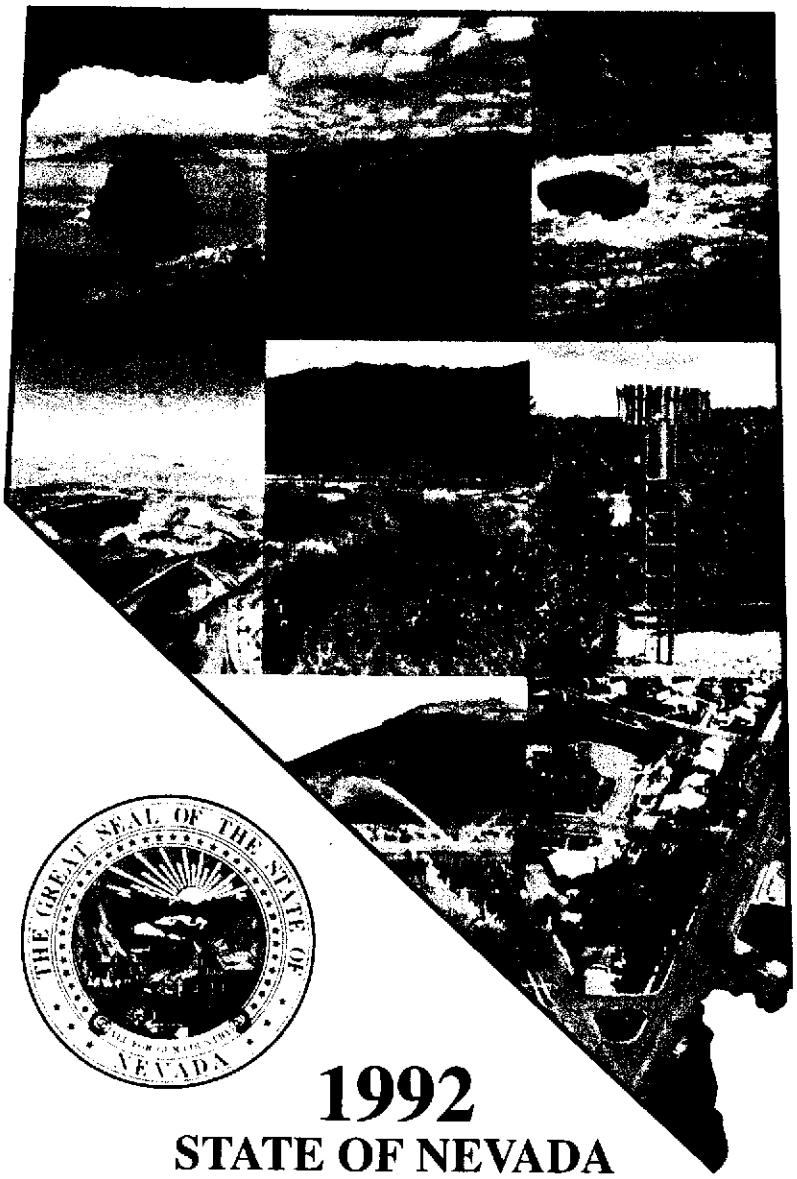
NEVADA
WATER FACTS



1992
STATE OF NEVADA
Department of Conservation and Natural Resources
DIVISION OF WATER PLANNING

To the Citizens of the State of Nevada:

Water is Nevada's most precious renewable natural resource and it is our obligation to safeguard this limited resource. A key element in the responsible management of our water resources is education. Recognizing this need for water education, the Division of Water Planning has published *Nevada Water Facts*.

This booklet provides the reader with a brief introduction to Nevada's water resources and its uses, and some of the important water issues currently facing the State. Much of the information presented in this publication was taken from Division of Water Planning and U.S. Geological Survey reports.

This report was prepared by Randy Pahl, Division of Water Planning, with the assistance of the State Advisory Board on Water Resources Planning and Development and numerous other water professionals. Publication of *Nevada Water Facts* was initially made possible through funds provided by the State of Nevada and Nevada Project WET (Water Education for Teachers).

It is our hope that this publication will prove useful to those interested in learning about Nevada's water resources. Individuals wishing additional information are invited to contact the Division of Water Planning.

Sincerely,

Naomi S. Duerr, P.G.
State Water Planner/Administrator
Nevada Division of Water Planning

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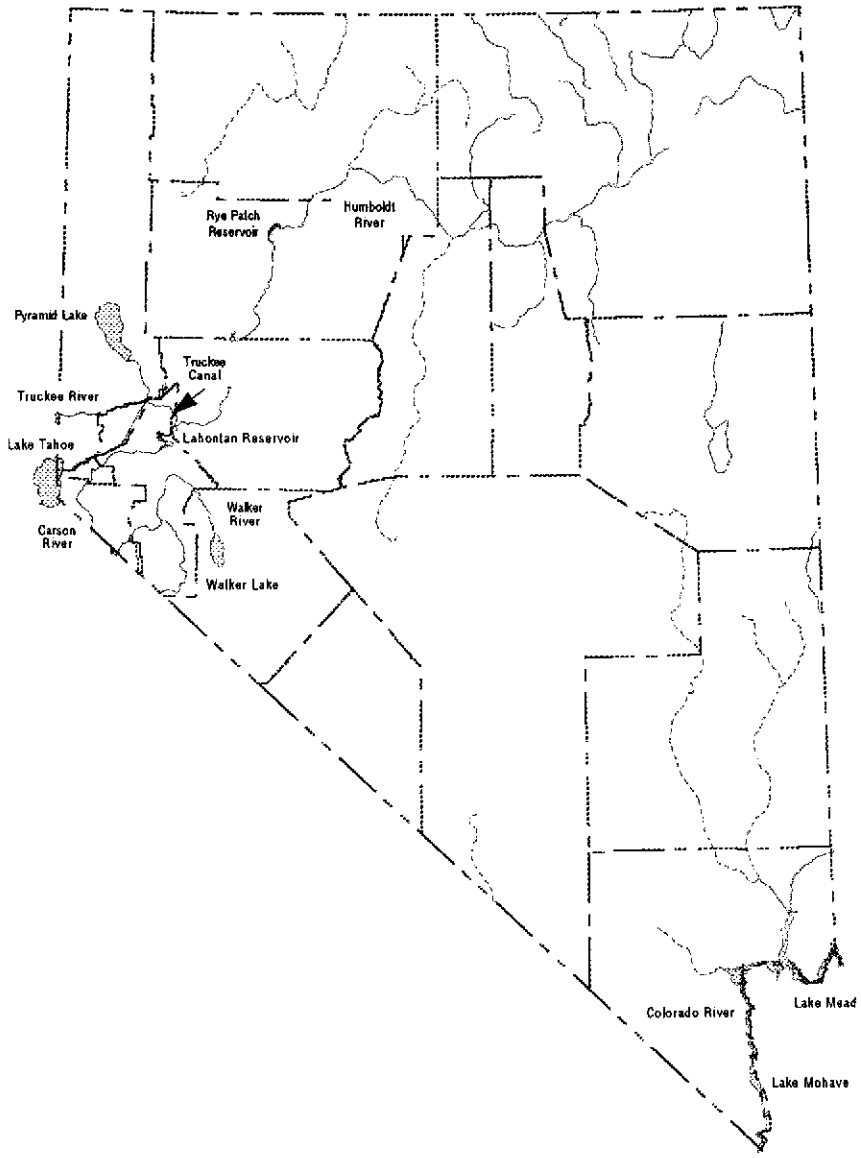


Source: Base map – U.S. Geological Survey, Water Resources Division, Carson City, Nevada.

MAJOR STREAMS, LAKES AND RESERVOIRS

Introduction

With an arid climate, Nevada has always been dependent upon the successful development of water resources. During the early development of the State, settlement locations were restricted to areas with readily available water. Now Nevadans have many more options than these early pioneers. Technologic advances have made it possible to deliver water to once remote areas, develop a variety of water sources, and meet the water needs of a growing population.

Water is a primary ingredient for the continued prosperity of Nevada, but its availability is limited. The challenge facing Nevadans is to wisely develop and use our most precious natural resource. With a limited water supply, conservation and wastewater reclamation become more necessary for responsible water management.

Education of the public about water and its use is a necessary building block for wise water management in the future. It is the intent of this booklet to provide the public with a brief introduction to our water resources. *Nevada Water Facts* begins with a statewide look at our available water resources, followed by current and future water use estimates and related information. In addition, a section has been provided which discusses some of the important water issues in Nevada. Next, general water information and selected definitions have been included.

Introduction

THE ROLE OF WATER IN THE EARLY DEVELOPMENT OF NEVADA

Water has always played an important role in the history of Nevada. During the 1840's, Nevada assumed the role it was to maintain for several years, a bridge between the rest of the United States and California. The Humboldt River was a natural highway for westward travelers at the same time providing a water source for the pioneers and their stock. From the Humboldt, the pioneers had the option of following the Carson River or Truckee River routes into California (Elliot, 1987).

The Old Spanish Trail served as a route through the southern part of the State. Along the trail travelers encountered *las vegas,* Spanish for "the meadows." Here, spring water created an oasis for weary pioneers and the area became a common camping site.

In response to the growing traffic towards California, small commercial establishments sprang up along the trails in areas with an adequate water supply. Along the Carson River segment of the Emigrant Trail, Mormon Station, later renamed Genoa, was founded in 1850 as a trading station and an outpost of the Mormon theocracy (Elliot, 1987). The first specific mention in historical records of irrigation in Nevada was at Mormon Station. Individual settlers raised irrigated crops to support themselves, and to supply the California gold seekers as they passed through the area.

Not long afterwards, a small Mormon outpost at Las Vegas was established as a way station on the road from the Utah settlements to Southern California points. During the

summer of 1855, the construction of an irrigation diversion in Las Vegas Creek by the Mormon colonists marked the beginning of organized irrigation in Nevada (State Engineer's Office, October 1971).

Growth fueled by the establishment of stations along the emigrant trails, and the discovery of gold and silver in Nevada, increased the demand for food for people and livestock. Because of the arid nature of the land, irrigation works were necessary to assure adequate food for the mining camps, the freight and stage teams, and the domestic stock.

As mining activities in Nevada boomed, so did the thirst for water for mining and milling operations, and other support developments. Small and large water development projects mushroomed throughout the State in an attempt to quench the growing demand. Since viable ore bodies were not always discovered in areas with an adequate water supply, innovative measures were undertaken to move water from its area of origin to another place of use. Perhaps the best known example of an early transbasin diversion in Nevada is the pipeline constructed to meet the growing water needs of the Comstock. This hand-riveted pipeline, considered an engineering feat for its time, carried water from the Tahoe Basin to Virginia City and neighboring towns (Galloway, 1947).

Introduction

NEVADA WATER LAW

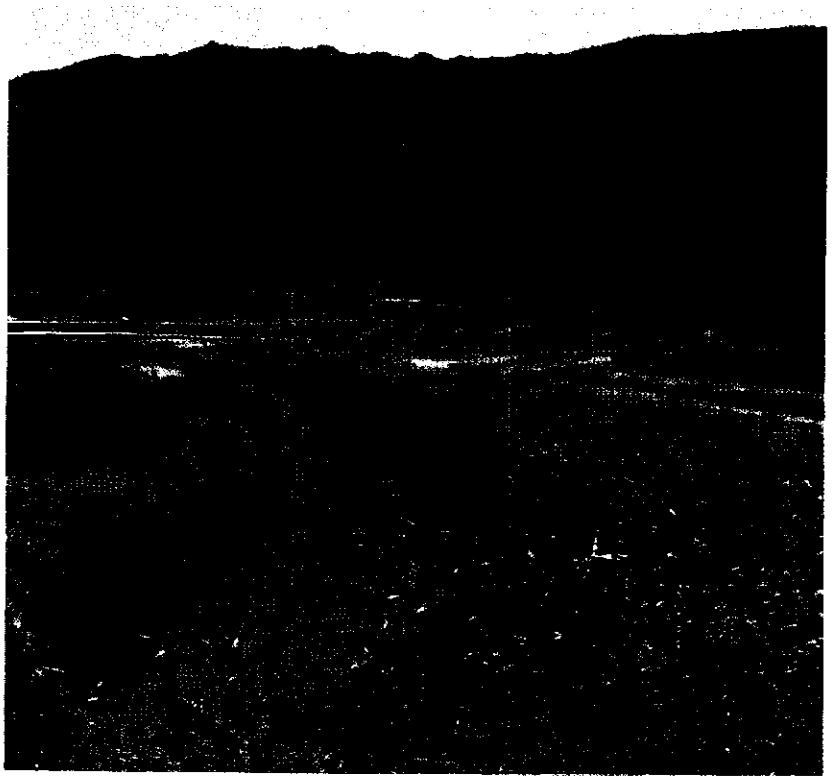
The water in Nevada on the surface and below the ground surface belongs to the public and is managed on their behalf by the State. Entities within the State can apply for the right to use that water. Nevada water law is founded on the doctrine of prior appropriation — "first in time, first in right." Under the appropriation doctrine, the first user of water from a water course acquires a priority right to the water and to the extent of its use (Shamberger, 1991).

Nevada water law is set forth in Nevada Revised Statutes (NRS), Chapters 533 and 534. In addition, there are numerous court decisions which have helped define Nevada water law. The State Engineer is the water rights administrator and is responsible for the appropriation, adjudication and distribution of water in the State. To carry out these duties he is vested with broad discretionary powers.

As part of the duties of the office, the State Engineer reviews applications for new water rights appropriations. In approving or rejecting an application, the State Engineer considers the following questions as set forth in NRS 533.370: 1) is there unappropriated water in the proposed source?; 2) would the proposed use impair existing rights?; and 3) will the proposed use prove detrimental to the public interest? Public interest is not defined by statute and the State Engineer can consider many different issues, including economic and environmental issues, in his evaluation.

All water rights are considered real property and thus are conveyed by deed. Water rights can be bought and sold, and the location and type of use changed. The attributes of

appropriative water rights in Nevada are: 1) beneficial use is the measure and the limit of the right to the use of the water; 2) rights are stated in terms of definite quantity, manner of use, and period of use; and 3) a water right can be lost by abandonment or forfeiture. Abandonment is determined by the intent of the water user to forsake the use of the water. A water right is lost by forfeiture if the right is not used for 5 years. Water lost through abandonment or forfeiture reverts back to the public and is subject to future appropriation.



Saroni Canal in Smith Valley (Photo by Nev.Div.of Water Planning).

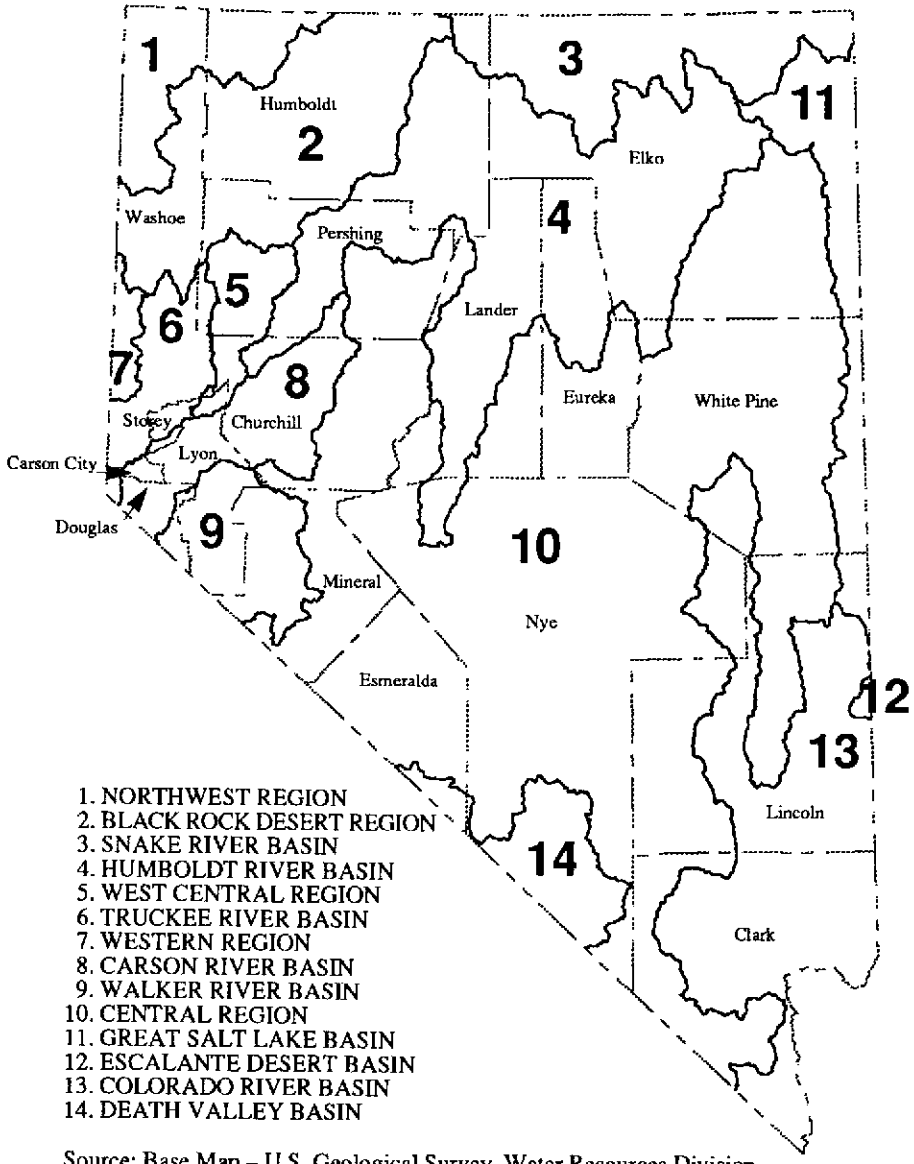
Water Resources

Throughout Nevada, the surface and ground waters of the State are equally important natural resources and have been the subject of numerous studies. This section is intended to provide the reader with a basic understanding of our most precious natural resource.

TOPOGRAPHY AND HYDROGEOGRAPHY

Nevada is characterized by isolated, long, narrow, roughly parallel mountain ranges and broad, intervening, near flat valleys and basins. The spectacular magnitude of alternating mountain ranges and valleys prompted the often used designation "Basin and Range Province" for most of Nevada. For water planning and management purposes, the U.S. Geological Survey and the Nevada Department of Conservation and Natural Resources have divided the State into discrete hydrologic units. Overall, 256 hydrographic areas and subareas within 14 major hydrographic regions have been delineated. The hydrographic regions are each comprised of major drainage basins such as the Truckee, Carson, Walker, Humboldt or Colorado Rivers.

About 93,000 of the total 110,500 square miles of the State lie in the Great Basin, the major subdivision of the Basin and Range Province, wherein drainage flows to enclosed basins rather than to the sea. The only hydrographic regions that flow to the sea are the Snake River drainage which flows to the Pacific Ocean via the Columbia River, and the Colorado River drainage which flows to the Gulf of California.



1. NORTHWEST REGION
2. BLACK ROCK DESERT REGION
3. SNAKE RIVER BASIN
4. HUMBOLDT RIVER BASIN
5. WEST CENTRAL REGION
6. TRUCKEE RIVER BASIN
7. WESTERN REGION
8. CARSON RIVER BASIN
9. WALKER RIVER BASIN
10. CENTRAL REGION
11. GREAT SALT LAKE BASIN
12. ESCALANTE DESERT BASIN
13. COLORADO RIVER BASIN
14. DEATH VALLEY BASIN

Source: Base Map – U.S. Geological Survey, Water Resources Division, Carson City, Nevada.

INDEX MAP OF NEVADA SHOWING
HYDROGRAPHIC REGIONS AND BASINS

Water Resources

CLIMATE AND PRECIPITATION

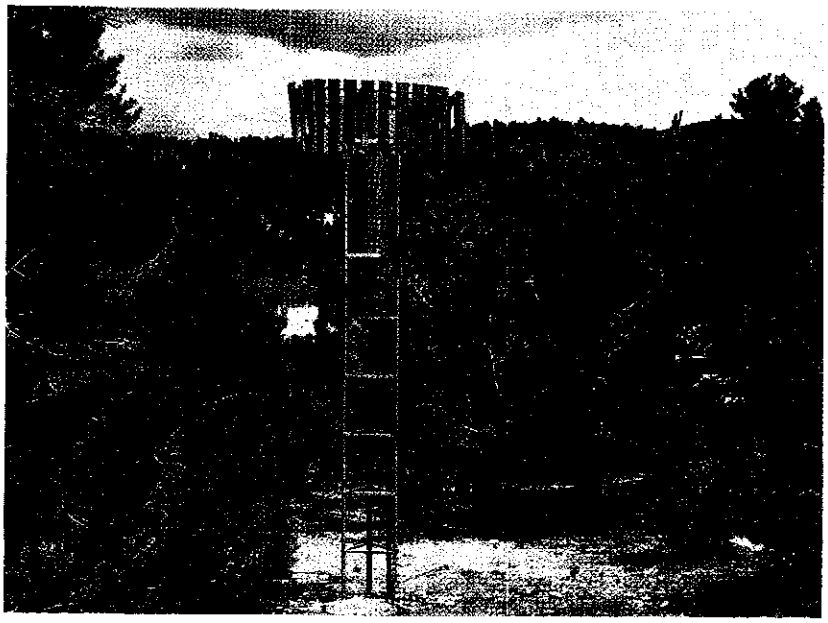
The climate of Nevada is characterized as semi-arid to arid with precipitation and temperature varying widely between the northern and southern regions of the State, and between valley floors and mountain tops. With temperatures that fall below -40° F during some months in the northeast, and rise over 120° F during a few summer days in the south, and precipitation that ranges from only three to four inches in Southern Nevada to over 40 inches (and over 300 inches of snowfall) in the Carson Range portion of the Sierra Nevada, Nevada is truly a land of great climatic contrast (James, 1984).

Total precipitation averages approximately 9 inches per year (53,000,000 acre-feet) making Nevada the most arid state in the Nation (Geraghty and others, 1973). Of the total annual average precipitation amount, approximately 10 percent accounts for stream runoff and groundwater recharge. The remaining 90 percent is lost through evaporation and transpiration. Average lake surface evaporation rates vary widely across the State from less than 36 inches per year in the west to over 80 inches per year in the south (State Engineer's Office, April 1973).

