funding for such projects would need to be developed and finalized.

A. CARSON VALLEY

Existing Regional Infrastructure:

1. Within the past 3-4 years Minden, Indian Hills GID, Carson City, and Douglas County have constructed in the neighborhood of $35-$40 Million in regional water infrastructure to produce, store, pump, and move water from the Minden area through Douglas County and into Carson City. The regional system is anticipated to be online with water deliveries to Carson City by early 2014. The following is a list of the projects completed by each entity in the past 3 years.

    a. Minden

        i. 2.5 MG Amber Way Tank

        ii. 30” Buckeye Main (Heybourne Road to Amber Way Tank)

iii. 24" Lucerne Main

iv. Buckeye Booster Station

v. Heybourne Booster Station (under construction)

b. Indian Hills GID

i. 18" IHGID Spur Line and Booster Station Upgrades

c. Douglas County

i. 1.5 MG Johnson Lane Tank

ii. 18" Johnson Lane Main

iii. Heybourne Road 30" Main (Johnson Lane to Carson City Booster Station)

iv. Carson City Booster Station (under construction)

Future Infrastructure: As growth continues in the Carson Valley area, additional regionalization of the water system will be an important consideration. The larger customer base helps mitigate costs for future treatment and allows for water to be managed on a broader regional basis. Thinking and planning for the long term of the entire regional water system allows for funds to be expended in more efficient ways than for independent systems to separately develop new facilities. Douglas County, Indian Hills, and Carson City found that their water needs could be met at less cost and more effectively by connection to a neighboring system. A list of the conceptual projects related to Figure 7.1, which shows the potential future intertie improvements to link the various Carson Valley water systems into one regional system, are provided in more detail in Appendix E. Carson Valley has a large percentage of the conceptual regional infrastructure laid out as part of the Manhard regional study, and other previous discussions between entities in the past.

With regard to Groundwater development, the Town of Minden and the Gardnerville Water Company are the favorable production centers for the Carson Valley for the following reasons:

- Currently do not require treatment (Both)
- Production capabilities being developed or in existence (Both)
- Increased pumping in these areas does not appear to significantly impact groundwater levels in these areas as evidenced by USGS groundwater modeling study. (Both)
- Minden and Gardnerville Water are already connected and further connections can be planned to improve the development of a centralized production area.
- Available water rights (Minden)

While these systems may be favorable for production, the Town of Minden and Gardnerville Water will have to individually determine how they view their place as it relates to water resources within the Carson River Watershed and the Carson Valley itself. The determination by the governing boards of each entity will help guide future decisions of the water purveyors in the Watershed.

Areas with water needs (have water but need to treat with expensive treatment, or increased pumping will continue to draw down water levels):

- Gardnerville Ranchos GID, Indian Hills GID, Fairgrounds/Sunrise Estates/Ruhenstroth, East Valley, North Valley

There is a concern of arsenic migration as the focus of pumping shifts to the Minden/Gardnerville area, and the potential to utilize the USGS groundwater model to study this is an idea. At this time, based on the water contours and direction of flow in the Carson Valley this does not appear to be an immediate concern. The arsenic appears to be more related to specific soil areas or particular aquifer strata. If funding were to become available for a monitoring well network to aid in calibrating the USGS groundwater model for an arsenic study it may be a worthwhile endeavor.

B. CARSON CITY

Carson City sits at the center of the Watershed in terms of water distribution. The water produced in the upper Watershed has to travel through Carson City via piping or the Carson River to the lower Watershed. Carson City is therefore a critical player in any regional water planning. Carson City has been developing regional infrastructure to improve its transmission and deliver system as well as reduce its dependence on poorly performing wells and wells that require expensive treatment. The inter-connection between Lyon County (Mound House) and Carson City was the first large-scale regional effort to provide support for neighboring water systems. Carson City will be obtaining water from the Minden area as of 2014 as part of a further regional effort with Minden, Douglas County, and Indian Hills GID.