AVERAGE ANNUAL PRECIPITATION AT SELECTED LOCATIONS

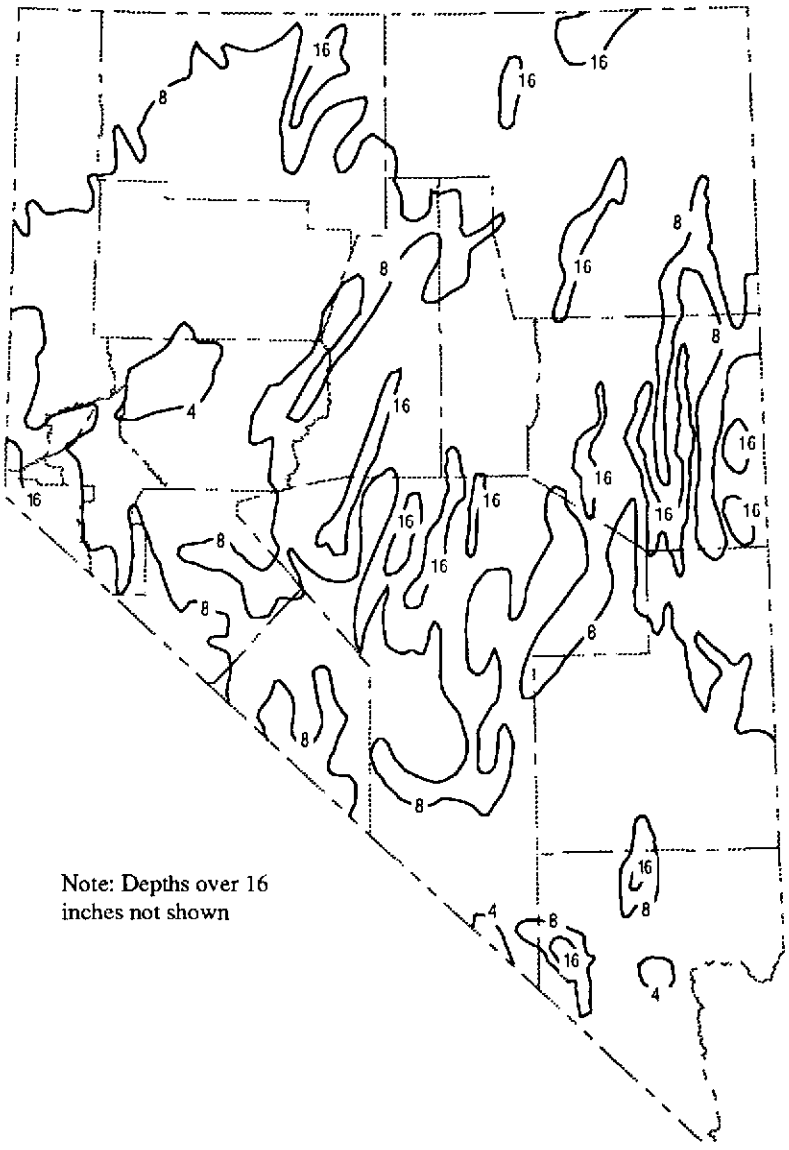
County	City	Average Annual Precipitation, in inches
Carson City	Carson City	10.8
Churchill	Fallon	4.9
Clark	Las Vegas	4.2
Douglas	Minden	8.2
Elko	Elko	9.3
Esmeralda	Goldfield	5.6
Humboldt	Winnemucca	7.9
Lander	Battle Mountain	7.5
Lincoln	Caliente	9.1
Lyon	Yerington	5.5
Mineral	Hawthorne	4.6
Nye	Tonopah	4.9
Pershing	Lovelock	5.5
Storey	Virginia City	12.1
Washoe	Reno	7.5
White Pine	Ely	9.0

Source: National Oceanic and Atmospheric Administration, "Climatological Data -Annual Summary: Nevada," Various Years.



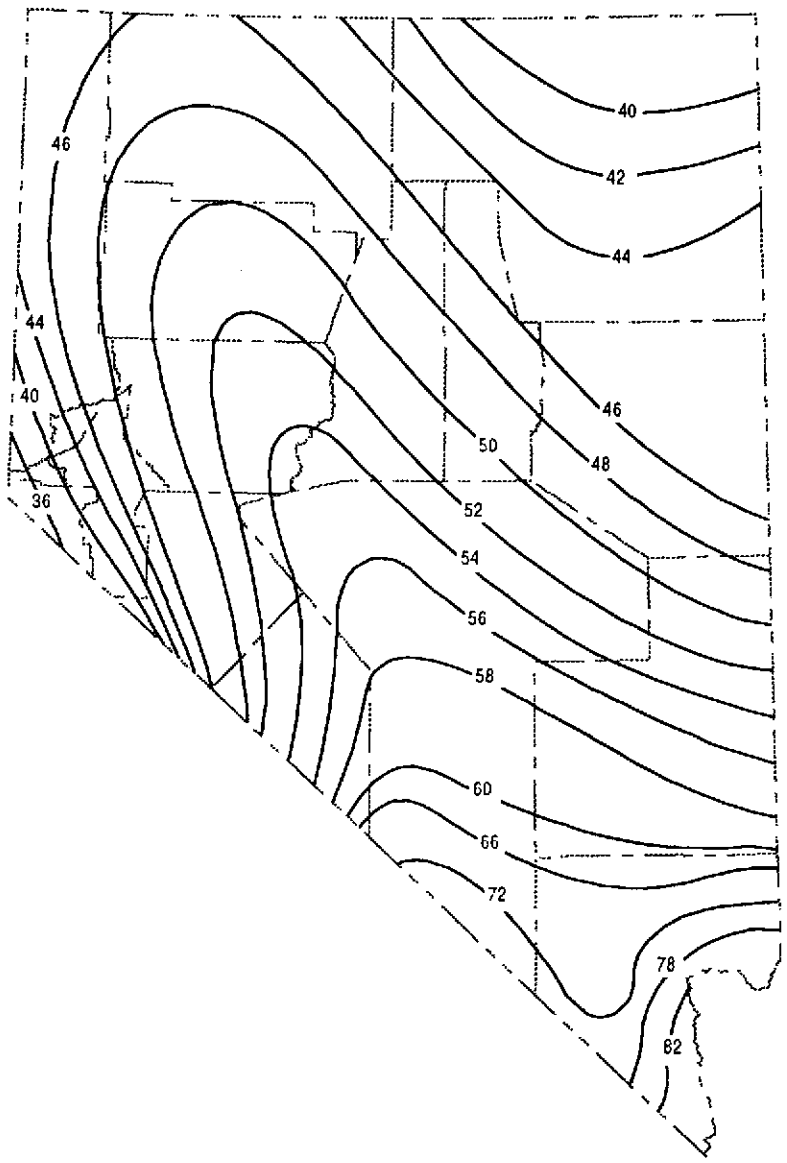
Rain gage at Conner's Pass, White Pine County (Photo by Nev. Div. of Water Planning)

Water Resources



Sources: Base map – U.S. Geological Survey, Water Resources Division, Carson City, Nevada;
Data – Houghton and others, Nevada's Weather and Climate, 1975.

AVERAGE ANNUAL PRECIPITATION,
IN INCHES PER YEAR



Source: Base map – U.S. Geological Survey, Water Resources Division, Carson City, Nevada; Data -Adapted from Climatic Atlas of the United States, U.S. Dept. of Commerce, Environmental Data Service, June 1968.

AVERAGE ANNUAL LAKE SURFACE EVAPORATION, IN INCHES PER YEAR

Water Resources

RIVERS AND STREAMS

Nevada can claim very few large rivers and streams compared to other states. Of particular importance are the characteristics of the following Nevada rivers and drainage basins:

- Colorado River: This region makes up 12,376 square miles of Nevada. The Colorado provides hydroelectric power and recreation at Lakes Mead and Mohave and water for agricultural, industrial and municipal uses.

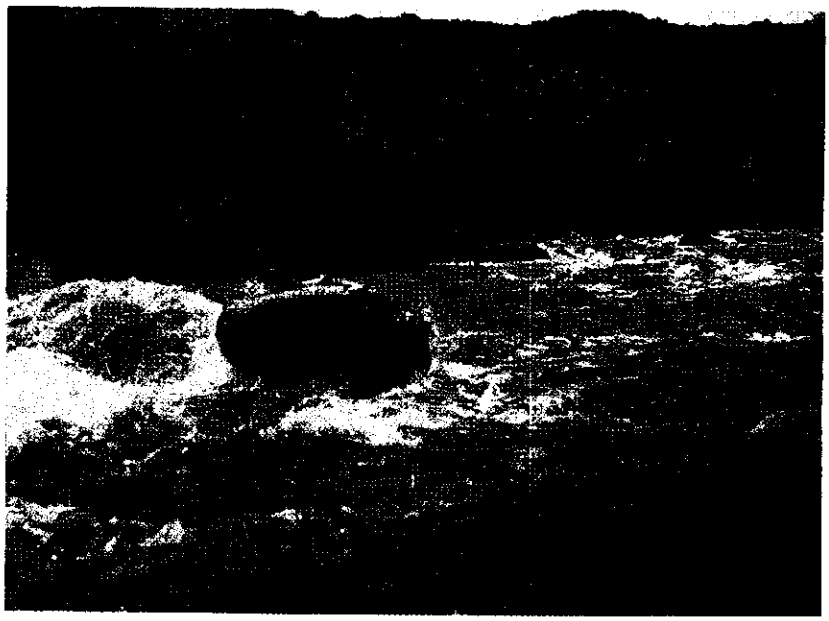
- Snake River: This watercourse drains 5,230 square miles in Northern Nevada and includes the watersheds of the Bruneau, Owyhee and Jarbidge Rivers.

- Humboldt River: This, the longest river in Nevada, is wholly contained within the State. The Humboldt has its headwaters in the Ruby, East Humboldt, Independence and Jarbidge Mountains and generally flows westward to terminate in the Humboldt and Carson sinks. The waters of the Humboldt serve a predominately agricultural economy as well as many small rural communities.

- Truckee River: The Tahoe Basin is the origin for this river which drains the eastern slope of the Sierra Nevada. The Truckee River flows east through Reno and terminates in Pyramid Lake. Along its course, water is utilized to meet the needs of municipal and industrial, agriculture, hydroelectric power, and fisheries. A portion of the Truckee River flow is diverted at Derby Dam and is conveyed by the Truckee Canal to Lahontan Reservoir in the Carson River Basin.

- Carson River: This river drains the east slope of the Sierras in an area south of Lake Tahoe and terminates in the Carson Sink. After flowing through Carson Valley in Douglas County, the river continues on to Lahontan Reservoir where the water is distributed throughout the Fallon area for agriculture, and wildlife and fisheries purposes.

- Walker River: The Walker River, with its headwaters in California, flows into Nevada and through Smith and Mason Valleys, and the Walker River Indian Reservation before terminating at Walker Lake. Waters of the Walker River are predominately used for agricultural purposes.



Carson River at Brunswick Canyon (Photo by Nev. Div. of Water Planning)

MAJOR LAKES AND RESERVOIRS OF NEVADA AND PORTIONS OF CALIFORNIA

Basin/Reservoir	County	Surface Area, acres[1]	Active Storage Capacity, acre-feet	Total Storage Capacity, acre-feet
Snake River Basin				
Wild Horse Reservoir	Elko	2,830	73,500	73,500
Humboldt River Basin				
Pitt-Taylor Res.,Lower	Pershing	2,570	22,200	22,200
Pitt-Taylor Res.,Upper	Pershing	2,070	24,200	24,200
Rye Patch Reservoir	Pershing	11,400	171,000	171,000
South Fork Reservoir	Elko	1,650	41,000	41,000
Truckee River Basin				
Big & Little Washoe Lakes	Washoe	5,800	14,000	38,000
Boca Reservoir	Nevada	980	40,870	41,110
Donner Lake	Nevada, Placer	800	9,500	Not reported
Independence Lake	Nevada, Sierra	700	17,500	Not reported
Lake Tahoe	Carson City, Douglas, Washoe, El Dorado, Placer	124,000	744,600	125,000,000
Martis Creek Lake	Nevada	770	20,400	21,200
Prosser Creek Res.	Nevada	750	28,640	29,840
Stampede Reservoir	Sierra	3,440	221,860	226,500
Carson River Basin				
Lahontan Reservoir	Churchill, Lyon	14,600	317,000	317,000
Walker River Basin				
Bridgeport	Mono	2,914	40,500	40,500
Topaz Lake	Douglas	2,410	61,000	126,000
Weber Reservoir	Mineral	950	13,000	13,000
Colorado River Basin				
Lake Mead	Clark	158,000	26,200,000	29,700,000
Lake Mohave	Clark	28,000	1,810,000	1,820,000

[1] Entire waterbody

Basin/Lake	County	1990 Surface Area, acres	1990 Contents, acre-feet
Truckee River Basin			
Pyramid Lake	Washoe	112,600	22,170,000
Walker River Basin			
Walker Lake	Mineral	35,600	2,527,000

NEVADA SURFACE WATER SUMMARY

Values in acre-feet per year unless otherwise noted

Precipitation

Estimated annual average.....53,000,000

Surface water (annual flow statistics at selected locations)

Gaging Station Name	Average	50% Frequency[1]	80% Frequency[2]
Truckee River at Farad, CA	556,800	497,600	339,400
Truckee River at Reno, NV	483,400	401,000	233,100
Truckee River below Derby Dam near Wadsworth, NV	281,200	145,700	41,400
East Fork Carson River near Gardnerville, NV	262,500	245,800	164,300
West Fork Carson River near Woodfords, CA	74,800	69,800	46,400
Carson River near Carson City, NV	294,400	262,800	146,600
Carson River near Ft. Churchill, NV	268,100	235,500	126,300
Humboldt River at Palisade, NV	289,000	239,900	126,300
Humboldt River near Imlay, NV	204,500	134,800	63,400
East Walker River near Bridgeport, CA	104,900	94,200	60,000
West Walker River near Coleville, CA	188,500	177,300	118,700
Walker River near Wabuska, NV	124,900	84,000	37,200
Colorado River below Hoover Dam, AZ-NV	10,163,000	9,380,000	7,517,000
Virgin River at Littlefield, AZ	172,500	145,000	102,700
Owyhee River above China Diversion Dam near Owyhee, NV	107,600	99,600	63,800

[1] Annual volume that is exceeded 5 out of 10 years

[2] Annual volume that is exceeded 8 out of 10 years

Source: Nevada Division of Water Planning Files

Water Resources

GROUNDWATER

The surface water resources in Nevada have been virtually fully appropriated and further development must either rely on groundwater sources or the reallocation of surface water supplies. Principal groundwater aquifers in Nevada are basin-fill deposits, carbonate rocks, and to a lesser extent, volcanic rock. The basin-fill aquifers are composed primarily of alluvial and colluvium deposits that partly fill the basins. Virtually all groundwater withdrawals at this time have been from the upper 500 feet of the basin-fill aquifers. Carbonate-rock aquifers in Eastern Nevada have not been significantly developed as a water supply, but are an important source of water. These carbonate rock formations, consisting mainly of limestone and dolomite, are found beneath the basin-fill aquifers in Eastern Nevada.

Numerous studies have been performed for quantification of available groundwater resources in a given basin. The following table presents perennial yield estimates for the 256 basins and sub-basins in Nevada. In addition, committed resources in each basin are reported. The committed resource is the total volume of permitted, certificated and vested groundwater rights which are recognized by the State Engineer and can be withdrawn in a groundwater basin in any given year. Also, whether or not a basin is designated is indicated in the following table. The State Engineer may designate a groundwater basin which is being depleted or is in need of additional administration, and in the interest of public welfare, declare preferred uses (such as municipal, domestic) in such basins. The State Engineer has additional authority in the administration of the water resources within a designated groundwater basin.

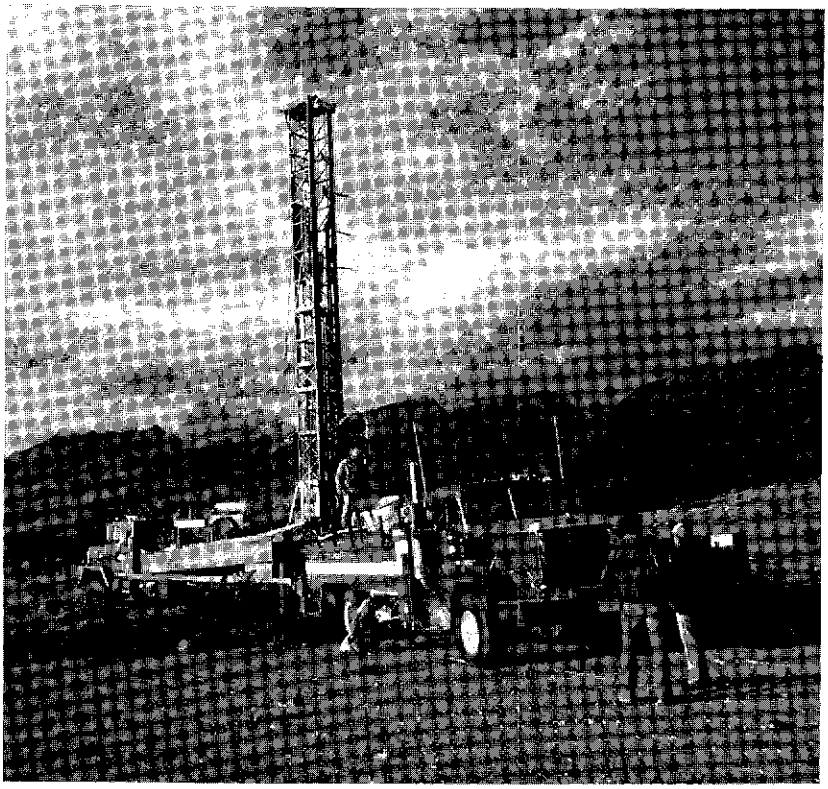
NEVADA GROUNDWATER SUMMARY

Values in acre-feet per year unless otherwise noted

Groundwater: (Groundwater budget for valley-fill reservoirs)

Groundwater recharge from precipitation	2,200,000
Perennial yield of valley-fill reservoirs	2,100,000
Groundwater stored in upper 100 feet of saturated valley fill (acre-feet)	250,000,000
Estimated transitional storage reserve (acre-feet)	84,000,000

Source: Nevada Division of Water Planning files



Drilling in the carbonate-rock aquifer province, Coyote Springs Valley
(Photo by Doug Maurer, U.S. Geological Survey)

GROUNDWATER BASIN INFORMATION

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Northwest Region					
1	Pueblo V.	118	2,000	5,923	7/92	N
2	Continental Lake V.	214	11,000	9,220	7/92	N
3	Gridley Lake V.	195	3,000	13,990	7/92	N
4	Virgin V.	494	6,000	9	7/92	N
5	Sage Hen V.	22	250	12	7/92	N
6	Guano V.	147	2,000	0	7/92	N
7	Swan Lake V.	226	Minor	0	7/92	N
8	Massacre Lake V.	176	3,000	8	7/92	N
9	Long V.	433	12,000	7,816	6/92	N
10	Macy Flat	27	250	0	7/92	N
11	Coleman V.	51	1,000	0	7/92	N
12	Mosquito V.	32	1,500	0	7/92	N
13	Warner V.	82	1,000	0	7/92	N
14	Surprise V.	214	2,500	0	7/92	N
15	Boulder V.	88	2,000	0	7/92	N
16	Duck Lake V.	533	8,000	2,082	7/92	N
	Black Rock Desert Region					
17	Pilgrim Flat	12	200	0	7/92	N
18	Painter Flat	31	1,200	0	7/92	N
19	Dry V.	39	100	0	7/92	N
20	Sano V.	12	25	0	7/92	N
21	Smoke Creek Desert	980	16,000	6,392	3/92	N
22	San Emidio Desert	305	2,500	7,440	7/92	Y
23	Granite Basin	9	200	0	7/92	N
24	Hualapai Flat	315	6,700	34,123	7/92	N
25	High Rock Lake V.	665	5,000	541	7/92	N
26	Mud Meadow	495	13,000	3,892	7/92	N
27	Summit Lake V.	60	1,000	12	7/92	N
28	Black Rock Desert	2,179	30,000	23,897	7/92	N
29	Pine Forest V.	528	11,000	40,990	7/92	Y
30	Kings River V.					
	(A) Rio King Subarea	300	17,000	60,217	7/92	Y
	(B) Sod House Subarea	113		6	4/92	Y
31	Desert V.	1,052	9,000	29,597	7/92	Y
32	Silver State V.	313	5,900	25,273	7/92	Y
33	Quinn River V.					
	(A) Orovada Subarea	632	60,000	83,123	7/92	Y
	(B) McDermitt Subarea	592		9,232	7/92	Y
	Snake River Basin					
34	Little Owyhee River Area	716	1,400	28	2/92	N
35	South Fork Owyhee River	1,310	8,000	3,054	6/92	N
36	Independence V.	345	12,000	16,345	7/92	N
37	Owyhee River Area	533	7,000	8,860	7/92	N
38	Bruneau River Area	514	10,000	0	7/92	N
39	Jarbidge River Area	278	12,000	56	7/92	N
40	Salmon River Area	1,218	10,000	8,172	7/92	Y
41	Goose Creek Area	316	1,700	958	2/92	N

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Humboldt River Basin					
42	Marys River Area	1,073		32,704	7/92	Y
43	Starr Valley Area	332	83,000	3,597	4/92	Y
44	North Fork Area	1,110		11,081	7/92	Y
45	Lamoille V.	257		3,674	7/92	Y
46	South Fork Area	99		31	2/92	Y
47	Huntington V.	787	25,000	8,124	6/92	Y
48	Dixie Creek – Ten Mile Creek Area	392		27,060	7/92	Y
49	Elko Segment	314	13,000[2]	29,755	7/92	Y
50	Susie Creek Area	223	6,000	169	2/92	Y
51	Maggie Creek Area	396		13,739	7/92	Y
52	Marys Creek Area	61	13,000[2]	1,940	2/92	Y
53	Pine V.	1,002	20,000	11,206	7/92	Y
54	Crescent V.	752	16,000	19,325	7/92	Y
55	Carico Lake V.	376	4,000	2,855	7/92	N
56	Upper Reese River V.	1,138	37,000	31,219	7/92	Y
57	Antelope V.	452	9,000	34,524	6/92	Y
58	Middle Reese River V.	319	14,000	50,784	6/92	Y
59	Lower Reese River V.	588	20,000	23,769	7/92	N
60	Whirlwind V.	94		5,871	6/92	Y
61	Boulder Flat	544	30,000	104,451	5/91	Y
62	Rock Creek V.	444	2,800	2,026	6/92	N
63	Willow Creek V.	405		5,022	6/92	N
64	Clovers Area	720		35,784	7/92	Y
65	Pumpernickel V.	299	72,000	27,756	7/92	N
66	Kelley Creek Area	301		29,647	7/92	Y
67	Little Humboldt V.	975		9,155	7/92	N
68	Hardscrabble Area	167	34,000	0	2/92	N
69	Paradise V.	600		105,112	7/92	Y
70	Winnemucca Segment	435	17,000	40,644	7/92	Y
71	Grass V.	520	13,000	42,938	7/92	Y
72	Imlay Area	771	3,000	7,604	7/92	Y
73	Lovelock V.	635	43,000	4,062	7/92	N
	(A) Oreana Subarea	98	2,000	5,296	2/92	Y
74	White Plains	164	100	47	2/92	Y
	West Central Region					
75	Brady Hot Springs	178	2,500	1,288	7/92	Y
76	Fernley Area	120	600	15,092	7/92	Y
77	Fireball Area	58	100	0	2/92	N
78	Granite Springs V.	967	4,500	784	2/92	N
79	Kumiva V.	333	500	2	2/92	N

[2] Combined perennial yield of Basins 49 & 52

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Truckee River Basin					
80	Winnemucca Lake V.	371	3,300	262	2/92	N
81	Pyramid Lake V.	672	7,000	55	2/92	N
82	Dodge Flat	92	2,100	5,221	7/92	N
83	Tracy Segment	285	6,000R	5,352	7/92	Y
84	Warm Springs Area	247	3,000	14,057	7/92	Y
85	Spanish Springs V.	76	1,000	10,029	7/92	Y
86	Sun V.	10	25	20	2/92	Y
87	Truckee Meadows	203	27,000R	79,765	7/92	Y
88	Pleasant V.	39	10,000R	10,945	7/92	Y
89	Washoe V.	82	15,000R	11,413	7/92	Y
90	Lake Tahoe Basin	139	Minor	1,862	3/92	Y
91	Truckee Canyon Segment	84	2,000	3,186	7/92	Y
	Western Region					
92	Lemmon V.					
	(A) Western Part	53	1,500	1,990	7/92	Y
	(B) Eastern Part	40		2,870	7/92	Y
93	Antelope V.	18	150	56	2/92	Y
94	Bedell Flat	53	300	127	2/92	Y
95	Dry V.	80	1,000	26	2/92	N
96	Newcomb Lake V.	9	200	0	7/92	N
97	Honey Lake V.	193	13,000	23,135	6/92	Y
98	Skedaddle Creek V.	43	200	0	7/92	N
99	Red Rock V.	58	1,000	898	2/92	Y
100	Cold Springs V.	30	500	1,162	7/92	Y
	(A) Long V.	25	NR	2,336	3/92	Y
	Carson River Basin					
101	Carson Desert	2,022	2,500	22,851	7/92	Y
	(A) Packard V.	160	710R	2,621	7/92	Y
102	Churchill V.	480	1,600	8,584	7/92	Y
103	Dayton V.	369	9,445	33,155	7/92	Y
104	Eagle V.	69	7,000	9,289	5/91	Y
105	Carson V.	419	49,000R	102,981	12/90	Y
	Walker River Basin					
106	Antelope V.	115	2,600	7,417	7/92	Y
107	Smith V.	479	17,000R	59,088	6/92	Y
108	Mason V.	516	25,000	149,175	10/90	Y
109	East Walker Area	586	5,500	9,008	7/92	N
110	Walker Lake					
	(A) Schurz Subarea	502	1,500	35	2/92	N
	(B) Lake Subarea	307	700	2,282	7/92	N
	(C) Whiskey Flat-Hawthorne Subarea	541	5,000	12,625	7/92	Y
	Central Region					
111	Alkali V.					
	(A) Northern Part	18	300	0	7/92	N
	(B) Southern Part	65	700	0	7/92	N
112	Mono V.	27	300	0	7/92	N
113	Huntoon V.	97	150	2,596	7/92	N

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[3]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Central Region (cont'd)					
114	Teels Marsh V.	323	1,400	738	7/92	N
115	Adobe V.	15	150	0	7/92	N
116	Queen V.	65	600	0	7/92	N
117	Fish Lake V.	706	30,000	65,987	7/92	Y
118	Columbus Salt Marsh V.	370	4,000	2,299	7/92	N
119	Rhodes Salt Marsh V.	199	1,000	49	2/92	N
120	Garfield Flat	92	150	0	2/92	N
121	Soda Spring V.					
	(A) Eastern Part	246	600	3,591	7/92	Y
	(B) Western Part	130	200	478	7/92	Y
122	Gabbs V.	1,277	5,000	25,536	7/92	Y
123	Rawhide Flats	227	500	116	7/92	N
124	Fairview V.	285	250	55	7/92	Y
125	Stingaree V.	43	100	413	7/92	Y
126	Cowkick V.	110	800	820	7/92	Y
127	Eastgate Valley Area	216	4,000	231	7/92	Y
128	Dixie V.	1,303	15,000	37,435	7/92	Y
129	Buena Vista V.	742	10,000	33,456	7/92	Y
130	Pleasant V.	285	2,600	1,699	7/92	Y
131	Buffalo V.	504	8,000	8,890	7/92	N
132	Jersey V.	142	250	27	7/92	Y
133	Edwards Creek V.	416	8,000	11,811	7/92	N
134	Smith Creek V.	582	10,000	3,219	6/92	N
135	Ione V.	460	2,500	1,167	6/92	N
136	Monte Cristo V.	284	400	256	7/92	N
137	Big Smoky V.					
	(A) Tonopah Flat	1,603	6,000	29,514	7/92	Y
	(B) Northern Part	1,323	65,000	82,966	7/92	Y
138	Grass V.	595	13,000	4,683	6/92	N
139	Kobeh V.	868	16,000	28,923	7/92	Y
140	Monitor V.					
	(A) Northern Part	529	8,000	278	6/92	N
	(B) Southern Part	509	10,000	3,478	7/92	N
141	Ralston V.	971	6,000	3,471	7/92	Y
142	Alkali Spring V.	313	3,000	20,110	7/92	N
143	Clayton V.	555	20,000	21,399	7/92	N
144	Lida V.	535	350	214	7/92	N
145	Stonewall Flat	381	100	12	7/92	N
146	Sarcobatus Flat	812	3,000	1,977	7/92	Y
147	Gold Flat	684	1,900	95	7/92	N
148	Cactus Flat	403	300	619	7/92	N
149	Stone Cabin V.	985	2,000	2,237	7/92	Y
150	Little Fish Lake V.	434	10,000	0	2/92	N
151	Antelope V.	444	4,000	1,635	6/92	N
152	Stevens Basin	17	100	19	6/92	N
153	Diamond V.	752	30,000	134,176	7/92	Y
154	Newark V.	801	18,000	12,035	7/92	N
155	Little Smoky V.					
	(A) Northern Part	591	5,000	3,484	6/92	N
	(B) Central Part	57	100	4	6/92	N
	(C) Southern Part	510	1,000	24	6/92	N
156	Hot Creek V.	1,036	5,500	1,425	6/92	N
157	Kawich V.	350	2,200	8	7/92	N

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Central Region (cont'd)					
158	Emigrant V.					
	(A) Groom Lake V.	663	2,800	12	6/92	N
	(B) Papoose Lake V.	104	10	0	6/92	N
159	Yucca Flat	305	350	0	2/92	N
160	Frenchman Flat	463	16,000	0	2/92	N
161	Indian Springs V.	655	500	1,626	2/92	Y
162	Pahrump V.	789	12,000	78,065	7/92	Y
163	Mesquite V. (Sandy V.)	236	2,200	2,845	7/92	Y
164	Ivanpah V.					
	(A) Northern Part	253	700	3,039	7/92	Y
	(B) Southern Part	73	250	603	7/92	Y
165	Jean Lake V.	96	50	10	7/92	Y
166	Hidden Lake V.	34	Minor	7	7/92	Y
167	Eldorado V.	530	500	2,609	7/92	Y
168	Three Lakes V.	298	4,000	0	2/92	N
169	Tikapoo V.					
	(A) Northern Part	607	1,300	7	6/92	N
	(B) Southern Part	391	3,000	0	6/92	N
170	Penoyer V.					
	(Sand Spring V.)	700	4,000	19,168	6/92	Y
171	Coal V.	460	6,000	25	6/92	N
172	Garden V.	493	6,000	366	1/92	N
173	Railroad V.					
	(A) Southern Part	603	2,800	5,329	7/92	N
	(B) Northern Part	2,149	75,000	40,820	7/92	N
174	Jakes V.	422	12,000	54	6/92	N
175	Long V.	651	6,000	3,307	7/92	N
176	Ruby V.	1,004	53,000	33,822	7/92	Y
177	Clover V.	464	10,000	21,060	7/92	Y
178	Butte V.					
	(A) Northern Part	271	6,000	110	7/92	N
	(B) Southern Part	739	14,000	318	6/92	N
179	Steptoe V.	1,942	70,000	78,531	7/92	Y
180	Cave V.	362	2,000	13	6/92	N
181	Dry Lake V.	882	2,500	56	6/92	N
182	Delamar V.	383	3,000	7	6/92	N
183	Lake V.	557	12,000	28,981	7/92	Y
184	Spring V.	1,661	100,000	24,778	7/92	N
185	Tippett V.	345	3,500	472	6/92	N
186	Antelope V.					
	(A) Southern Part	125	800	637	6/92	N
	(B) Northern Part	270	1,700	613	6/92	N
187	Goshute V.	954	11,000	10,617	6/92	Y
188	Independence V.					
	(Pequop V.)	562	9,000	2,042	7/92	Y
	Great Salt Lake Basin					
189	Thousand Springs V.					
	(A) Herrill Siding-Brush Creek Area	163	1,800	6,679	7/92	Y
	(B) Toano-Rock Spring Area	618	2,600	11,233	7/92	Y
	(C) Rocky Butte Area	183	1,400	415	6/92	Y
	(D) Montello-Crittenden Creek Area	482	14,000	24,402	7/92	Y

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Great Salt Lake Basin (cont'd)					
190	Grouse Creek V.	55	350	33	6/92	N
191	Pilot Creek V.	326	4,500	2,772	7/92	Y
192	Great Salt Lake Desert	507	5,000	3,357	7/92	N
193	Deep Creek V.	208	2,000	0	2/92	N
194	Pleasant V.	75	1,500	976	6/92	N
195	Snake V.	777	25,000	12,389	7/92	N
196	Hamlin V.	413	5,000	368	6/92	N
	Escalante Desert					
197	Escalante Desert	106	1,000	2	6/92	N
	Colorado River Basin					
198	Dry V.	113	1,000	7,207	7/92	N
199	Rose V.	12	100	1,660	6/92	N
200	Eagle V.	52	300	297	6/92	N
201	Spring V.	287	4,100	1,164	6/92	N
202	Patterson V.	418	4,500	5,435	7/92	N
203	Panaca V.	334	9,000	28,134	7/92	Y
204	Clover V.	364	1,000	3,690	7/92	N
205	Lower Meadow V. Wash	979	5,000	29,680	7/92	Y
206	Kane Springs V.	234	Minor	0	2/92	N
207	White River V.	1,607	37,000	25,007	7/92	N
208	Pahroc V.	508	21,000	7	6/92	N
209	Pahranagat V.	768	25,000	9,714	7/92	N
210	Coyote Spring V.	657	18,000	0	6/92	Y
211	Three Lakes V.	311	5,000	521	7/92	Y
212	Las Vegas V.	1,564	25,000	91,257	12/91	Y
213	Colorado River V.	563	200R	1,606	7/92	Y
214	Piute V.	338	600	6,612	7/92	Y
215	Black Mountains Area	630	1,300	6,212	6/92	Y
216	Garnet V.	156	400	930	5/92	N
217	Hidden V.	80	200	0	2/92	N
218	California Wash	318	2,200	506	7/92	N
219	Muddy River Springs Area	91	37,000	8,328	6/92	Y
220	Lower Moapa V.	252	16,500	5,660	5/92	Y
221	Tule Desert	192	1,000	4	6/92	N
222	Virgin River V.	907	3,600R	13,307	7/92	Y
223	Gold Butte Area	533	500	92	7/92	N
224	Greasewood Area	108	300	5	7/92	N
	Death Valley Basin					
225	Mercury V.	110		0	2/92	N
226	Rock V.	82		0	2/92	N
227	Forty Mile Canyon					
	(A) Jackass Flats	279	24,000	56	7/92	N
	(B) Buckboard Mesa	240		0	2/92	N
228	Oasis V.	460		1,727	7/92	Y
229	Crater Flat	182		3,056	7/92	N
230	Amargosa Desert	896		42,026	7/92	Y
231	Grapevine Canyon	162	400	12	7/92	N
232	Oriental Wash	182	150	396	7/92	N

[1] Nevada portion only

R = Recharge to the basin

NR = Not Reported

Source: Nevada Division of Water Planning, Hydrographic Basin Summaries: 1992, July 1992.

WATER QUALITY

The chemical quality of the waters of the State can vary considerably depending upon location, time of year, climatic conditions, etc. A detailed discussion of the water quality in Nevada is beyond the scope of this booklet. For specific information on water quality in an area, please contact the Nevada Divisions of Environmental Protection or Water Planning.

Surface and Ground Water Quality

Water quality is affected by natural causes and/or human-induced contamination. Chemical constituent sources can be identified as point or nonpoint sources. A point source has a discernible discharge point, such as a municipal or industrial wastewater plant discharge pipe or percolation pond. A nonpoint source is a diffuse source with constituents entering the stream or aquifer from a widespread area, such as natural mineral deposits or irrigated lands.

The quality of the surface waters in Nevada has been improving due to the removal of point sources and more stringent standards being implemented on the remaining point sources by the Nevada Division of Environmental Protection (NDEP). Agricultural and rangeland nonpoint sources are contributing large sediment and nutrient loads to the waters of the State. The NDEP nonpoint source program is helping to further improve water quality by promoting better grazing and irrigation practices (NDEP, April 1992).

The quality of water from most groundwater aquifers in Nevada is suitable, or marginally suitable, for most uses. Most aquifers contain water with constituent concentrations that do not exceed State and national drinking water standards.

However, portions of some groundwater sources have constituent concentrations exceeding these standards. Excessive concentrations in groundwater result from both natural processes and human activities (USGS, 1988b).

Nevada Drinking Water Standards

The primary objective of the State's drinking water standards is to assure safe water for human consumption. The following table lists the maximum primary and secondary contaminant concentrations for drinking water. Primary standards limit contaminants which may affect consumer health. Secondary standards were developed to deal with the aesthetic qualities of drinking water.

PRIMARY REGULATIONS

Inorganic Chemicals	
Arsenic	0.05 mg/l
Barium	1 mg/l
Cadmium	0.010 mg/l
Chromium	0.05 mg/l
Lead	0.05 mg/l
Mercury	0.002 mg/l
Nitrate (as N)	10 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l
Fluoride	1.4-2.4 mg/l
Organic Chemicals	
Endrin	0.0002 mg/l
Lindane	0.004 mg/l
Methoxychlor	0.1 mg/l
Toxaphene	0.005 mg/l
2,4-D	0.1 mg/l
2,4,5-TP Silvex	0.001 mg/l
TTHM	0.10 mg/l
Turbidity	1-5 TU
Coliform Bacteria	1/100 ml (mean)
Radiological	
Radium 226 and 228	5 pCi/l
Gross Beta	4 mrem/year (50 pCi/l)
Gross Alpha	15 pCi/l
Sodium & Corrosivity	Monitoring only

SECONDARY REGULATIONS

Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Foaming agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 threshold odor number
pH	6.5-8.5
Sulfate	250 mg/l
TDS	500 mg/l
Zinc	5 mg/l

Water Use

Availability of water, which reflects the variable climate in the State, has always been a controlling factor in the settlement of Nevada. Water is used by virtually every sector of the State economy, e.g. public supply, rural domestic, irrigation and livestock, industrial and mining, and thermoelectric. This section presents information on past, current and possible future water use by these sectors.

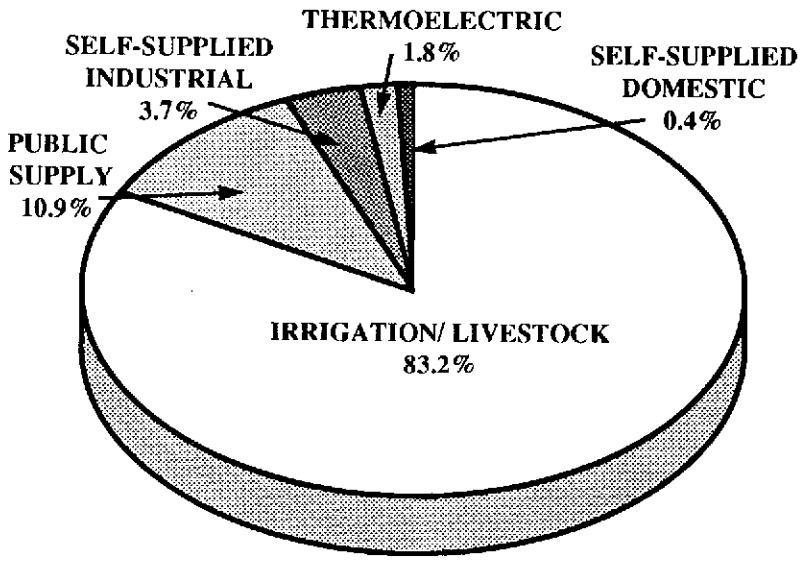
ESTIMATED WATER USE IN NEVADA IN 1,000 ACRE-FEET PER YEAR

Use Category	1980	1985	1990
Public Supply			
Withdrawn	258	323	439
Consumed	141	177	269
Self-supplied Domestic			
Withdrawn	12	13	15
Consumed	7	7	8
Irrigation/Livestock			
Withdrawn	3,485	3,780	3,360
Consumed	1,690	1,950	1,800
Self-supplied Industrial[1]			
Withdrawn	166	46	148
Consumed	74	26	65
Thermoelectric			
Withdrawn	105	27	74
Consumed	22	26	49
Total			
Withdrawn	4,026	4,190	4,036
Consumed	1,934	2,186	2,191

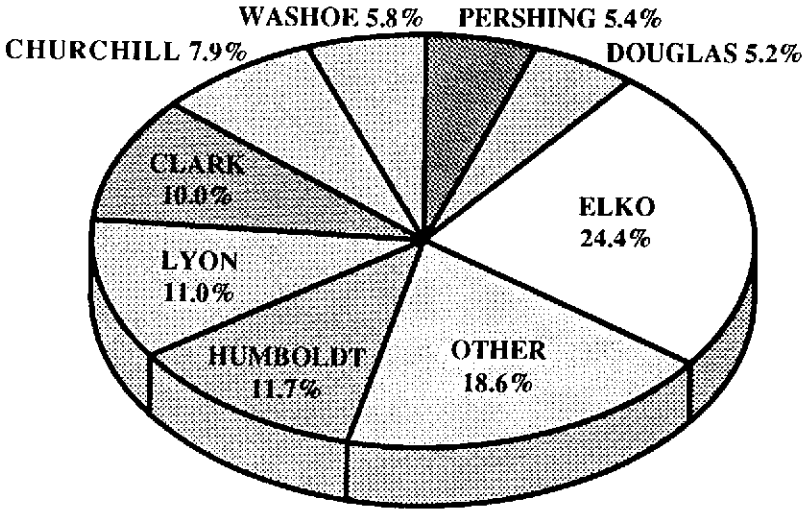
[1]Includes self-supplied industrial, commercial and mining uses. 1980 and 1985 values do not include mine pit dewatering amounts.

Sources: Crompton, J., Personal Communication, U.S. Geological Survey, June 1992.
Nevada Division of Water Planning, Forecast of County Municipal & Industrial Water Needs to the Year 2020, March 1992.
Nevada Division of Water Planning, Forecast of County Agricultural Water Needs to the Year 2020, March 1992.
Nevada Division of Water Planning, Mining Water Use in Nevada – 1990, May 1992.
U.S. Geological Survey, Estimated Use of Water in the United States in 1980, U.S. Geological Survey, 1983.
U.S. Geological Survey, Estimated Use of Water in the United States in 1985, U.S Geological Survey, 1988a.

Water Use



1990 STATEWIDE WATER WITHDRAWALS BY CATEGORY



1990 STATEWIDE WATER WITHDRAWALS BY COUNTY

As shown on the following table, the irrigation/livestock sector withdraws more water per year than any other use category. Elko County withdrawals were the largest in the State with a majority of the County's water withdrawals used for irrigation.

Total water withdrawals are given in terms of gallons per capita (person) per day (gpcd) for each county. As expected the rural counties with agricultural and mining activities had the highest water use per person. For planning purposes, agricultural, mining and industrial water use is not usually reported in "gpcd" as these water uses are independent of the county/area population. Typically, per capita water use figures are utilized by planners for systems where a significant portion of the water use can be attributed to people, such as municipal water systems.