Existing Regional Infrastructure:

- N/S 24" Main on Edmonds and Bigelow.
- E/W 24" Main (Saliman Road to River Wells)
- 16" Main and Water Tanks connecting Carson City with Lyon County Utilities/Mound House.

Future Infrastructure: Carson City related regional infrastructure is shown on Figure 7.1 with more detailed information provided in Appendix E. The focus for Carson City future regional infrastructure is transmission capacity within and through the City to provide for the future movement of water within the Watershed.

C. LYON COUNTY & STOREY COUNTY
(Moundhouse, Dayton, Stagecoach, Silver Springs, Virginia City, and Gold Hill)

Existing Regional Infrastructure: Some efforts at regional pipelines and interconnections have been made within the Lyon County Utilities system including the 16" main and associated infrastructure linking Carson City with Lyon County Utilities. However, the lack of a true regional plan for how water might be made available for development in areas served by Lyon County Utilities, Stagecoach, Silver Springs, and adjacent areas of Storey County has in some ways hampered the ability to size lines and locate them were needed for the long term overall use of the area. This preliminary study is the first basic step in identifying potential corridors and water sources; however, more in-depth analysis will be necessary to determine realistic future demands based on developable areas and what the existing aquifers in the Lyon County, Stagecoach, and Silver Springs can sustain. Knowing the true sustainable levels of pumping in these areas will begin to dictate the needs for importing water via pipeline or the river.

Future Infrastructure: Future infrastructure in the Lyon County/Storey County area is highly dependent on growth and development potential. The largest potential driving factors for a regional transmission main are the development of the Lyon County Highlands and Silver Springs with the USA Parkway Project. There is a lack of viable long-term groundwater production at this location in the Watershed for major development and water will need to be brought in via pipeline or some type of arrangement made for upstream surface water to be brought into the Lahontan area for use.

Utilizing rough estimates there has been discussion of 7,000 units plus commercial development in the Lyon County Highlands linked to Reno and Silver Springs via the planned USA Parkway. Water demands for such a development could approach 7,000 to 8,000 acre-ft annually. At an average annual demand of 7,000 AFA, this would equate to a max day demand of 13.25 mgd (9,200 gpm). At a velocity of 5 ft/s to minimize line losses a 30" pipeline would be needed to transmit a demand of 9,200 gpm to the Lyon County Highlands.

Figure 7.2 illustrates a number of conceptual projects and alignments for the transmission of water to Silver Springs and potentially beyond. As planning continues a multitude of alternatives for moving water within the Watershed will need to be evaluated.

Virginia City Area

Virginia City, Gold Hill, and Silver City's water source is the Marlette System comprised of piping and a siphon that crosses beneath Hwy 395 north of Carson City connecting the towns to Marlette Lake and Hobart Reservoir located between Carson City and Lake Tahoe. This delivery system was developed in the late nineteenth century and today, due to the age of the system, periodically fails and needs continuous attention. Storey County has no plans to abandon the Marlette Water System as their primary source of water or to construct a secondary line at this time. The development of a secondary means of water delivery may become necessary, and with a regional system these communities could be served water via Carson City and Mound House as shown in Figure 7.2. However, while the regional system may serve as a reserve source of water to these communities, primary consideration should be given on repairing and rehabilitating the historic Marlette System. Comstock Mining Inc. (which currently purchases large quantities of water from the Marlette System) and Storey County have engaged in planning discussions on the potential for the mining company to upgrade significant portions of the water system. The system upgrade would benefit both the mine and the communities served thereby.

Stagecoach/Silver Springs

The potential for development and growth is significant in their areas with large areas of land being privately owned (as opposed to Federally Managed property). The USA Parkway Project when completed will reduce the travel time from Silver Springs to Reno/Sparks by potentially half. As stated earlier a determination of the potential developable areas in Stagecoach and Silver Springs linked to the true sustainable pumping levels will need to be determined in order to properly size regional infrastructure.