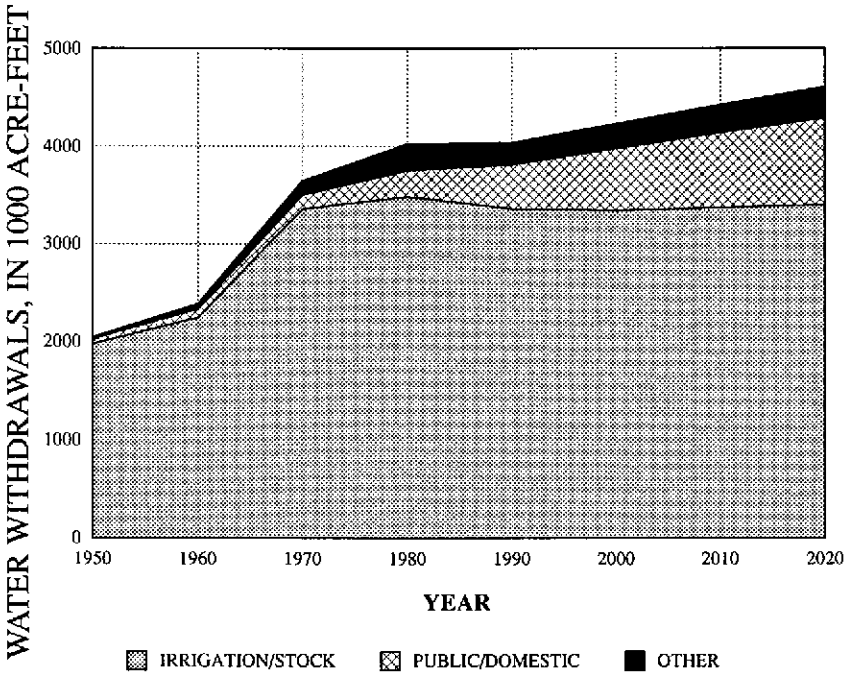
1990 TOTAL WATER WITHDRAWALS BY COUNTY AND CATEGORY

	Total Withdrawals, 1000 af/yr					
County	Public Supply and Domestic	Irrigation/ Livestock	Other[1]	Total	Population	Withdrawals, gpcd
Carson City	11.8	6.3	0.2	18.3	40,443	405
Churchill	4.2	288.1	26.3	31.6	17,938	15,855
Clark	311.7	41.3	50.4	403.4	741,459	485
Douglas	10.2	197.6	0.5	208.3	27,637	6,730
Elko	12.4	960.8	9.8	983.0	33,530	26,170
Esmeralda	0.3	40.3	12.8	53.4	1,344	35,470
Eureka	0.5	121.2	30.4	152.1	1,547	87,775
Humboldt	3.8	434.0	32.3	470.1	12,844	32,675
Lander	1.1	156.3	18.6	176.0	6,266	25,075
Lincoln	1.8	57.7	0.1	59.6	3,775	14,095
Lyon	5.2	432.8	5.9	443.9	20,001	19,815
Mineral	2.4	29.3	1.4	33.1	6,475	4,565
Nye	5.6	121.0	7.8	134.4	17,781	6,750
Pershing	1.4	216.5	1.7	219.6	4,336	45,215
Storey	0.4	1.3	3.5	5.2	2,526	1,840
Washoe	78.2	140.9	13.9	233.0	254,667	815
White Pine	3.4	114.6	6.0	124.0	9,264	11,950
State Total	454.3	3,360.0	221.7	4,036.0	1,201,833	3,000

[1]Industrial and thermoelectric
Note: Figures may not add to totals due to independent rounding.

Water Use

Forecasts of water use by various sectors have been performed by the Division of Water Planning. These estimates indicate that total withdrawals may increase by about 15% by the Year 2020. It is anticipated that withdrawals by each of the main water use sectors will increase during this period, with public-supply use experiencing the largest increase over the next 30 years. However agricultural water use will continue to represent a major portion of total Statewide water use.



HISTORIC AND PROJECTED TOTAL STATEWIDE WATER WITHDRAWALS

Water Use

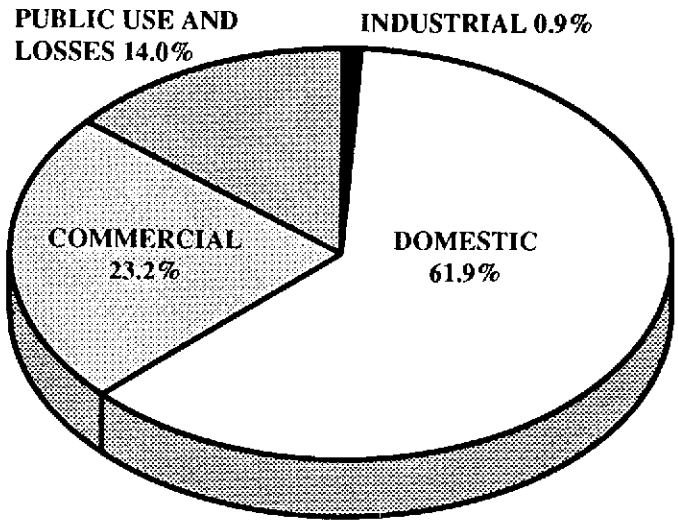
PUBLIC-SUPPLY WATER USE

As used in this booklet, public supply refers to water withdrawn by public and private water suppliers and delivered to domestic, commercial, and industrial uses. Public-supply water use is often referred to as municipal and industrial (M&I) water use.

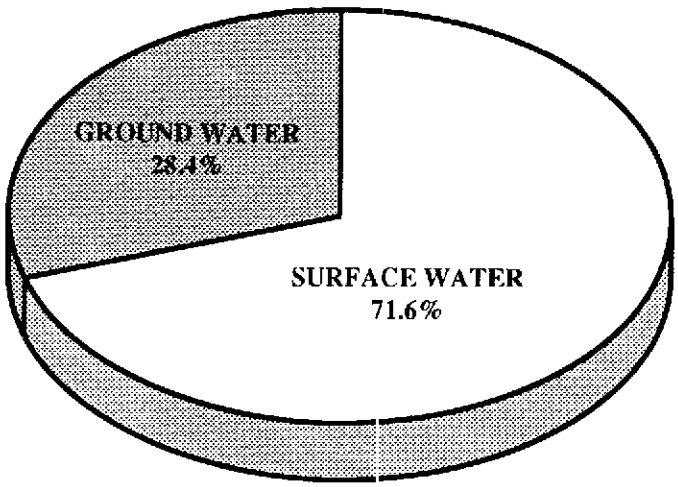
Approximately 93% of the State's population is served by public-supply systems. Population is a major factor affecting the amount of water needed for a particular public system. A common approach to reporting public water use is in terms of gallons per capita (person) per day (gpcd), allowing one to project the future water use of various water purveyors. The average Statewide public-supply water use was 320 gpcd in 1990. Of this total, 200 gpcd is attributed to residential (domestic) deliveries with 45% of this water used indoors and 55% used outdoors.

The following table presents water use information for selected public-supply water purveyors in Nevada. As the State's population grows, the demand for water by public-supply systems will increase. Estimates of future water demands of these purveyors and the 17 counties follow. For several of the selected purveyors, future water demands will exceed current water supplies within the next 30 years. The major purveyors, such as the Las Vegas Valley Water District, Westpac Utilities and others, are currently pursuing plans to increase water supplies to meet these demands. For the other systems in need of additional supplies, the Nevada Division of Water Planning is providing planning assistance as requested.

Water Use



1990 PUBLIC SUPPLY WATER DELIVERIES BY CATEGORY



1990 PUBLIC WATER WITHDRAWALS BY SOURCE

1990 FRESHWATER USE DATA FOR SELECTED WATER PURVEYORS

County/Water Purveyor	Population	Total Withdrawals (mgd)	Total Withdrawals (gpcd)	Residential Deliveries (gpcd)
Carson City				
Carson City Water	34,300	8.507	248	169
Churchill				
Fallon City Water	6,370	1.733	272	218
Clark				
Big Bend Water (Laughlin)	5,580	3.406	610	251
Boulder City Water	14,050	5.925	422	275
Henderson City Water	70,390	22.726	323	202
Las Vegas Valley Water District	592,040	201.062	340	197
Logandale (Moapa Valley Water)	5,000	1.771	354	154
Mesquite-Farmstead Water Assoc.	1,900	0.879	463	315[1]
North Las Vegas	84,580	24.270	286	213
Douglas				
Gardnerville Ranchos GID	7,550	2.286	303	276
Gardnerville Town Water	2,950	0.982	333	227[1]
Indian Hills GID	1,850	0.285	154	116
Kingsbury GID	1,500	1.283	855	497
Minden Town Water	2,200	0.928	422	288
Round Hill GID	1,005	0.245	244	222
Topaz Mutual Co, Inc	1,440	0.170	118	110
Elko				
Carlin Utilities	2,870	0.694	242	165[1]
Elko City Water	18,000	5.318	295	201[1]
Spring Creek Utilities	5,130	1.328	259	212
Wells Municipal Water	1,250	0.894	717	489[1]
Wendover Town Water	2,200	1.745	793	556[1]
Esmeralda				
Goldfield Town Water	500	0.108	216	146[1]
Eureka				
Eureka Water Association	900	0.274	306	209[1]
Humboldt				
McDermitt Water	225	0.107	476	324[1]
Orovada Water District	120	0.055	458	317[1]
Winnemucca City Water	7,500	2.268	302	220
Lander				
Lander Co. Sewer & Water Dist. 1	5,000	0.820	164	112[1]
Lincoln				
Alamo Sewer and Water GID	525	0.275	524	358[1]
Caliente Town Water	1,220	0.576	472	366
Panaca-Farmstead Water Assoc.	800	0.400	499	359[1]
Pioche Public Utilities	475	0.163	343	234[1]

1990 FRESHWATER USE DATA FOR SELECTED WATER PURVEYORS (CONT'D)

County/Water Purveyor	Population	Total Withdrawals (mgd)	Total Withdrawals (gpcd)	Residential Deliveries (gpcd)
Lyon				
Dayton Town Utilities	1,825	0.571	313	152
Fernley Utilities	5,800	1.332	230	157[1]
Stagecoach GID	910	0.151	166	146
Yerington City Water	2,750	0.722	263	145
Mineral				
Hawthorne Utilities	5,000	1.091	218	123
Mina Water System	480	0.059	123	113
Nye				
Beatty Water & Sanitation Dist	2,200	0.418	190	129[1]
Central Nevada Utilities	2,100	1.420	676	456[1]
Gabbs Town Water	720	0.220	305	208[1]
Tonopah Water System	4,475	0.794	177	65[2]
Pershing				
Lovelock Water System	3,250	1.075	330	222[1]
Storey				
Storey Co. Water District	1,150	0.196	170	115[1]
Washoe				
Incline Village GID	10,990	2.904	264	165
Purity Utilities	2,670	0.848	318	261
Reno Park Water Company	3,060	0.423	138	123
Sun Valley Water	9,900	1.309	132	105
Westpac Utilities	191,000	56.366	295	180
Washoe County Utilities	8,945	2.456	275	265
White Pine				
Ely Municipal Water	6,500	2.583	397	298[1]
AVERAGE			320	200

[1] Assumed 75% of deliveries were for residential use

[2] System serves several residential dwellings with in-house businesses that are considered commercial by water purveyor

Source: Nevada Division of Water Planning, Forecast of County Municipal & Industrial Water Needs to the Year 2020, March 1992.

Water Use

WATER USE AROUND THE HOUSE

	Without Water Saving Fixtures, in gallons	With Water Saving Fixtures, in gallons
Toilet, per flush	3.5 – 7	1.6
Showerhead, per 5 minutes	15 – 40	10 – 12.5
Kitchen/lavatory faucet, 5 minutes	14 – 35	11
Dishwasher, per load	14	9.5 – 12
Washing machine, per full load	55	42 – 47.5

ESTIMATED RESIDENTIAL WATER USE IN NEVADA

Average annual residential use.....200 gpcd
- Outdoor use.....110 gpcd
- Indoor use .....90 gpcd
- Dishwashing.....3.5%
- Toilet.....21.3%
- Faucets.....22.1%
- Laundry 25.4%
- Showers/baths.....27.7%

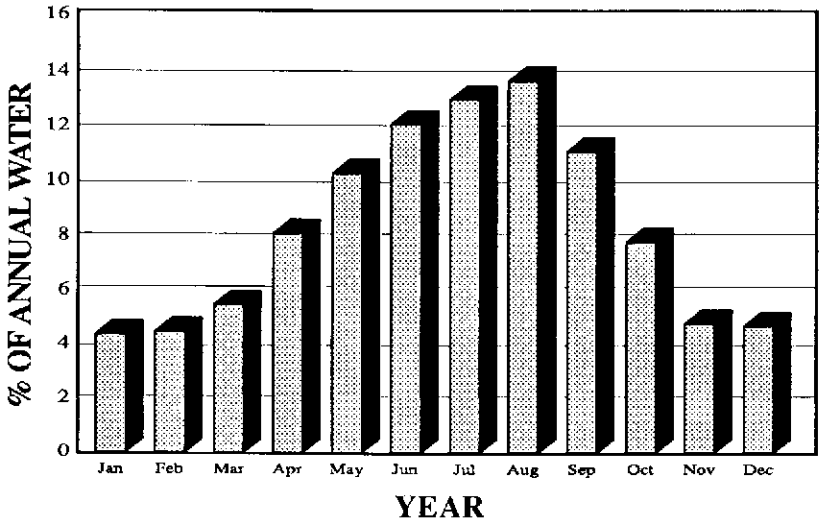
Sources: California Dept. of Water Resources, WaterPlan: Benefit/Cost Analysis Software for Water Management Planning – Water Conservation Assumptions, Oct. 1989.

Gupta, V.L. and D.E. Carlson, Residential Water Consumption in Reno-Sparks, Nevada, Desert Research Institute Publication No.41059,University of Nevada System, 1978.

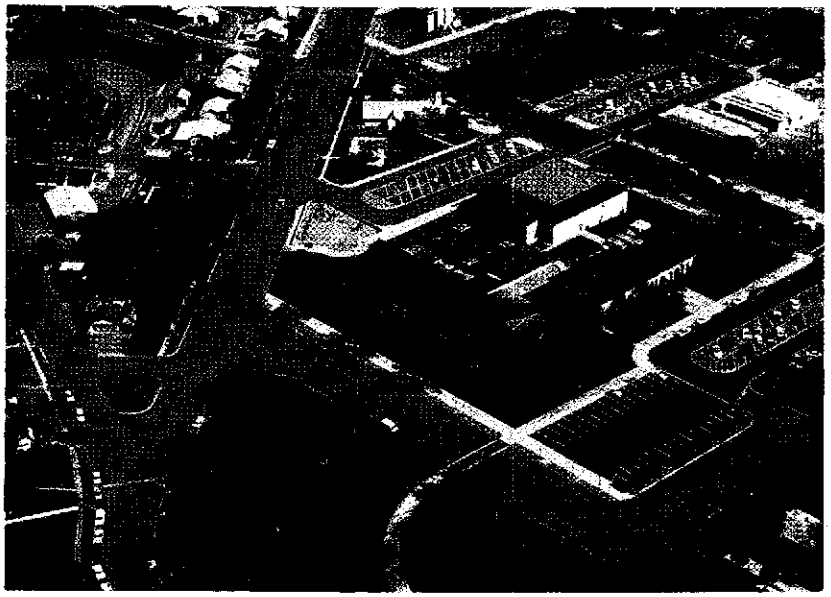
Vickers, A., "Water-Use Efficiency Standards for Plumbing Fixtures: Benefits of National Legislation," American Water Works Association Journal, Vol. 82, No. 5, May 1990.

Westpac Utilities, Water Conservation Plan for Reno/Sparks Metropolitan Area – Draft Report, Reno, Nevada, March 1992.

Water Use



MONTHLY WATER USE DISTRIBUTION FOR TYPICAL PUBLIC-SUPPLY SYSTEM IN NEVADA



Boulder City, Nevada (Photo by Nev. Div. of Water Planning)

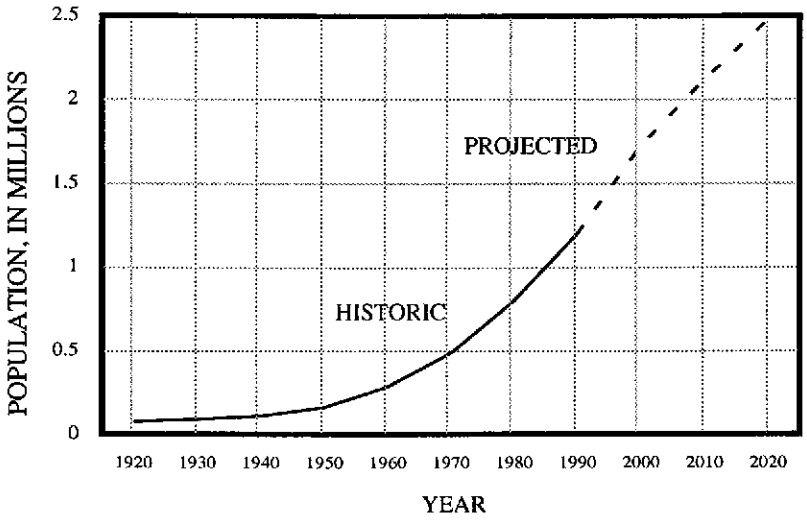
POPULATION AND M&I WATER USE (FRESHWATER AND REUSE) FORECASTS

County	Population			
	1990	2000	2010	2020
Carson City	40,443	55,000	65,850	75,800
Churchill	17,938	25,000	30,250	35,100
Clark	741,459	1,096,700	1,362,100	1,606,200
Douglas	27,637	40,550	50,200	59,100
Elko	33,530	46,650	56,500	65,600
Esmeralda	1,344	1,850	2,250	2,600
Eureka	1,547	2,150	2,650	3,050
Humboldt	12,844	17,900	21,700	25,150
Lander	6,266	8,750	10,550	12,250
Lincoln	3,775	5,250	6,350	7,350
Lyon	20,001	27,900	33,700	39,100
Mineral	6,475	9,050	10,950	12,650
Nye	17,781	24,750	30,000	34,800
Pershing	4,336	6,050	7,350	8,500
Storey	2,526	3,550	4,250	4,950
Washoe	254,667	343,500	409,750	470,650
White Pine	9,264	12,900	15,600	18,150
State Total	1,201,833	1,727,500	2,120,000	2,481,000

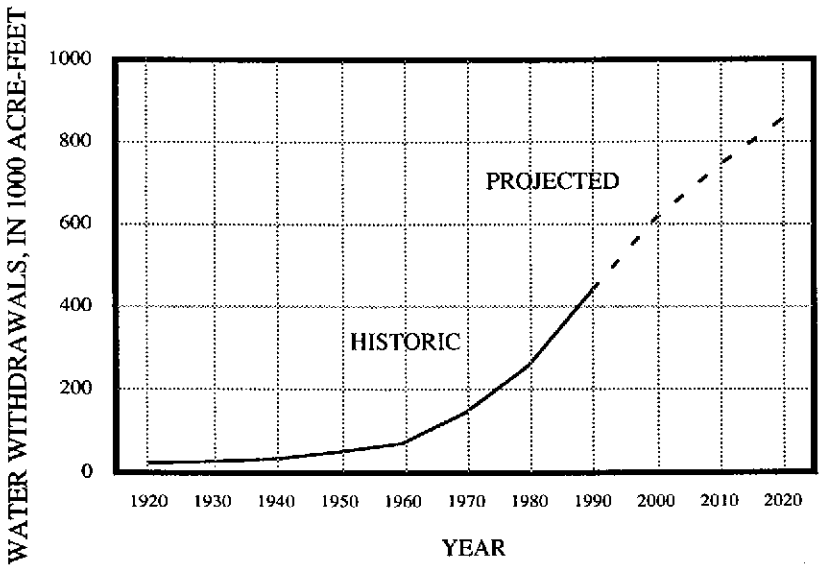
County	Total Water Demand (1000 acre-feet per year)			
	1990	2000	2010	2020
Carson City	11.3	15.4	18.6	21.6
Churchill	2.6	3.5	4.3	4.9
Clark	307.6	431.8	522.4	600.5
Douglas	9.3	12.8	15.8	18.6
Elko	11.6	15.6	18.9	21.9
Esmeralda	0.2	0.2	0.3	0.3
Eureka	0.4	0.5	0.6	0.7
Humboldt	3.2	4.5	5.4	6.3
Lander	0.9	1.3	1.6	1.9
Lincoln	1.7	2.3	2.8	3.2
Lyon	3.9	5.9	8.2	10.6
Mineral	2.3	2.9	3.3	3.6
Nye	4.2	5.5	6.5	7.4
Pershing	1.2	1.7	2.1	2.4
Storey	0.3	0.5	0.6	0.7
Washoe	75.2	103.9	123.9	142.3
White Pine	3.2	4.8	5.9	6.8
State Total	439.2	613.1	741.0	853.9

Source: Nevada Division of Water Planning, Forecast of Municipal & Industrial Water Needs to the Year 2020, March 1992.
Note: Figures may not add to totals due to independent rounding.

Water Use



HISTORIC AND PROJECTED STATEWIDE POPULATION



HISTORIC AND PROJECTED STATEWIDE M&I WATER USE

POPULATION FORECASTS FOR SELECTED WATER PURVEYORS (1990-2020)

County	Water Purveyor	Population 1990	2000	2010	2020
Carson City	Carson City Water	34,300	48,600	60,300	72,000
Churchill	Fallon City Water	6,370	10,200	13,000	15,600
Clark	Big Bend Water (Laughlin)[1]	5,582	17,522	28,040	35,352
	Boulder City Water[1]	14,054	19,277	23,430	26,327
	Henderson City Water[1]	70,387	126,901	175,471	215,816
	Las Vegas Valley Water Dist.[1]	592,038	805,416	947,223	1,072,437
	Nellis Air Force Base[1]	9,000	9,000	9,000	9,000
	N. Las Vegas City Water[1]	84,583	119,437	148,290	175,422
	Total[1]	775,644	1,097,553	1,331,454	1,534,354
	Mesquite-Farmstead Water	1,900	3,613	4,958	5,895
	Moapa Valley Water	5,000	6,900	8,400	9,600
Douglas	Gardnerville City Water	2,950	4,730	6,520	8,300
	Gardnerville Ranchos GID	7,545	10,600	13,000	15,300
	Minden City Water	2,200	3,530	4,850	6,175
Elko	Carlin City Water	2,870	3,650	4,250	4,800
	Elko City Water[2]	18,000	27,000	34,000	41,000
	Wells City Water	1,247	1,280	1,300	1,320
	Wendover City Water	2,200	3,100	3,700	4,300
Esmeralda	Goldfield City Water	500	680	830	960
Eureka	Eureka Water Association	896	1,250	1,550	1,750
Humboldt	Winnemucca City Water	7,500	9,500	11,000	12,400
Lander	Lander Co. Sewer/Water Dist. #1	5,000	7,000	8,400	9,800

[1] Population projections provided by WRMI Technical Committee (January, 1992).
[2] Population projections provided by F. Konakis, Elko City Engineer.

FRESHWATER WITHDRAWAL FORECASTS FOR SELECTED PURVEYORS (1990-2020)

Values in 1,000 acre-feet per year

County	Water Purveyor	Freshwater Use 1990	2000	2010	2020	Current Water Supply
Carson City	Carson City Water[1]	9.5	11.9	16.0	19.4	16.3
Churchill	Fallon City Water	1.9	3.1	3.9	4.7	3.9
Clark	Big Bend Water (Laughlin)[2]	3.8	10.7	16.6	20.3	
	Boulder City Water[2]	6.6	9.2	12.0	14.5	
	Henderson City Water[2]	25.5	47.5	69.8	84.3	
	Las Vegas Valley Water Dist.[2]	225.2	303.1	346.7	377.9	
	Nellis Air Force Base[2]	4.3	4.8	4.8	4.8	
	N. Las Vegas City Water[2]	27.1	31.7	43.7	52.9	
	Total[3]	292.6	406.9	493.6	554.6	452.6
	Mesquite-Farmstead Water	1.0	1.9	2.6	3.1	9.2
	Moapa Valley Water (Logandale)	2.0	2.7	3.3	3.8	4.4
Douglas	Gardnerville City Water	1.1	1.6	2.2	2.8	7.1
	Gardnerville Ranchos GID	2.6	3.2	4.0	4.6	4.6
	Minden City Water[4]	1.0	1.4	2.0	2.5	12.4
Elko	Carlin City Water	0.8	1.2	1.4	1.6	4.5
	Elko City Water[5]	6.0	9.8	12.4	14.9	17.2
	Wells City Water[6]	1.0	0.7	0.7	0.7	7.1
	Wendover City Water[7]	2.0	3.2	3.8	4.4	4.4
Esmeralda	Goldfield City Water	0.1	0.1	0.2	0.2	0.1
Eureka	Eureka Water Association[8]	0.3	0.4	0.5	0.5	1.5
Humboldt	Winnemucca City Water	2.5	3.2	3.7	4.2	5.9
Lander	Lander Co. Sewer/Water Dist. #1	0.9	1.3	1.6	1.8	2.9

[1] By the Year 2020, Carson City plans on having the necessary water rights and facilities to withdraw 22,331 AF/YR.

[2] Water use projections provided by WRMI Technical Committee (January, 1992).

[3] The WRMI Technical Committee projected available supply (at full allocation) for the major purveyors in Southern Nevada to be approximately 452,557 AF/YR. With conservation measures, this supply will meet demands until the Year 2006. The proposed Cooperative Water Project is planned to increase availability by 250,000 AF/YR.

[4] The water supply was calculated by expanding the diversion rate, actual supply may be less.

[5] Water use projections provided by F. Konakis, Elko City Engineer.

[6] Water meters were installed in 1990. It was assumed that per capita water demands will decrease from 790 gpcd to 500 gpcd.

[7] Additional groundwater rights have been applied for which will increase available supply in excess of the Year 2020 demands.

[8] Reported available water supply without vested rights is 712 AF/YR. With vested rights included, available supply is 1,515 AF/YR.

POPULATION FORECASTS FOR SELECTED WATER PURVEYORS (1990-2020) (CONT'D)

County	Water Purveyor	Population 1990	2000	2010	2020
Lincoln	Alamo City Water[3]	525	920	1,1501	500
	Caliente City Water	1,220	1,680	2,030	2,350
	Panaca-Farmstead Water[3]	802	950	1,140	1,370
	Pioche Public Utilities[3]	475	860	1,030	1,240
Lyon	Dayton City Water	1,824	4,500	7,000	9,500
	Fernley City Water	5,800	9,000	12,300	16,000
	Yerington City Water	2,750	3,700	4,800	5,930
Mineral	Hawthorne City Water	5,000	7,000	8,500	9,800
Nye	Beatty City Water	2,200	2,600	3,000	3,400
	Central Nevada Utilities (Pahrump)	2,100	4,100	6,100	8,100
	Gabbs City Water	721	740	760	780
	Tonopah City Water	4,475	5,800	6,800	7,700
Pershing	Lovelock City Water	3,250	5,000	6,000	6,900
	Imlay City Water	260	345	430	515
Storey	Virginia City Water	1,150	1,600	2,000	2,300
Washoe	Incline Village GID[4]	10,990	14,560	16,086	16,853
	Purity Water[5]	2,670	4,100	5,300	6,200
	Sun Valley Water[5]	9,900	13,900	16,600	19,500
	Washoe County Utilities[5]	8,945	15,900	19,400	22,900
	Westpac[5]	191,000	225,000	262,000	304,000
White Pine	Ely City Water	6,500	9,100	10,900	12,700

[3] Population projections from "Water Supply and Demand Studies of Various Community Areas within Lincoln County, Nevada", R.O. Anderson, March 4, 1991.

[4] Population projections were provided by Incline Village GID. Population growth is due in part to increased duration of occupancy of existing dwelling (transition form seasonal residency to more permanent residency).

[5] Population projections from "Regional Water Resources Plan" Regional Water Planning and Advisory Board, July , 1990.

Source: Nevada Division of Water Planning, Forecast of County Municipal & Industrial Water Needs to the Year 2020, March 1992.

FRESHWATER WITHDRAWAL FORECASTS FOR SELECTED PURVEYORS (1990-2020)

Values in 1,000 acre-feet per year

County	Water Purveyor	Freshwater Use 1990	2000	2010	2020	Current Water Supply
Lincoln	Alamo City Water[9]	0.3	0.5	0.7	0.9	0.9
	Caliente City Water	0.6	0.9	1.1	1.2	6.7
	Panaca-Farmstead Water[9]	0.5	0.4	0.5	0.6	1.3
	Pioche Public Utilities[9]	0.2	0.3	0.4	0.5	2.0
Lyon	Dayton City Water	0.6	1.3	2.0	2.8	2.5
	Fernley City Water	1.5	2.8	3.8	4.9	7.8
	Yerington City Water	0.8	1.1	1.5	1.8	4.0
Mineral	Hawthorne City Water	1.2	1.6	2.0	2.3	3.1
Nye	Beatty City Water	0.5	0.6	0.7	0.8	1.2
	Central Nevada Utilities (Pahrump)	1.6	3.0	4.5	5.9	18.2
	Gabbs City Water	0.2	0.3	0.3	0.3	0.3
	Tonopah City Water[10]	0.9	1.2	1.4	1.6	1.6
Pershing	Lovelock City Water[11]	1.2	2.0	2.4	2.7	3.8
	Imlay City Water	0.1	0.1	0.1	0.1	0.6
Storey	Virginia City Water[12]	0.2	0.4	0.5	0.5	---
Washoe	Incline Village GID[13]	3.3	4.3	4.7	5.0	4.0
	Purity Water[14]	1.0	1.4	1.8	2.1	2.1
	Sun Valley Water[14,15]	1.5	1.6	1.9	2.2	---
	Washoe County Utilities[14]	2.8	4.5	5.4	6.4	6.7
	Westpac[14,16]	63.2	75.9	88.6	101.2	77.3
White Pine	Ely City Water	2.9	4.2	5.1	6.0	6.5

[9] Water use projections from "Water Supply and Demand Studies of Various Community Areas within Lincoln County, Nevada", R.O. Anderson, March 4, 1991.

[10] Additional groundwater rights have been applied for which will increase available supply in excess of demands in the Year 2020.

[11] Current water supply may be limited by perennial yield.

[12] The State is in the process of writing a contract for the delivery of water from the Marlette Lake System to the Storey County Water System. The contract will provide for the delivery of sufficient water to meet the Year 2020 demands.

[13] In 1990, per capita water use was 390 gpcd. According to Incline Village GID, increased water use in the future will be attributed to increased domestic use. For projection purposes, 150 gpcd was assumed for that population over the 1990 population.

[14] Water use projections from "Regional Water Resources Plan", Regional Water Planning and Advisory Board, July 1990.

[15] Westpac Utilities wholesales water to Sun Valley Water.

[16] According to R. Squires, Westpac, the total available supply for Westpac as of September 1, 1991 is 77,313 AF/YR. New subdivisions and other projects to be served by Westpac are required to turn over sufficient water rights to Reno, Sparks, or Washoe County. These rights are then contracted or leased to Westpac, increasing Westpac's total available supply. With the advent of the negotiated settlement (Public Law 101-618), Westpac is projected to have 119,000 AF/YR within the next 40 years. In addition, Westpac is considering numerous alternatives to further increase total available supply as required to meet future needs.

Water Use

MINING WATER USE

During the 1980's, the Nevada mineral industry experienced tremendous growth with total mineral production (excluding geothermal and petroleum) reaching an all-time high of $2.7 billion in 1990 (Nevada Bureau of Mines & Geology, 1991). This recent growth would not have occurred without the availability of economic water supplies for mineral extraction and concentration.

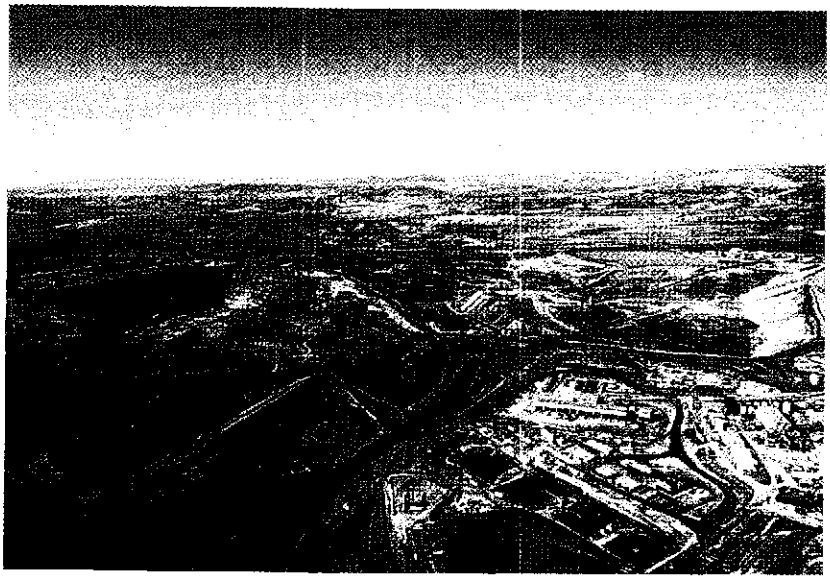
Minerals mined in Nevada can be divided into two categories, metals and industrial minerals. Metals mined in Nevada include gold, silver, lead, zinc, molybdenum and copper. Industrial minerals include aggregate, barite, cement, clay, gypsum, lime, diatomite, lithium carbonate and silica. Water use varies widely among operations and is dependent upon the mineral being recovered and the recovery process employed. The following table provides county water use estimates for the major metal and industrial mineral operations.

Future mineral production and water usage by mines in Nevada is difficult to predict because of the volatile nature of the industry. With gold and silver operations accounting for over 70% of the State mining water use, any significant future changes in gold and silver production will impact total mining water use. Large metal mining operations in Northern Nevada are currently contemplating significant mine dewatering operations on the order of over 100,000 acre-feet annually by the turn of the century. Implementation of these plans could double current mining water withdrawals.

1990 MINING WATER USE ESTIMATES

County	Withdrawals		Consumptive Use	
	(mgd)	(af/yr)	(mgd)	(af/yr)
Carson City	0.003	3	0.003	3
Churchill	0.081	90	0.078	87
Clark	2.892	3,239	2.141	2,399
Douglas	0.121	136	0.117	131
Elko	3.930	4,402	3.526	3,950
Esmeralda	11.392	12,761	8.870	9,936
Eureka	22.993	25,755	11.114	12,499
Humboldt	24.233	27,144	6.216	6,963
Lander	16.587	18,580	6.647	7,445
Lincoln	0.103	115	0.100	112
Lyon	2.481	2,779	0.956	1,071
Mineral	1.226	1,374	1.208	1,353
Nye	6.518	7,301	6.471	7,248
Pershing	1.490	1,669	1.432	1,604
Storey	0.205	230	0.184	206
Washoe	2.175	2,436	0.786	881
White Pine	2.615	2,930	2.524	2,828
State Total	99.045	110,944	52.380	58,666

Source: Nevada Division of Water Planning, Mining Water Use in Nevada – 1990, May 1992.



Barrick Goldstrike mine and mill (Photo by American Barrick Resources)

AGRICULTURAL WATER USE

In 1990 irrigation accounted for about 83 percent of total water withdrawals in Nevada. Irrigated crops grown in Nevada include alfalfa and other hay, winter and spring wheat, potatoes, alfalfa seed, and vegetables. Harvested croplands account for approximately 70 percent of all irrigated lands, with the remaining 30 percent being irrigated pasture. Actual irrigated acreage amounts vary from year to year depending upon several factors, including water availability. Over the last 20 years, total irrigated acreage has fluctuated between 711,000 acres and 882,000 acres, with current (1990) levels at approximately 766,200 acres.

Nevada has experienced rapid population growth during the past three decades. As a result, pressure is being exerted on agricultural water right holders to sell their water rights to other users. Population projections by the Nevada Division of Water Planning suggest Nevada's population may double by the Year 2020 further increasing the competition for water supplies. Responsible planning will be needed to meet the future needs of agriculture. To assist in the planning process, the Division of Water Planning has forecasted future irrigation water needs for each of the counties. The results of these forecasts are presented in the following table.

IRRIGATION WATER WITHDRAWALS AND CONSUMPTIVE USE FORECASTS

County	Withdrawals (af/yr) 1990	2000	2010	2020
Carson City	6,300	5,670	4,830	4,200
Churchill	286,700	235,000	235,000	235,000
Clark	40,880	34,160	27,440	20,720
Douglas	197,000	194,500	191,500	189,000
Elko	956,120	996,380	1,036,480	1,076,660
Esmeralda	39,990	39,990	39,990	39,990
Eureka	120,840	120,840	120,840	120,840
Humboldt	432,180	432,180	432,180	432,180
Lander	155,250	161,100	167,400	173,250
Lincoln	57,400	60,600	63,960	67,240
Lyon	431,500	431,500	431,500	431,500
Mineral	29,150	30,475	32,065	33,390
Nye	120,540	117,600	115,080	112,140
Pershing	215,730	215,730	215,730	215,730
Storey	1,280	1,280	1,280	1,280
Washoe	139,950	132,075	124,425	116,550
White Pine	113,900	113,900	113,900	113,900
State Total	3,344,710	3,322,980	3,353,600	3,383,570

County	Consumptive Use (af/yr) 1990	2000	2010	2020
Carson City	3,150	2,835	2,415	2,100
Churchill	176,900	145,000	145,000	145,000
Clark	26,280	21,960	17,640	13,320
Douglas	90,620	89,470	88,000	86,940
Elko	513,040	534,600	556,160	577,720
Esmeralda	25,110	25,110	25,110	25,110
Eureka	73,140	73,140	73,140	73,140
Humboldt	226,380	226,380	226,380	226,380
Lander	82,800	85,920	89,280	92,400
Lincoln	37,800	39,960	42,120	44,280
Lyon	198,490	198,490	198,490	198,490
Mineral	13,750	14,375	15,125	15,750
Nye	77,490	75,600	73,980	72,090
Pershing	110,160	110,160	110,160	110,160
Storey	640	640	640	640
Washoe	68,420	64,570	60,830	56,980
White Pine	70,350	70,350	70,350	70,350
State Total	1,794,520	1,778,560	1,794,910	1,810,850

Source: Nevada Division of Water Planning, Forecast of County Agricultural Water Need to the Year 2020, March 1992

REUSE OF WASTEWATER TREATMENT PLANT EFFLUENT

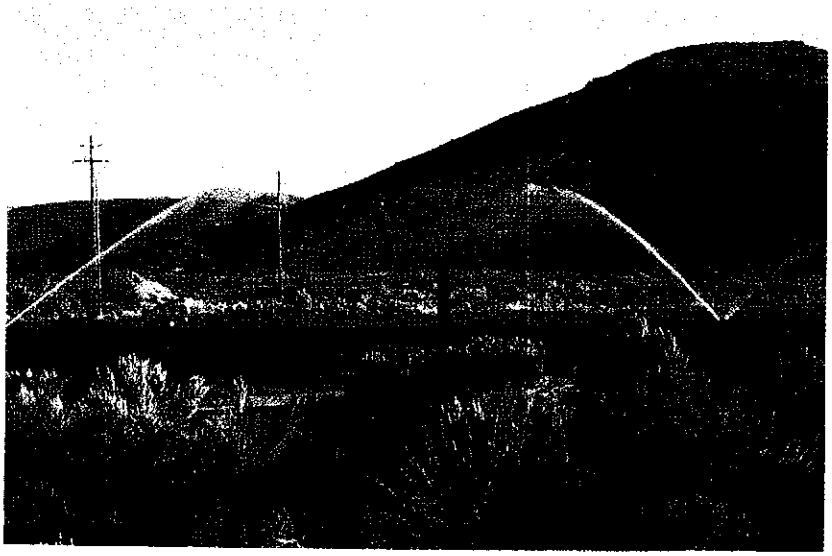
Increasingly stringent wastewater discharge requirements coupled with scarce supplies of freshwater are inducing municipalities and industries to seek alternative uses of wastewater rather than treatment and subsequent discharge to a stream or to a groundwater aquifer. The most common use of treated wastewater is land application for irrigation of agricultural land or urban areas, such as golf courses.

The reuse of wastewater treatment plant effluent has increased in Nevada in recent years. In 1979 there were approximately 12 reuse application sites (Division of Water Planning, Sept. 1979). By 1990 the number had increased to over 20. Current uses of reclaimed wastewater effluent in Nevada include agricultural irrigation, golf course and landscape irrigation, industrial uses, wetlands applications, and construction water. In 1990 public wastewater treatment facilities discharged approximately 150 mgd (170,000 af/year). Of this amount, only about 9 percent was reclaimed directly for the above uses. However, if one takes into account the effluent that is discharged to a river, such as the Truckee and Colorado Rivers, and later diverted by other users, the effluent reuse percentage exceeds 90%.

1990 RECLAIMED WATER USE IN NEVADA

County	Total Releases from Public Sewage Treatment Facilities (mgd)	(1000 af)	Reclaimed Water Use (mgd)	(1000 af)
Carson City	3.80	4.26	2.48	2.78
Churchill	1.18	1.32	0.01	0.01
Clark	104.98	117.59	4.34	4.86
Douglas	3.48	3.90	3.38	3.79
Elko	3.84	4.30	0.99	1.11
Esmeralda	0.03	0.03	0.00	0.00
Eureka	0.06	0.07	0.00	0.00
Humboldt	0.89	1.00	0.00	0.00
Lander	0.46	0.52	0.00	0.00
Lincoln	0.31	0.35	0.00	0.00
Lyon	0.95	1.06	0.32	0.36
Mineral	0.49	0.55	0.00	0.00
Nye	0.76	0.85	0.07	0.08
Pershing	0.25	0.28	0.00	0.00
Storey	0.10	0.11	0.00	0.00
Washoe	29.40	32.93	1.32	1.48
White Pine	1.25	1.40	0.37	0.41
State Total	152.23	170.52	13.28	14.88

Source: Reports filed with Nevada Division of Environmental Protection



Irrigating Carson City golf course with reclaimed water
(Photo by Nev. Div. of Water Planning)

Water Issues

The following is a summary of some of the water issues concerning Nevadans statewide. The information presented is meant to provide a brief overview of each issue. If the reader desires additional information please contact the Division of Water Planning.

Negotiated Settlement (Public Law 101-618)

The latest effort to resolve long-standing disputes over water and water rights on the Truckee River has been the enactment of congressional settlement legislation for the Truckee and Carson Rivers. This legislation, known as Public Law 101-618 or the Fallon Paiute Shoshone Tribal Settlement Act and the Truckee-Carson-Pyramid Lake Water Rights Settlement Act, was approved by the 101st Congress at the end of its 1990 session (California Dept. of Water Resources, June 1991). Main topics covered by the legislation are:

- An interstate allocation between California and Nevada is made of the use of waters of the Truckee and Carson Rivers. Provisions are made for transfer of water and water rights.

- A number of contingencies are placed on the effective date of the legislation, and the various parties involved are required to dismiss assorted litigation.

- A new operating agreement is to be negotiated for the Truckee River. The agreement will include a water rights agreement negotiated by Sierra Pacific Power Company and the Pyramid Lake Paiute Tribe and ratified by the federal government.

- The Newlands Project is reauthorized to serve additional purposes, including recreation, fish and wildlife,

and as a municipal water supply for the Fallon area. An efficiency study of the Newlands Project is required. The Secretary of the Interior is directed to enforce Newlands Project compliance with OCAP (Operating Criteria and Procedures).

- A recovery program is to be developed for the Pyramid Lake cui-ui and Lahontan cutthroat trout. Water right acquisitions are authorized. Provisions are made for a study on improving stream channel conditions in the lower Truckee River above Pyramid Lake. A tribal economic development fund of $40 million is established for the Pyramid Lake Paiute Tribe. Another fund of $25 million is established for the lake's fishery.

- A water rights purchase program is authorized for the Lahontan Valley wetlands with the intent of sustaining a long-term average of 25,000 acres of wetlands.

- The Fallon Paiute Shoshone Tribal Settlement Act establishes a settlement fund for this Tribe totaling $43 million. The Tribe is authorized to purchase land and water rights to consolidate tribal holdings within the reservation.

Pyramid Lake Cui-ui Recovery Program

The cui-ui is a lake sucker found only in Pyramid Lake and was federally listed as endangered on March 11, 1967. Reduction of Truckee River inflow to Pyramid Lake, caused by upstream storage and diversions of water, was the primary agent producing conditions which led to the endangered status of cui-ui.

The first cui-ui recovery plan was written in 1978 by a Cui-ui Recovery Team composed of representatives from the U.S. Fish and Wildlife Service, Nevada Department of Wildlife, and Pyramid Lake Paiute Indian Tribe. This plan was updated in 1980 and revised in 1984, and since that time has guided recovery actions. Pursuant to the Endangered Species Act, the current Cui-ui Recovery Team has revised the recovery plan. The Recovery Plan identifies a variety of conservation measures which, if implemented individually or in combination, could result in reclassification or recovery of the cui-ui (U.S. Fish and Wildlife Service, 1992).

Pyramid Lake (Photo by Steve Van Denburgh, U.S. Geological Survey)

Truckee River Operating Agreement

The Truckee River is currently operated in accordance with the 1935 Truckee River Agreement, the 1944 Orr Ditch Decree and various flood criteria. Since that time, conditions on the Truckee River have changed, e.g. new reservoirs have been built or acquired by Truckee River water users, and the Lahontan cutthroat and the cui-ui have been classified as threatened and endangered species, respectively. For the last decade efforts have been made to establish a new river operating agreement which would provide additional drought storage for municipal use and additional river flows when needed to support cui-ui spawning.

In 1989, the Pyramid Lake Paiute Tribe and Sierra Pacific Power Company signed a Preliminary Settlement Agreement, which if certain conditions were satisfied would allow water to be stored in Stampede Reservoir and used by Sierra Pacific for drought supplies in drought years, and by the Tribe for fish purposes in normal and wet years. In 1990, Congress passed Public Law 101-618, referred to as the Negotiated Settlement. When conditions of Public Law 101-618 are fulfilled, the Preliminary Settlement Agreement will take effect and the Truckee River will be operated in accordance with a new agreement known as the Truckee River Operating Agreement or TROA. This new agreement will incorporate provisions of the 1989 Preliminary Settlement Agreement and Public Law 101-618.