D. CHURCHILL COUNTY

Existing Regional Infrastructure: While Churchill County and the City of Fallon operate water treatment and wastewater facilities, there is no existing regional infrastructure between Churchill County and the City of Fallon. However, the City of Fallon and the Naval Air Station (NAS) do have an intertie to accommodate NAS wastewater treatment needs.

Future Infrastructure: The development of regional infrastructure in the Churchill County area is most likely to be focused in the area surrounding the City of Fallon. The distance from Lahontan or other water systems to the City of Fallon makes an intertie between the Fallon area and the upper Carson River water systems a difficult proposition unless there were no other less expensive alternatives for additional water supply.

The primary focus of regionalization in the Fallon area should be the interconnection and incorporation of the multiple private and County maintained systems with the City of Fallon and Fallon Naval Air Station systems to create a true Fallon regional water system. While politically difficult, such a system would create a larger customer base that could spread the cost of treatment or other necessary improvements and reduce the impact of rate adjustments for all customers. With the limited information available from the City of Fallon, the Naval Air Station, and private systems a schematic of potential interconnections is unable to be produced at this time. However, it would be beneficial to conduct such an analysis should the political environment change and regionalization becomes more of a reality.

Recent information from USGS data has indicated that the groundwater levels in the Basalt aquifer, which Fallon, NAS, and the Fallon Paiute Shoshone Tribe rely on, have been dropping, potentially due to pumping exceeding the annual recharge to the Basalt aquifer. Water level monitoring in the surrounding Shallow and Intermediate alluvial aquifers, which Churchill County's system relies upon have not experienced any significant water level declines. If water levels continue to drop in the Basalt aquifer, an external source of water may be required for viable growth as well as to restore the aquifer to a more sustainable use/recharge balance.

Chapter 8 – Findings and Recommendations

In review of the information gathered by the CWSD and additional research conduct as part of this report, the current state of the water purveyors in the Carson Watershed is stable. All of the water systems currently have sufficient water supply and rights to meet current demands. Additionally, the projected growth for the Watershed is currently nominal enough to minimize the need for extreme measures at this time. However, with that said, a ramp up of growth above current estimates, changes in climate, decreases in aquifer supply and/or quality, and an expansion of treatment requirements could easily push the Watershed into a need for more immediate action and balancing municipal and industrial needs with agriculture and environmental needs. By planning for the future, and laying the groundwork for a master plan of the Watershed, the water purveyors and other users of the river can be prepared to act when the need arises, or will already have the infrastructure in place to address the need.

The following are the recommendations for moving forward to expand upon the existing information to further develop an overall master plan for the Carson Watershed:

- In order to fully develop a solid basis for the needs of the region for water, each system needs to be fully evaluated to determine realistic actual available supply during high use periods, including an analysis of supplies that require treatment or are kept solely for emergency backup. The determination of realistic existing supply capacity and limitations in supply capacity in areas of the Watershed will help to focus the discussion on were the supply for future needs can realistically come from. Once the source of supply is determined a plan can be developed to transport, store, and use that supply.
- As part of the management of the Watershed a water balance for the Watershed will need to be developed. This would include the annual groundwater recharge of the various basins, the current groundwater pumping, the decreed surface water and averaged actual river/stream flows, effluent return, etc. These inputs would be utilized to determine the available water in specific areas of the Watershed, which areas need water, and which areas have excess water on a Watershed basis.
- Continue ongoing work to educate water users and water purveyors of the need to expand to water conservation method as a means to manage our water resources.
- Continue ongoing work to educate the surface and ground water users in the Watershed on the impacts of climate change on water use patterns and work to develop a plan for dealing with those impacts before they occur.
- Further research and development of a viable plan to manage water between segments of the Carson River is a significant task that will need to be evaluated and undertaken as part of an overall Watershed management system/plan.
- Further research and development of viable Water Banking and Water Leasing programs along the Carson River as part of the overall Watershed management.