Currently members of several California, Nevada and Federal agencies as well as Sierra Pacific Power Company, Pyramid Lake Paiute Tribe, Truckee-Carson Irrigation District, Washoe County Water Conservation District and others are engaged in drafting an operating agreement and conducting environmental evaluations. The schedule prepared by the U.S. Bureau of Reclamation indicates that a final operating agreement and all environmental analysis will be completed by the end of 1995 (Moser, July 1992).

Lahontan Valley Wetlands

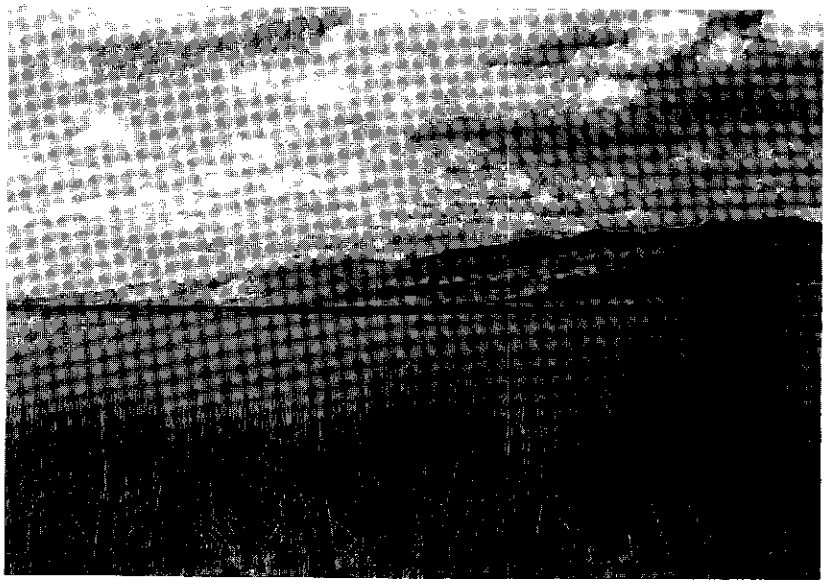
Located in Northern Nevada, near Fallon, the Stillwater National Wildlife Refuge and Management Area and the Lahontan Valley Wetlands represent a critical wetland ecosystem in Nevada and a key "steppingstone" on the Pacific flyway.

Efforts are underway to increase the quantity and quality of water entering the Lahontan Valley Wetlands. Section 206 of Public Law 101-618 authorized and directed the U.S. Secretary of the Interior, in conjunction with the State of Nevada and other parties, to acquire by purchase or other means sufficient water and water rights to sustain, on a long term average, approximately 25,000 acres of primary wetland habitat within Lahontan Valley. The three primary wetland areas have been identified as the Stillwater National Wildlife Refuge and Management Area, Carson Lake and Pasture, and Fallon tribal land wetlands.

The U.S. Fish and Wildlife Service has begun the Environmental Impact Statement process to examine environmental, economic, and social effects of converting agricultural water from the Newlands Project to environmental uses as needed to maintain 25,000 acres of wetlands.

Newlands Project Operating Criteria and Procedures

The Newlands Project, one of the first Bureau of Reclamation projects, provides water for irrigation, incidental domestic, and other water needs to a defined service area in the lower Carson River basin near Fallon. Water for the project is



Stillwater wetlands (Photo by Nev. Div. of Water Planning)

supplied from the Truckee and Carson Rivers. Water from the Truckee River is diverted at Derby Dam and conveyed to the project via the Truckee Canal.

Competition for the limited water supplies of the Truckee and Carson Rivers has led to a number of lawsuits. One of the major disputes is known as the OCAP litigation, named after the Operating Criteria and Procedures for the Newlands Project. The OCAP originally arose from the efforts of

the Bureau of Reclamation to develop a method of Newlands Project operation that would maximize the use of Carson River water in the project and minimize the diversion of Truckee River water to the project. The concept was a response to the 1967 listing of the Pyramid Lake cui-ui as an endangered species under the Federal Endangered Species Act. A 1973 decision, resulting from litigation instigated by the Pyramid Lake Paiute Tribe, held that water was being wasted in the Newlands Project and that the Bureau of Reclamation was required to deliver to Pyramid Lake the water in excess of valid Newlands Project rights. Subsequently, the Bureau of Reclamation began to issue an interim OCAP each year.

On April 15, 1988, the Secretary of the Interior adopted Operating Criteria and Procedures (OCAP) for the Newlands Project. This OCAP contains rules and incentives to ensure reasonable, efficient water management on the project through reliance on local control and initiatives. Public Law 101-618 directs the Secretary of the Interior to enforce compliance with OCAP. Compliance is measured based upon facts which can be readily determined and reviewed by the Truckee-Carson Irrigation District and the U.S. Bureau of Reclamation.

Walker Lake

Walker Lake, a remnant of the ancient Lake Lahontan at the terminus of Walker River, is rapidly declining in both volume and quality. Since 1920 the surface elevation of Walker Lake has dropped over 110 feet, and the alkalinity of the water is increasing to a point which affects the longevity

Cutting alfalfa in the Newlands Project (Photo by Nev. Div. of Water Planning)

of the existing cutthroat trout population. If the current trend continues, trout habitat in the lake will no longer exist (Cooper and Koch, 1984).

Walker Lake water levels are expected to decline for several more decades. An average annual lake inflow of about 100,000 acre-feet (Rush, 1974) and average annual evaporation of about 150,000 acre-feet (based upon 1990 water surface area) results in an annual deficit of about 50,000 acre-feet. The Division of Water Planning has estimated that Walker Lake is likely to reach equilibrium (evaporation losses = lake inflow) in about 50 to 100 years. At that time, the total

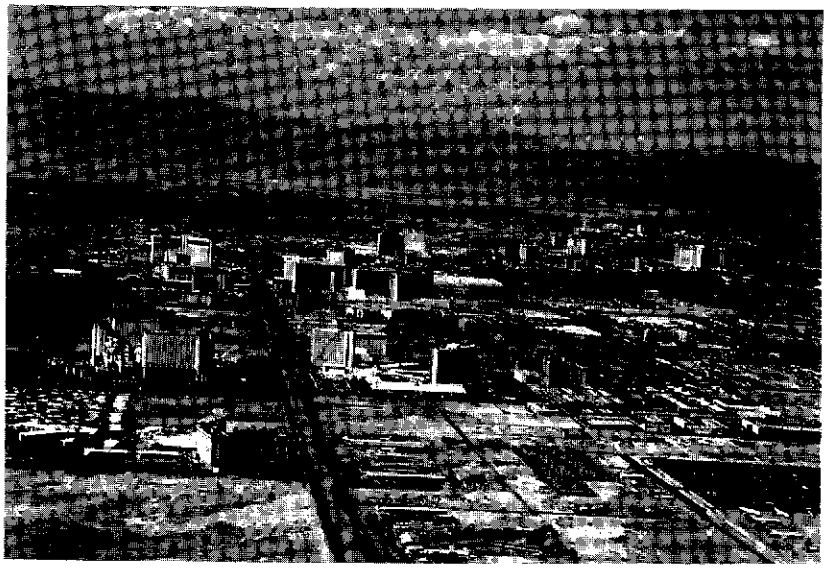
water volume of the lake will be about one-fourth of the current volume and the lake will cease to exist as a viable fishery.

Cooperative Water Project

The Cooperative Water Project (CWP) is a proposed water supply project to meet future water needs in the Las Vegas area. Water use projections performed for Southern Nevada have indicated that the region's available water supply will not be able to support projected development beyond 2002. Implementation of a responsible water conservation program will further extend that time until 2006 (WRMI, January 1991).

Realizing that the available water in the region may soon be inadequate for projected needs, the Las Vegas Valley Water District filed 146 applications for unappropriated water in 28 basins in four counties. After preliminary evaluations of the available supply were made, applications in 7 of these basins were withdrawn. Before CWP can become a reality, it will first be necessary for the State Engineer to grant water right permits for these applications.

The project goal is to develop about 250,000 acre-feet, 180,000 acre-feet of groundwater and 70,000 acre-feet of water from the Virgin River. This may require as much as 1,000 miles of pipeline, 200 or more groundwater production wells, monitoring wells, desalinization facilities, numerous pumping plants, and associated electrical facilities. The CWP is scheduled to bring water into the valley by 2007 (Katzer and others, March 31, 1992). It is anticipated that the CWP will provide sufficient additional water to meet Southern Nevada's needs beyond the Year 2030 (with conservation).



Las Vegas, Nevada (Photo by Steve Van Denburgh, U.S. Geological Survey)

Desalination of Virgin River Water

Under the proposed Cooperative Water Project (CWP), up to 70,000 acre-feet of Virgin River water would be diverted to meet future water needs in the Las Vegas area. Virgin River water is highly saline at 1,500 to 3,500 milligrams per liter (mg/l), exceeding the State drinking-water standard of 1,000 mg/l. Desalination of these waters will be necessary to produce a potable water supply. In order to minimize desalting requirements, water would be diverted from the Virgin River during high flow months (November through April), desalinated and then piped to entities in Las Vegas Valley. This would reduce the salt loading of the Colorado River which has a monetary benefit to downstream users, and would also supply a source of needed potable water. The cost of desalting Virgin River water would hopefully be paid by the federal government to meet salinity treaty obligations with Mexico.

Another option for utilization of Virgin River water is to allow the water to flow naturally down to the Colorado River for diversion at the existing intakes of the Southern Nevada Water System, which presently serves the Las Vegas area. This "wheeling" of water would alleviate the need for direct desalination of Virgin River water due to dilution by the greater flow of the Colorado River. However, there are political, institutional and legal issues which must be resolved before this can occur.

Truckee Meadows Project (Honey Lake Valley)

The Truckee Meadows Project (TMP) is designed to import groundwater from the Fish Springs Ranch area in the Nevada portion of the Honey Lake Valley, located approximately 35 miles north of Reno. TMP is uniquely organized in that a private company, Western Water Development Company, provided the initial capital to verify the viability of the project for a public entity. Thereafter Washoe County is in the process of implementing the project.

In June of 1989 Washoe County filed the necessary applications with the State Engineer for the interbasin transfer. On March 1, 1991, following extensive public hearings, approval was granted to transport 13,000 acre-feet of water from Honey Lake Valley to the Reno-Sparks area.

The proposed project consists of approximately 10 wells, 39 miles of buried water pipeline 36" in diameter, pump booster station, storage tanks, and necessary distribution system to Lemmon and Spanish Springs Valleys, an area north and adjacent to Reno and Sparks. Upon completion of the EIS (Environmental Impact Statement) process, financing for construction will be obtained from the State Board for Financing Water Projects. Delivery of materials and construction are anticipated to take from 9 to 12 months. Project costs have been estimated at $85 million for engineering, construction,

and contingencies; $30.5 million for associated water rights, and $2 million for annual operating expenses (Holt, July 1992).

Bodie Dam Project

During the 1985 legislative session, Assembly Bill 289 was passed which established a Committee to Study the Carson River which "...shall collect and evaluate information concerning the hydrology of the Carson River and its tributaries and the feasibility of constructing reservoirs, to be used for multiple purposes, in the Carson River basin above Lahontan Reservoir." Kennedy/Jenks/Chilton Consulting Engineers (KJC) was selected to perform the needed professional services required to fulfill the objectives established by this committee.

During average years, Carson River water users in Douglas and Lyon Counties and Carson City currently have sufficient water supplies for existing needs. KJC has estimated that by the Year 2010, additional water resources will be needed in these areas. In 1987 KJC recommended the Bodie Dam Project for meeting future demands in Douglas and Lyon Counties and Carson City. The proposed Bodie Dam would be located on the East Fork of the Carson River downstream of the California-Nevada state line. Bodie Dam would be either an earth fill or roller compacted concrete dam approximately 200 feet in height and would impound approximately 50,000 acre-feet of water. Bodie Reservoir would be filled through water rights acquired downstream, and would provide approximately 36,000 acre-feet of additional water each year for use in Douglas and Lyon Counties and Carson City. In addition, the Bodie Dam Project would provide flood control and recreational benefits.

The 1989 Legislature restructured the Carson Water Subconservancy District to expand the authority of the District and directed it to continue water supply investigations with particular emphasis on the proposed Bodie Dam. Since that time, the District has completed preliminary geologic reconnaissance and foundation studies, additional population and water demand forecasts, and a review of regulatory and permitting requirements. Further development of the Bodie Dam Project is pending completion of the Douglas County master planning process currently underway (Forest, July 1992).

Safe Drinking Water Act

The Safe Drinking Water Act of 1974 provides for the safety of drinking water supplies throughout the United States by establishing and enforcing national drinking water quality standards. Congress authorized the Environmental Protection Agency (EPA) to support state and local community drinking water programs by providing financial and technical assistance to undertake research and study efforts.

Under the Safe Drinking Water Act (SDWA), EPA has the primary responsibility of establishing the national standards; the States are responsible for enforcing the standards and otherwise supervising public water supply systems and sources of drinking water.

In response to mandates of the 1986 amendments to SDWA, EPA is developing, proposing, and adopting new drinking water regulations that are significantly changing water treatment practices and water utility operations. Since passage of the 1986 amendments, regulations for volatile organic chemicals, fluoride, surface water treatment, total coliform bacteria, synthetic organic and inorganic chemicals, and lead and copper have been promulgated by EPA. Additional regulations regarding radionuclides (radon), other synthetic organic and inorganic chemicals, and disinfection are anticipated.

The cost of these new regulations to water systems in Nevada is significant. It has been estimated that $100 to $170 million in capital improvements are needed throughout the State for compliance with these latest regulations. Financial assistance for SDWA compliance projects is available through a State loan/grant program established by AB 197 and AB 198. This program is administered by the State Board for Financing Water Projects.

Drought

As Nevada is the driest State in the Nation, drought is relatively common and expected. Every 6 out of 10 years, the major rivers in the State experience below average flows. For most of Nevada, which depends mostly on streamflow for water supply, a drought is considered to be a period of 2 or more consecutive years in which streamflow is much less than average. The most significant droughts were during 1928-37, 1953-55, 1959-62, 1976-77, and 1987-92. Droughts can magnify quality problems for surface and groundwater sources. By decreasing streamflow, droughts tend to lessen the quality of remaining water for human and wildlife uses. Droughts also can cause more reliance on groundwater sources which may stress the resource beyond its long-term potential.

In 1987 Governor Bryan formed the Drought Review and Reporting Committee (DRRC) to inform the citizens of Nevada about climatological conditions and the severity of the current drought. As the drought progressed the DRRC helped produce a State Drought Plan that outlines the State and Federal actions that can be taken during various stages of drought. Following is a summary of drought impacts during the period 1987-1992.

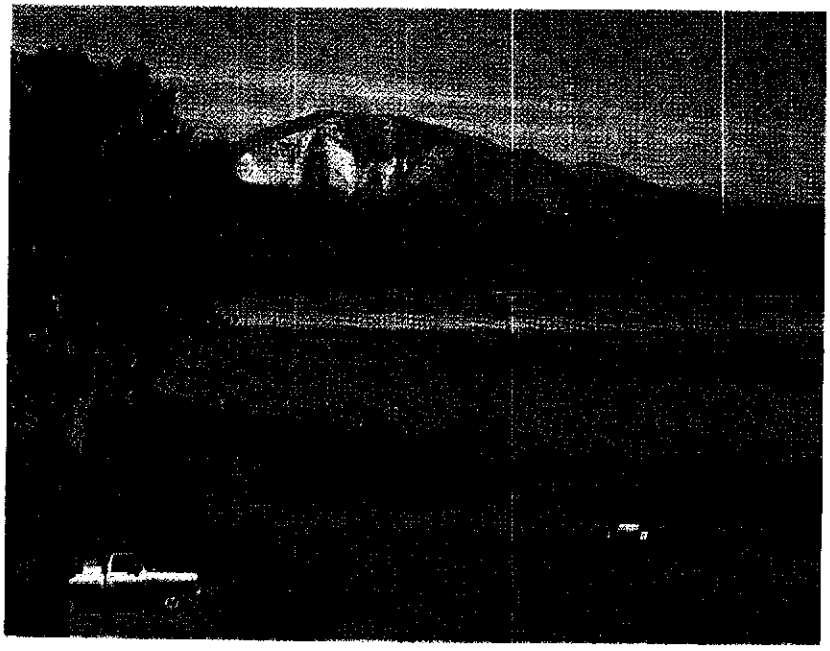
1987-1992 Drought Impact Summary

Municipalities in Nevada have done very well coping with the drought. Two small towns (Midas and Tuscarora) have had their springs dry up resulting in temporary water hauling operations to provide drinking water. Both of these towns are switching to more reliable groundwater supplies. Frugal water management and water conservation efforts have allowed the citizens of Reno and Sparks to continue outdoor watering, even with their main source of water (Truckee River) greatly reduced.

Agriculture has been severely impacted by the drought. Crop and livestock losses for 1991 totaled more than $22 million. Emergency programs provided to farmers have totaled $6 million. In 1992 Lovelock Irrigation District received only 5% of their required water, Truckee-Carson Irrigation District 30%, and the Walker River Irrigation District 40%. Losses in 1992 are expected to exceed those of 1991.

Fish and wildlife have been significantly stressed due to the drought. Many of Nevada's wetland areas are either dry or are severely diminished. These wetlands are important resting stops for migratory birds. The limited availability of food and habitat will stress the birds during migration and increase mortality rates. The drought has resulted in minimum pools in most of Nevada's reservoirs. The fisheries in these pools are significantly stressed due to increases in temperature and oxygen depletion.

Water-based recreation has been severely impacted at Lahontan, Rye Patch and several other smaller Nevada reservoirs. Visitor counts at these reservoirs are low, and boating access is limited or nonexistent.



Dry Washoe Lake-1992 (Photo by Nev. Div. of Water Planning)

Water Conservation

The rapidly growing population and economy of Nevada will require ever increasing amounts of water in the future, however available sources for meeting these needs are limited. Part of the solution is the implementation of water conservation measures. The ability of conservation measures to extend supplies, and delay and/or reduce the need for future supply development has been documented.

Water Issues

Water conservation will continue to be a critical component of overall water management. As William O. Maddaus (May 1990) notes, "the time is past when [water supply] needs can be met simply by building more water storage and delivery systems." The challenge facing water suppliers in today's political, environmental, and economic climate, he concludes, "is to fully integrate our findings on demand management into long-range water supply planning."

Recognizing the need for conservation, the 1991 State Legislature passed Assembly Bill (AB) 359 and Senate Bill (SB) 360. AB 359 requires each county and city to impose certain minimum standards for plumbing fixtures, by building codes or ordinance, for new residential, commercial, or industrial construction beginning on or after March 1, 1992.

In accordance with SB 360, each supplier of water for municipal, industrial or domestic purposes is required to adopt a water conservation plan based on the climate and the living conditions of its service area. The plan is to include provisions relating to:

- Increasing public awareness of the State's limited water supply and the need to conserve;
- Identifying and reducing leakage in water supplies, inaccuracies in water meters, and high pressure situations;
- Increasing the reuse of wastewater treatment plant effluent;

- Contingency plan for drought conditions that ensures an adequate supply of potable water; and

- Adoption of a plan to provide incentives to encourage water conservation; to retrofit existing structures with reduced flow plumbing fixtures; and for installation of landscaping that uses a minimal amount of water.

Environmental Issues

Carson River Mercury Site. Various studies have indicated that Carson River sediment, water, and aquatic biota contain higher than background mercury levels. The source of this mercury has been traced to the historic Comstock Lode mills which used mercury to separate silver and gold from the ore. Since 1985, a fish consumption health advisory has been issued for portions of the Carson River and Lahontan Reservoir because of elevated mercury levels in game fish.

In August 1990, the U.S. Environmental Protection Agency (EPA) listed the Carson River Mercury Site (CRMS) as a Superfund site because of the potential threat to human health and the area environment. CRMS includes a 100-mile stretch of the Carson River beginning below Carson City and extending downstream below Lahontan Reservoir to Stillwater National Wildlife Refuge; and tailing piles and sediments in Gold, Sixmile, and Sevenmile Canyons. Currently, studies are underway to identify the extent of the problem and the human health and ecological risks.

Leaking Underground Storage Tanks. Leaking Underground Storage Tank (LUST) systems threaten human health and the environment by contaminating groundwater and possibly causing fires or explosions. In response to the increasing number of leaking tanks and the resulting environmental damage, federal regulations were developed which set minimum installation standards. These standards have been designed to prevent leaks and spills from Underground Storage Tank (UST) systems. The majority of tanks affected by these regulations store petroleum products. In accordance with the regulations, all tank systems must have leak detection installed by December 1993. By December 1998 all unprotected tank systems must be upgraded with corrosion protection and have spill and overfill devices, or be replaced or removed using proper installation or closure methods.

The State of Nevada has adopted the federal regulations, and requires certification for tank installers, testers, and cleanup consultants. In Nevada, there are over 9,000 USTs (at about 3,000 sites) registered with the Nevada Division of Environmental Protection. Of these, about 3,300 USTs have been identified as LUSTs. About 2,600 LUSTs have been cleaned up and closed in accordance with the regulations. Cleanup has been initiated on the other 700 LUSTs. In July 1989, Nevada adopted a Petroleum Fund to provide monies for LUST cleanup activities. Taxes on the sale of petroleum products and UST registration fees generate money for the Petroleum Fund.

Sparks Fuel/Solvent Site. Operations of the Santa Fe Pipe-line and the Southern Pacific Railroad (SFPL/SFRR) and others have significantly impacted soils and groundwater quality in a localized area in East Sparks through releases of hydrocarbon products. In certain areas, over 2 feet of free floating

product (diesel and jet fuel) is present on the groundwater. This problem extends approximately 4,000 feet from the SFPL/SFRR properties to the Sparks gravel pit owned by Helms Construction Company.

In their gravel operations, Helms Construction dewaters the pit resulting in a 100 foot reduction in groundwater levels in the Sparks area. This operation results in the discharge of approximately 6 million gallons of water per day to the Truckee River. Due to Helm's dewatering activities, hydrocarbon product flows towards the pit where it discharges. Water quality data has indicated that no hydrocarbon product is discharged to the Truckee River by the dewatering system due to the sump configuration at the pumps and use of on-site detention basins.

On November 21, 1990, NDEP received notification from Helms Construction of their intent to discontinue dewatering activities. However, this termination may cause contamination of up to 60 feet (vertically) and 2,000 feet (laterally) of previously uncontaminated soils. Also, changes in the groundwater gradient, associated with the termination of dewatering, may result in hydrocarbon discharges to the Truckee River. In January 1991, NDEP filed a complaint in District Court against the ten responsible parties to delineate the plume and conduct remediation and continue the pumping of Helm's Pit. In August 1991, the U.S. Environmental Protection Agency (EPA) ordered the responsible parties to develop a workplan for the delineation of the contaminant plume, determination of any imminent and substantial health and environmental threats, and the commencement of removal activities. The workplan was approved by EPA in October 1991.

Nonpoint Source Pollution. Nonpoint sources (NPS) of water pollution were recognized by the U.S. Congress as a major contributor of pollution to waters of the Nation. Section 319 of the 1987 Clean Water Act established provisions to control NPS. NPS, or diffuse source pollution, is associated with agricultural, construction, mining, urban and silvicultural activities. Examples of NPS are irrigation return flows, septic tank discharge, urban runoff, and erosion from disturbed areas. Control of NPS is achieved through implementation of Best Management Practices (BMPs). BMPs may be defined as methods or measures taken to improve the management of a NPS so as to control its contaminant contribution to a stream or aquifer.

In response to NPS problems in the State, the Nevada Division of Environmental Protection (NDEP) is developing a BMP Handbook to serve as a guide for planning NPS controls. In addition, the Nonpoint Source Task Force was formed to promote and coordinate interagency NPS water quality activities in the State of Nevada. Some of the objectives of the NPS Task Force are to: 1) design and implement projects and programs consistent with the Nevada NPS Management Program; 2) educate the public about NPS problems and solutions; and 3) promote state-of-the-art BMPs for NPS control. Funding for NPS control development is available through a grant program administered by NDEP.

Wellhead Protection Program. The Wellhead Protection (WHP) Program was established by the 1986 Amendments to the Safe Drinking Water Act (SDWA). The purpose of the program is to protect public groundwater supplies from contamination and prevent the need for costly treatment of water to meet drinking water standards. The program is based upon the concept that the development and application of land-use controls and other preventative measures can protect groundwater.

A comprehensive WHP Program comprises several distinct and essential elements: 1) specification of roles and duties of State agencies, local government entities, and public water suppliers; 2) delineation of the wellhead protection area (WHPA) for each well; 3) identification of potential sources of contaminants within each WHPA; 4) development of management approaches to protect the water supply within the WHPA; 5) contingency planning for the provision of alternate drinking water supplies in the event of well or wellfield contamination; 6) consideration of all potential contaminant sources within the expected wellhead area of a new water well; and 7) provisions for public participation.

The Nevada Division of Environmental Protection (NDEP) is encouraging water purveyors in the State to develop a WHP Program for their area. As part of this voluntary program, NDEP is providing technical and possibly financial support for WHP Program development. Currently, the cities of Fernley, Battle Mountain and Carson City are actively developing WHP Programs.

Endangered and Threatened Species

Nevada is among the top ten states in the number of federally listed endangered and threatened species. Over 300 additional organisms in the State are candidates for listing. Most of the listed animals and plants are water-dependent species associated with streams, springs, or wetlands. Protection and recovery of these elements of our diverse natural heritage will be challenging as demands for Nevada's waters continue to grow.

DEFINITIONS

ACRE-FOOT (AF): The volume of water required to cover 1 acre of area at a depth of 1 foot.

ACTIVE STORAGE: The volume of water in a reservoir below the maximum controllable level and above the minimum controllable level that can be released under gravity. In general, it is the volume of water between the outlet works and the spillway crest. In some instances, minimum pool operating constraints may prevent lowering the reservoir to the level of the outlet works, and the water below the minimum pool level is not considered to be in active storage.

AQUIFER: A geologic formation, group of formations, or part of a formation that contains enough saturated permeable material to yield significant quantities of water to wells and springs.

ARTIFICIAL RECHARGE: The addition of water to the groundwater reservoir by human activities, such as injection wells or induced infiltration from spreading basins.

BASIN: A part of the surface of the earth that is drained by a river and its tributaries.

BENEFICIAL USE: The use of water for any purpose from which benefits are derived, such as for irrigation, hydroelectric power, industrial and domestic use. Benefits vary with locality and custom, and what constitutes beneficial use is often defined by statute or by court decision.

CONSUMPTIVE USE: The portion of water withdrawn from a surface or groundwater source that is consumed for a particular use (i.e. irrigation, domestic needs, and industry), and does not return to its original source or another body of water.

DOMESTIC WATER USE: The use of water primarily for household purposes, and the irrigation of gardens, lawns, and shrubbery surrounding a residence.

DROUGHT: Although there is no universally accepted quantitative definition of drought, it may be defined as a period of abnormally dry weather sufficiently prolonged to cause a serious hydrological imbalance.

EVAPOTRANSPIRATION: The volume of water evaporated and transpired from soil and plant surfaces (essentially the same as "consumptive use" except that it does not include the water retained in the plant tissue).

GAGING STATION: A particular site on a stream, canal, lake or reservoir where systematic observations of water levels or flow are made.

GROUNDWATER RECHARGE: Inflow to a groundwater aquifer. Sources of inflow could be precipitation, streams, irrigation, and artificial recharge.

M&I WATER USE: M&I (municipal and industrial) water use includes residential (domestic), commercial, and industrial uses; public uses such as parks and golf courses; and unaccounted for losses in the water transmission and delivery pipelines. M&I water is delivered by public supply systems as operated by public entities or private water purveyors.

PERENNIAL YIELD: The amount of usable water from a groundwater aquifer that can be economically withdrawn and consumed each year for an indefinite period of time. It can not exceed the natural recharge to that aquifer and ultimately is limited to the maximum amount of discharge that can be utilized for beneficial use.

RETURN FLOW: That part of a diverted flow which is not consumptively used and returns to its original source or another body of water.

TRANSITIONAL STORAGE RESERVE: The quantity of water in storage in a particular groundwater aquifer that is extracted during the transition period between natural equilibrium conditions and new equilibrium conditions with groundwater pumped at perennial yield levels.

General Information

WATER EQUIVALENTS TABLE

1 cubic foot.....7.48 gallons .....62.4 pounds
1 acre-foot .....43,560 cubic feet .....325,851 gallons

1 cubic foot per second (cfs).....449 gallons per minute (gpm)
1 cfs for 24 hours .....1.9835 acre-feet
for 30 days .....59.5 acre-feet
for 1 year.....724 acre-feet

1 million gallons .....3.07 acre-feet
1 million gallons per day (mgd) .....1,120 acre-feet per year
1 mgd .....1.55 cfs
1,000 gpm .....4.42 acre-feet per day

ABBREVIATIONS

AF = acre-feet
AF/YR = acre-feet per year
CFS = cubic feet per second
GPCD = gallons per capita (per person) per day
MGD = million gallons per day
mg/l = milligrams per liter (parts per million, ppm)
pCi/l = picocuries per liter

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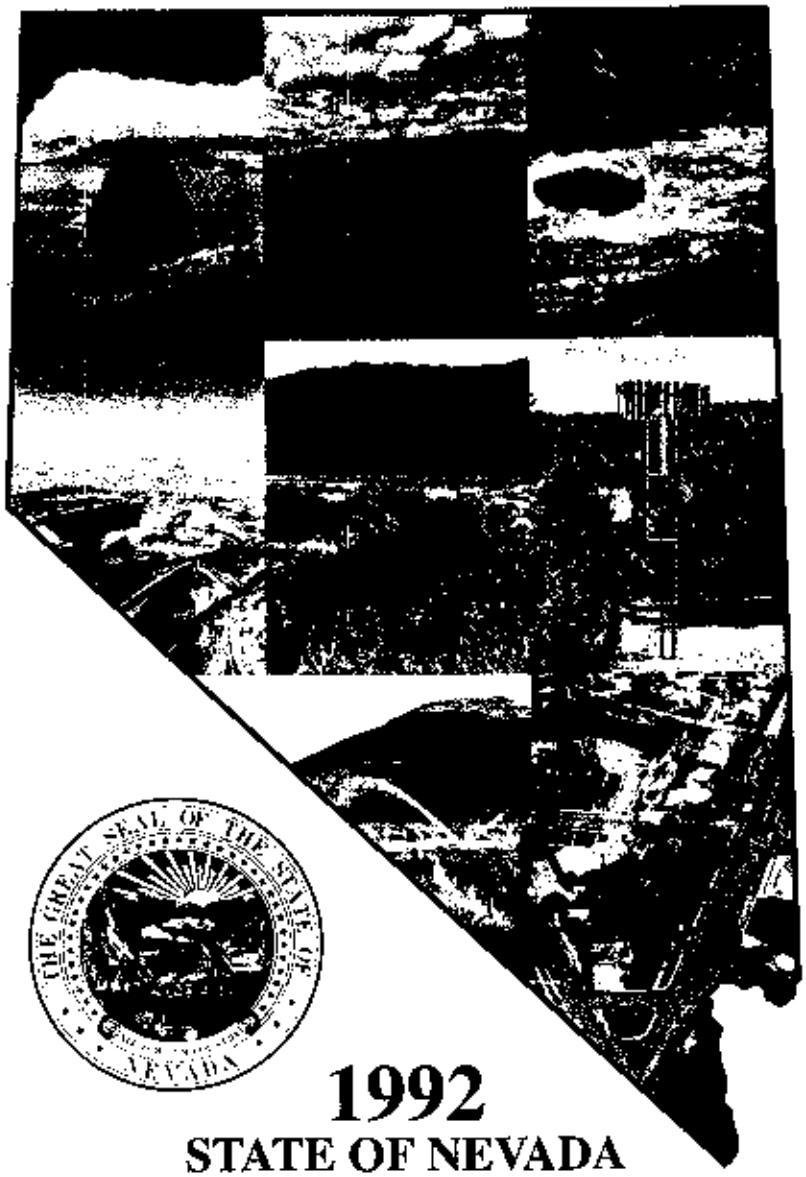
NEVADA
WATER FACTS



1992

STATE OF NEVADA

Department of Conservation and Natural Resources

DIVISION OF WATER PLANNING

To the Citizens of the State of Nevada:

Water is Nevada's most precious renewable natural resource and it is our obligation to safeguard this limited resource. A key element in the responsible management of our water resources is education. Recognizing this need for water education, the Division of Water Planning has published *Nevada Water Facts*.

This booklet provides the reader with a brief introduction to Nevada's water resources and its uses, and some of the important water issues currently facing the State. Much of the information presented in this publication was taken from Division of Water Planning and U.S. Geological Survey reports.

This report was prepared by Randy Pahl, Division of Water Planning, with the assistance of the State Advisory Board on Water Resources Planning and Development and numerous other water professionals. Publication of *Nevada Water Facts* was initially made possible through funds provided by the State of Nevada and Nevada Project WET (Water Education for Teachers).

It is our hope that this publication will prove useful to those interested in learning about Nevada's water resources. Individuals wishing additional information are invited to contact the Division of Water Planning.

Sincerely,

Naomi Duerr

Naomi S. Duerr, P.G.
State Water Planner/Administrator
Nevada Division of Water Planning

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Visit our Website at: http://www.state.nv.us/cnr/ndwp/home.htm

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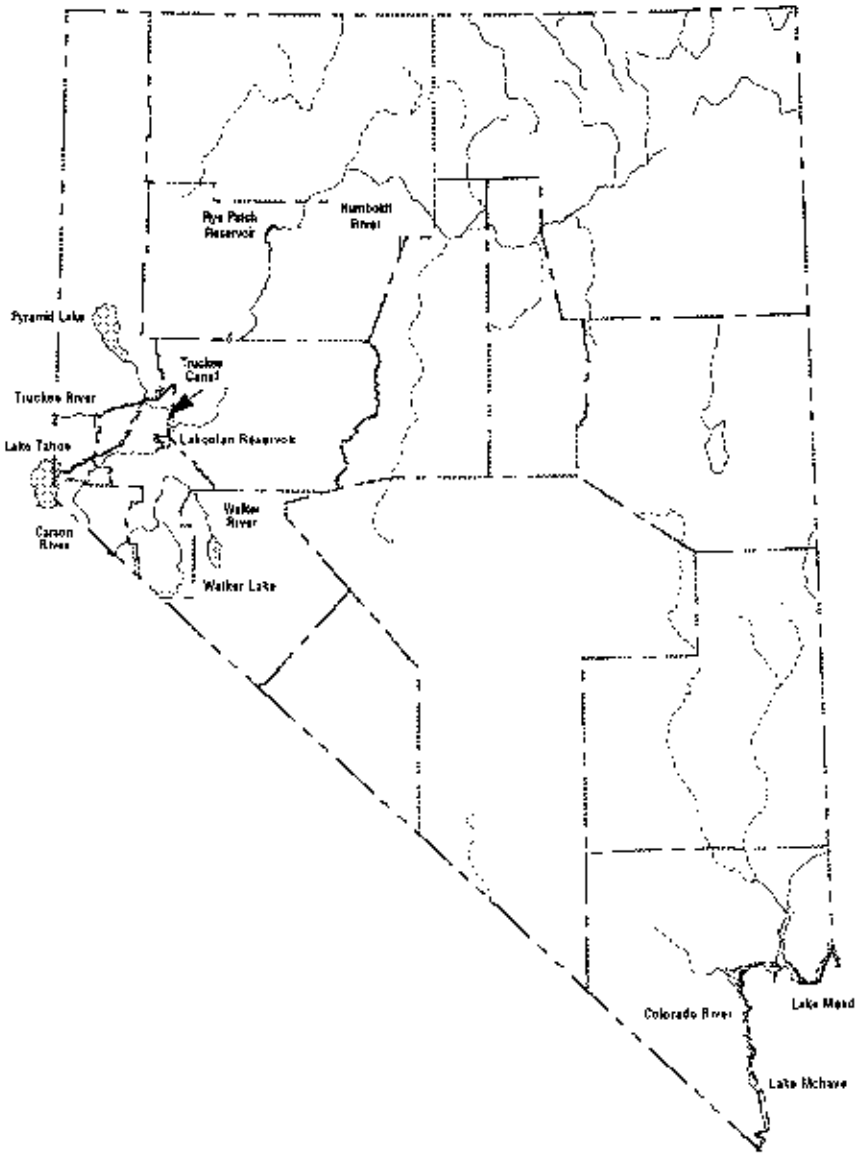
Introduction



Source: Base map – U.S. Geological Survey, Water Resources Division, Carson City, Nevada.

MAJOR STREAMS, LAKES AND RESERVOIRS

Introduction

With an arid climate, Nevada has always been dependent upon the successful development of water resources. During the early development of the State, settlement locations were restricted to areas with readily available water. Now Nevadans have many more options than these early pioneers. Technologic advances have made it possible to deliver water to once remote areas, develop a variety of water sources, and meet the water needs of a growing population.

Water is a primary ingredient for the continued prosperity of Nevada, but its availability is limited. The challenge facing Nevadans is to wisely develop and use our most precious natural resource. With a limited water supply, conservation and wastewater reclamation become more necessary for responsible water management.

Education of the public about water and its use is a necessary building block for wise water management in the future. It is the intent of this booklet to provide the public with a brief introduction to our water resources. *Nevada Water Facts* begins with a statewide look at our available water resources, followed by current and future water use estimates and related information. In addition, a section has been provided which discusses some of the important water issues in Nevada. Next, general water information and selected definitions have been included.

Introduction

THE ROLE OF WATER IN THE EARLY DEVELOPMENT OF NEVADA

Water has always played an important role in the history of Nevada. During the 1840's, Nevada assumed the role it was to maintain for several years, a bridge between the rest of the United States and California. The Humboldt River was a natural highway for westward travelers at the same time providing a water source for the pioneers and their stock. From the Humboldt, the pioneers had the option of following the Carson River or Truckee River routes into California (Elliot, 1987).

The Old Spanish Trail served as a route through the southern part of the State. Along the trail travelers encountered *las vegas*, Spanish for "the meadows." Here, spring water created an oasis for weary pioneers and the area became a common camping site.

In response to the growing traffic towards California, small commercial establishments sprang up along the trails in areas with an adequate water supply. Along the Carson River segment of the Emigrant Trail, Mormon Station, later renamed Genoa, was founded in 1850 as a trading station and an outpost of the Mormon theocracy (Elliot, 1987). The first specific mention in historical records of irrigation in Nevada was at Mormon Station. Individual settlers raised irrigated crops to support themselves, and to supply the California gold seekers as they passed through the area.

Not long afterwards, a small Mormon outpost at Las Vegas was established as a way station on the road from the Utah settlements to Southern California points. During the

summer of 1855, the construction of an irrigation diversion in Las Vegas Creek by the Mormon colonists marked the beginning of organized irrigation in Nevada (State Engineer's Office, October 1971).

Growth fueled by the establishment of stations along the emigrant trails, and the discovery of gold and silver in Nevada, increased the demand for food for people and livestock. Because of the arid nature of the land, irrigation works were necessary to assure adequate food for the mining camps, the freight and stage teams, and the domestic stock.

As mining activities in Nevada boomed, so did the thirst for water for mining and milling operations, and other support developments. Small and large water development projects mushroomed throughout the State in an attempt to quench the growing demand. Since viable ore bodies were not always discovered in areas with an adequate water supply, innovative measures were undertaken to move water from its area of origin to another place of use. Perhaps the best known example of an early transbasin diversion in Nevada is the pipeline constructed to meet the growing water needs of the Comstock. This hand-riveted pipeline, considered an engineering feat for its time, carried water from the Tahoe Basin to Virginia City and neighboring towns (Galloway, 1947).

Introduction

NEVADA WATER LAW

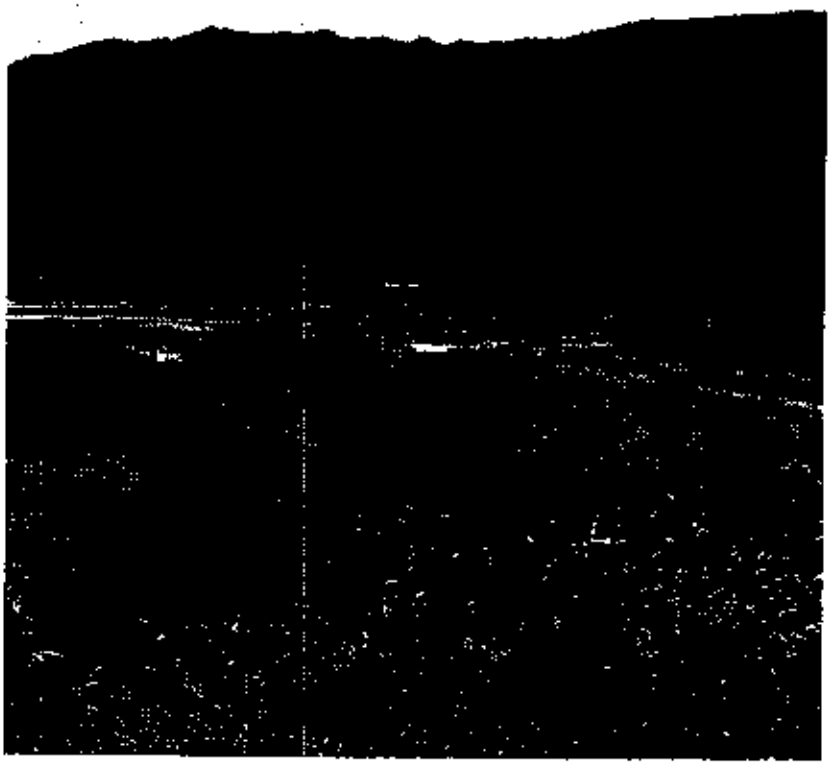
The water in Nevada on the surface and below the ground surface belongs to the public and is managed on their behalf by the State. Entities within the State can apply for the right to use that water. Nevada water law is founded on the doctrine of prior appropriation — "first in time, first in right." Under the appropriation doctrine, the first user of water from a water course acquires a priority right to the water and to the extent of its use (Shamberger, 1991).

Nevada water law is set forth in Nevada Revised Statutes (NRS), Chapters 533 and 534. In addition, there are numerous court decisions which have helped define Nevada water law. The State Engineer is the water rights administrator and is responsible for the appropriation, adjudication and distribution of water in the State. To carry out these duties he is vested with broad discretionary powers.

As part of the duties of the office, the State Engineer reviews applications for new water rights appropriations. In approving or rejecting an application, the State Engineer considers the following questions as set forth in NRS 533.370: 1) is there unappropriated water in the proposed source?; 2) would the proposed use impair existing rights?; and 3) will the proposed use prove detrimental to the public interest? Public interest is not defined by statute and the State Engineer can consider many different issues, including economic and environmental issues, in his evaluation.

All water rights are considered real property and thus are conveyed by deed. Water rights can be bought and sold, and the location and type of use changed. The attributes of

appropriative water rights in Nevada are: 1) beneficial use is the measure and the limit of the right to the use of the water; 2) rights are stated in terms of definite quantity, manner of use, and period of use; and 3) a water right can be lost by abandonment or forfeiture. Abandonment is determined by the intent of the water user to forsake the use of the water. A water right is lost by forfeiture if the right is not used for 5 years. Water lost through abandonment or forfeiture reverts back to the public and is subject to future appropriation.



Saroni Canal in Smith Valley (Photo by Nev.Div.of Water Planning).

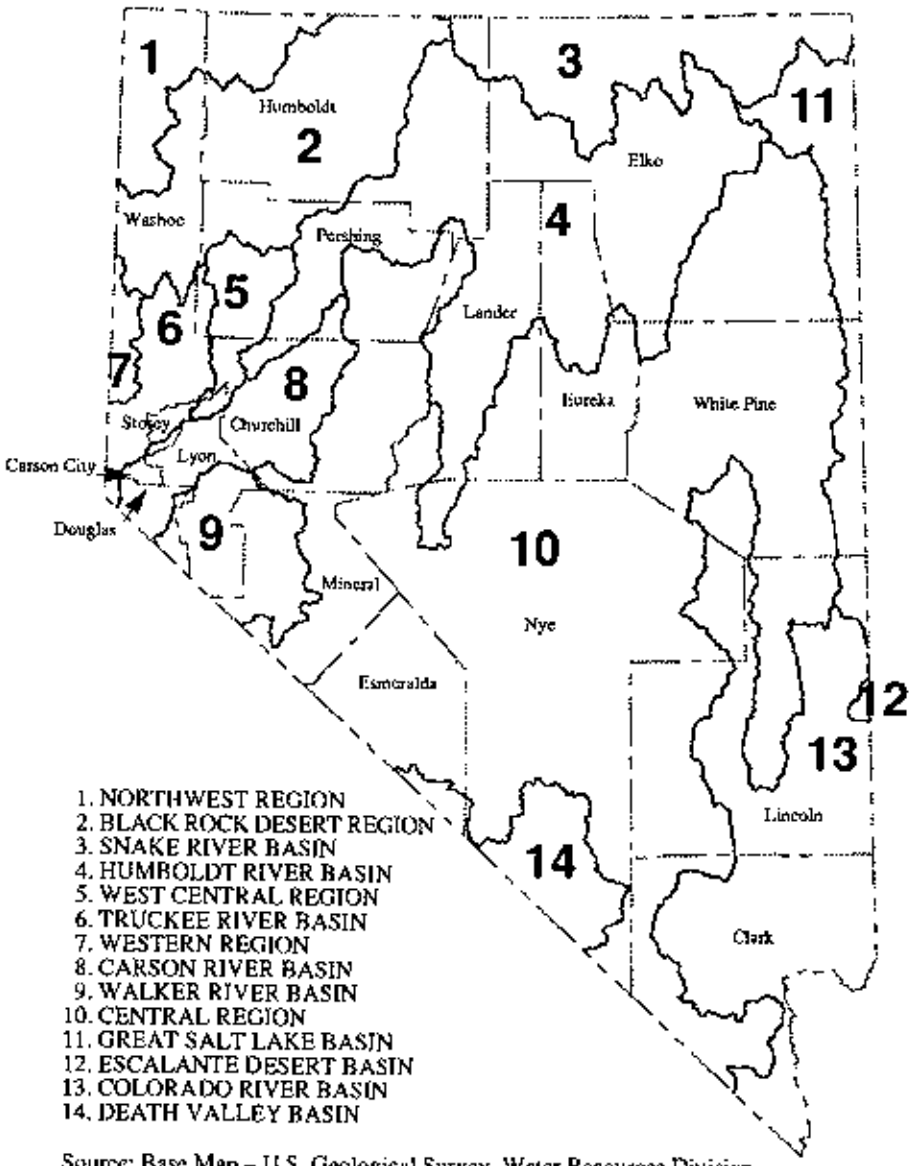
Water Resources

Throughout Nevada, the surface and ground waters of the State are equally important natural resources and have been the subject of numerous studies. This section is intended to provide the reader with a basic understanding of our most precious natural resource.

TOPOGRAPHY AND HYDROGEOGRAPHY

Nevada is characterized by isolated, long, narrow, roughly parallel mountain ranges and broad, intervening, near flat valleys and basins. The spectacular magnitude of alternating mountain ranges and valleys prompted the often used designation "Basin and Range Province" for most of Nevada. For water planning and management purposes, the U.S. Geological Survey and the Nevada Department of Conservation and Natural Resources have divided the State into discrete hydrologic units. Overall, 256 hydrographic areas and subareas within 14 major hydrographic regions have been delineated. The hydrographic regions are each comprised of major drainage basins such as the Truckee, Carson, Walker, Humboldt or Colorado Rivers.

About 93,000 of the total 110,500 square miles of the State lie in the Great Basin, the major subdivision of the Basin and Range Province, wherein drainage flows to enclosed basins rather than to the sea. The only hydrographic regions that flow to the sea are the Snake River drainage which flows to the Pacific Ocean via the Columbia River, and the Colorado River drainage which flows to the Gulf of California.



1. NORTHWEST REGION
2. BLACK ROCK DESERT REGION
3. SNAKE RIVER BASIN
4. HUMBOLDT RIVER BASIN
5. WEST CENTRAL REGION
6. TRUCKEE RIVER BASIN
7. WESTERN REGION
8. CARSON RIVER BASIN
9. WALKER RIVER BASIN
10. CENTRAL REGION
11. GREAT SALT LAKE BASIN
12. ESCALANTE DESERT BASIN
13. COLORADO RIVER BASIN
14. DEATH VALLEY BASIN

Source: Base Map – U.S. Geological Survey, Water Resources Division, Carson City, Nevada.

INDEX MAP OF NEVADA SHOWING
HYDROGRAPHIC REGIONS AND BASINS

Water Resources

CLIMATE AND PRECIPITATION

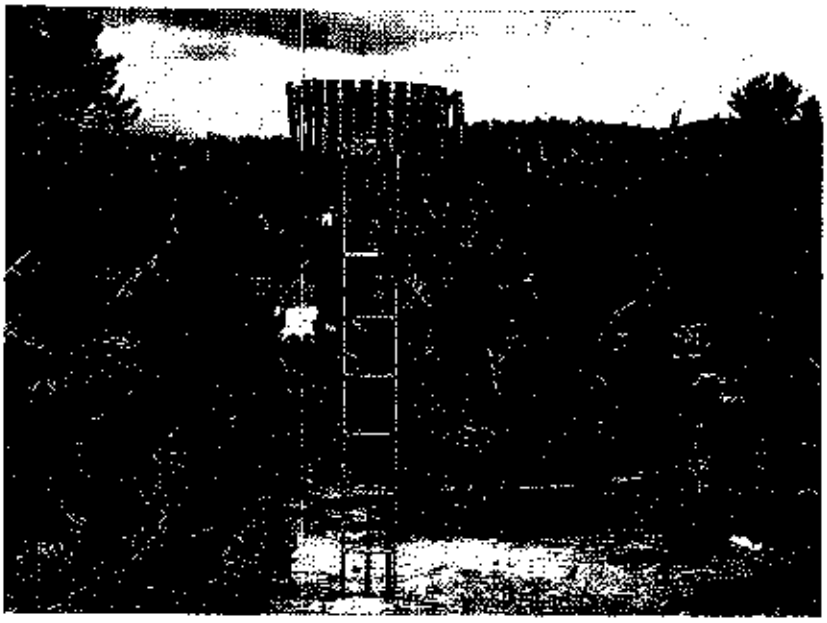
The climate of Nevada is characterized as semi-arid to arid with precipitation and temperature varying widely between the northern and southern regions of the State, and between valley floors and mountain tops. With temperatures that fall below -40° F during some months in the northeast, and rise over 120° F during a few summer days in the south, and precipitation that ranges from only three to four inches in Southern Nevada to over 40 inches (and over 300 inches of snowfall) in the Carson Range portion of the Sierra Nevada, Nevada is truly a land of great climatic contrast (James, 1984).

Total precipitation averages approximately 9 inches per year (53,000,000 acre-feet) making Nevada the most arid state in the Nation (Geraghty and others, 1973). Of the total annual average precipitation amount, approximately 10 percent accounts for stream runoff and groundwater recharge. The remaining 90 percent is lost through evaporation and transpiration. Average lake surface evaporation rates vary widely across the State from less than 36 inches per year in the west to over 80 inches per year in the south (State Engineer's Office, April 1973).

AVERAGE ANNUAL PRECIPITATION AT SELECTED LOCATIONS

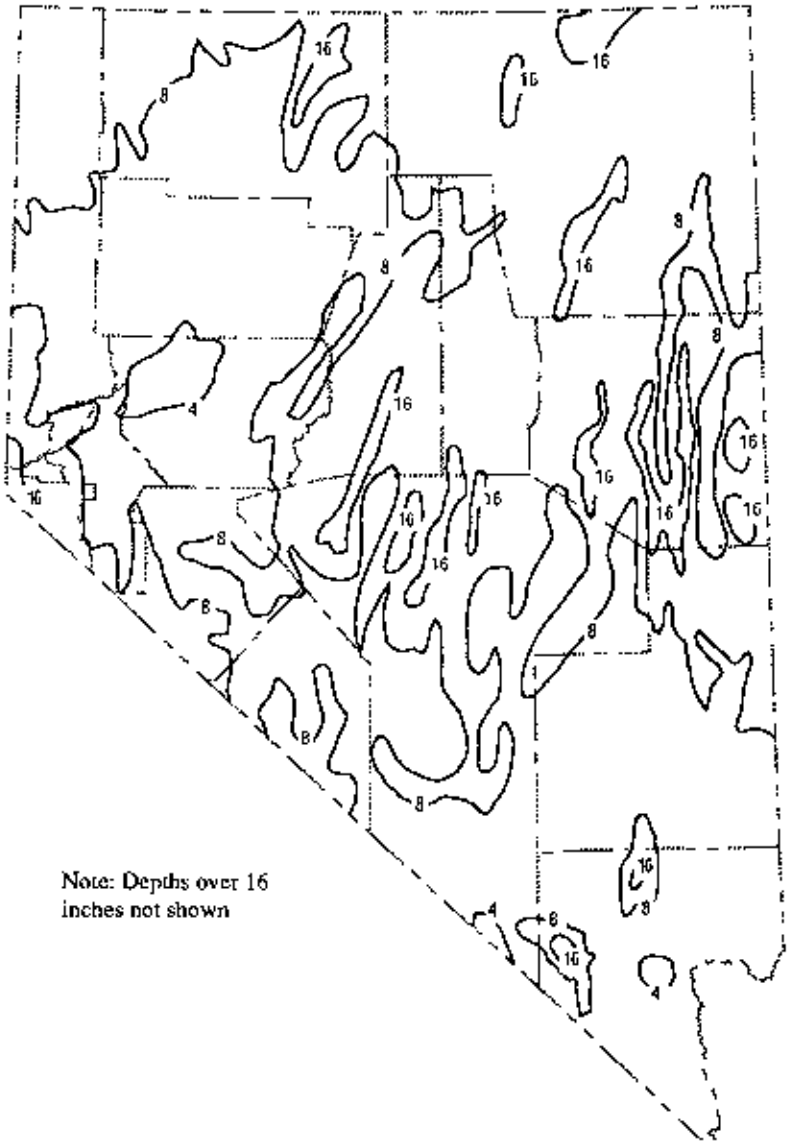
County	City	Average Annual Precipitation, in inches
Carson City	Carson City	10.8
Churchill	Fallon	4.9
Clark	Las Vegas	4.2
Douglas	Minden	8.2
Elko	Elko	9.3
Esmeralda	Goldfield	5.6
Humboldt	Winnemucca	7.9
Lander	Battle Mountain	7.5
Lincoln	Caliente	9.1
Lyon	Yerington	5.5
Mineral	Hawthorne	4.6
Nye	Tonopah	4.9
Pershing	Lovelock	5.5
Storey	Virginia City	12.1
Washoe	Reno	7.5
White Pine	Ely	9.0

Source: National Oceanic and Atmospheric Administration, "Climatological Data -Annual Summary: Nevada," Various Years.



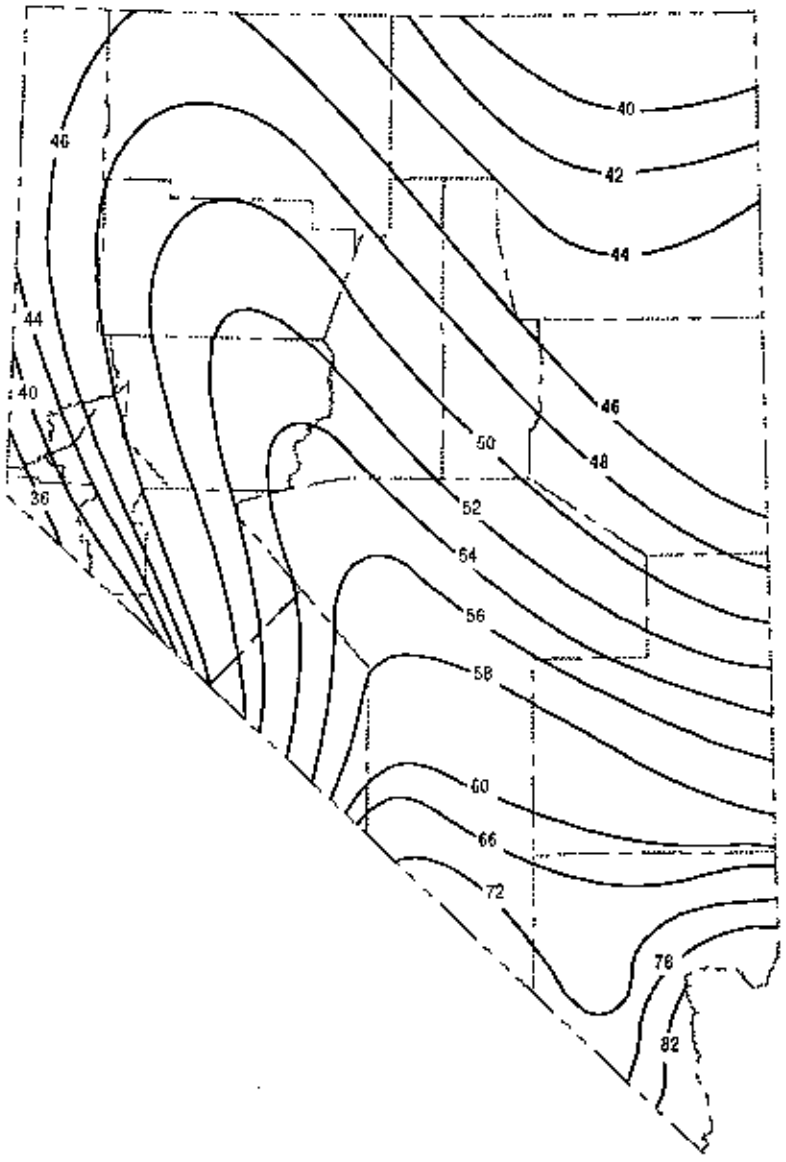
Rain gage at Conner's Pass, White Pine County (Photo by Nev. Div. of Water Planning)

Water Resources



Sources: Base map – U.S. Geological Survey, Water Resources Division, Carson City, Nevada;
Data – Houghton and others, Nevada's Weather and Climate, 1975.

AVERAGE ANNUAL PRECIPITATION,
IN INCHES PER YEAR



Source: Base map – U.S. Geological Survey, Water Resources Division, Carson City, Nevada; Data -Adapted from Climatic Atlas of the United States, U.S. Dept. of Commerce, Environmental Data Service, June 1968.

AVERAGE ANNUAL LAKE SURFACE
EVAPORATION, IN INCHES PER YEAR

Water Resources

RIVERS AND STREAMS

Nevada can claim very few large rivers and streams compared to other states. Of particular importance are the characteristics of the following Nevada rivers and drainage basins:

- Colorado River: This region makes up 12,376 square miles of Nevada. The Colorado provides hydroelectric power and recreation at Lakes Mead and Mohave and water for agricultural, industrial and municipal uses.

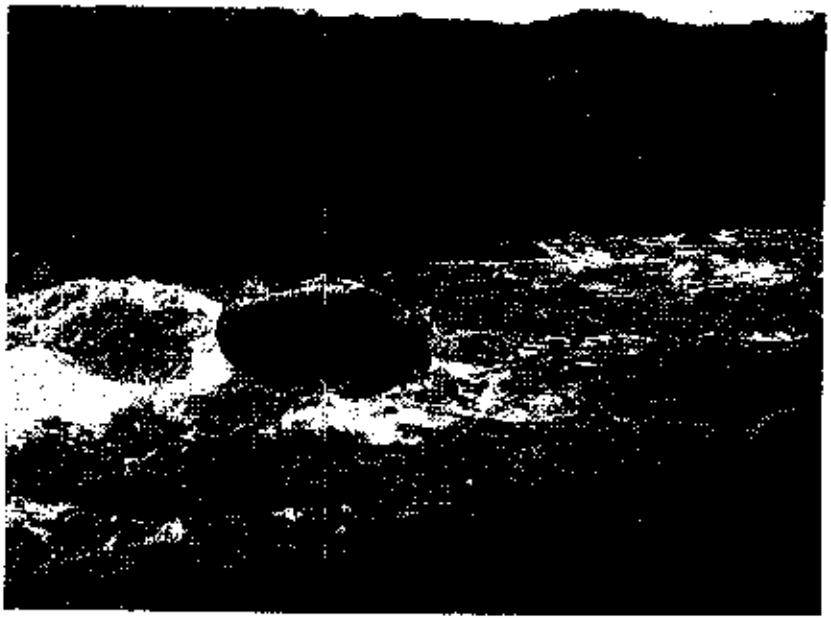
- Snake River: This watercourse drains 5,230 square miles in Northern Nevada and includes the watersheds of the Bruneau, Owyhee and Jarbidge Rivers.

- Humboldt River: This, the longest river in Nevada, is wholly contained within the State. The Humboldt has its headwaters in the Ruby, East Humboldt, Independence and Jarbidge Mountains and generally flows westward to terminate in the Humboldt and Carson sinks. The waters of the Humboldt serve a predominately agricultural economy as well as many small rural communities.

- Truckee River: The Tahoe Basin is the origin for this river which drains the eastern slope of the Sierra Nevada. The Truckee River flows east through Reno and terminates in Pyramid Lake. Along its course, water is utilized to meet the needs of municipal and industrial, agriculture, hydroelectric power, and fisheries. A portion of the Truckee River flow is diverted at Derby Dam and is conveyed by the Truckee Canal to Lahontan Reservoir in the Carson River Basin.

- Carson River: This river drains the east slope of the Sierras in an area south of Lake Tahoe and terminates in the Carson Sink. After flowing through Carson Valley in Douglas County, the river continues on to Lahontan Reservoir where the water is distributed throughout the Fallon area for agriculture, and wildlife and fisheries purposes.

- Walker River: The Walker River, with its headwaters in California, flows into Nevada and through Smith and Mason Valleys, and the Walker River Indian Reservation before terminating at Walker Lake. Waters of the Walker River are predominately used for agricultural purposes.



Carson River at Brunswick Canyon (Photo by Nev. Div. of Water Planning)

MAJOR LAKES AND RESERVOIRS OF NEVADA AND PORTIONS OF CALIFORNIA

Basin/Reservoir	County	Surface Area, acres[1]	Active Storage Capacity, acre-feet	Total Storage Capacity, acre-feet
Snake River Basin				
Wild Horse Reservoir	Elko	2,830	73,500	73,500
Humboldt River Basin				
Pitt-Taylor Res.,Lower	Pershing	2,570	22,200	22,200
Pitt-Taylor Res.,Upper	Pershing	2,070	24,200	24,200
Rye Patch Reservoir	Pershing	11,400	171,000	171,000
South Fork Reservoir	Elko	1,650	41,000	41,000
Truckee River Basin				
Big & Little Washoe Lakes	Washoe	5,800	14,000	38,000
Boca Reservoir	Nevada	980	40,870	41,110
Donner Lake	Nevada, Placer	800	9,500	Not reported
Independence Lake	Nevada, Sierra	700	17,500	Not reported
Lake Tahoe	Carson City, Douglas, Washoe, El Dorado, Placer	124,000	744,600	125,000,000
Martis Creek Lake	Nevada	770	20,400	21,200
Prosser Creek Res.	Nevada	750	28,640	29,840
Stampede Reservoir	Sierra	3,440	221,860	226,500
Carson River Basin				
Lahontan Reservoir	Churchill, Lyon	14,600	317,000	317,000
Walker River Basin				
Bridgeport	Mono	2,914	40,500	40,500
Topaz Lake	Douglas	2,410	61,000	126,000
Weber Reservoir	Mineral	950	13,000	13,000
Colorado River Basin				
Lake Mead	Clark	158,000	26,200,000	29,700,000
Lake Mohave	Clark	28,000	1,810,000	1,820,000

[1] Entire waterbody

Basin/Lake	County	1990 Surface Area, acres	1990 Contents, acre-feet
Truckee River Basin			
Pyramid Lake	Washoe	112,600	22,170,000
Walker River Basin			
Walker Lake	Mineral	35,600	2,527,000

NEVADA SURFACE WATER SUMMARY

Values in acre-feet per year unless otherwise noted

Precipitation

Estimated annual average.....53,000,000

Surface water (annual flow statistics at selected locations)

Gaging Station Name	Average	50% Frequency[1]	80% Frequency[2]
Truckee River at Farad, CA	556,800	497,600	339,400
Truckee River at Reno, NV	483,400	401,000	233,100
Truckee River below Derby Dam near Wadsworth, NV	281,200	145,700	41,400
East Fork Carson River near Gardnerville, NV	262,500	245,800	164,300
West Fork Carson River near Woodfords, CA	74,800	69,800	46,400
Carson River near Carson City, NV	294,400	262,800	146,600
Carson River near Ft. Churchill, NV	268,100	235,500	126,300
Humboldt River at Palisade, NV	289,000	239,900	126,300
Humboldt River near Imlay, NV	204,500	134,800	63,400
East Walker River near Bridgeport, CA	104,900	94,200	60,000
West Walker River near Coleville, CA	188,500	177,300	118,700
Walker River near Wabuska, NV	124,900	84,000	37,200
Colorado River below Hoover Dam, AZ-NV	10,163,000	9,380,000	7,517,000
Virgin River at Littlefield, AZ	172,500	145,000	102,700
Owyhee River above China Diversion Dam near Owyhee, NV	107,600	99,600	63,800

[1] Annual volume that is exceeded 5 out of 10 years

[2] Annual volume that is exceeded 8 out of 10 years

Source: Nevada Division of Water Planning Files

Water Resources

GROUNDWATER

The surface water resources in Nevada have been virtually fully appropriated and further development must either rely on groundwater sources or the reallocation of surface water supplies. Principal groundwater aquifers in Nevada are basin-fill deposits, carbonate rocks, and to a lesser extent, volcanic rock. The basin-fill aquifers are composed primarily of alluvial and colluvium deposits that partly fill the basins. Virtually all groundwater withdrawals at this time have been from the upper 500 feet of the basin-fill aquifers. Carbonate-rock aquifers in Eastern Nevada have not been significantly developed as a water supply, but are an important source of water. These carbonate rock formations, consisting mainly of limestone and dolomite, are found beneath the basin-fill aquifers in Eastern Nevada.

Numerous studies have been performed for quantification of available groundwater resources in a given basin. The following table presents perennial yield estimates for the 256 basins and sub-basins in Nevada. In addition, committed resources in each basin are reported. The committed resource is the total volume of permitted, certificated and vested groundwater rights which are recognized by the State Engineer and can be withdrawn in a groundwater basin in any given year. Also, whether or not a basin is designated is indicated in the following table. The State Engineer may designate a groundwater basin which is being depleted or is in need of additional administration, and in the interest of public welfare, declare preferred uses (such as municipal, domestic) in such basins. The State Engineer has additional authority in the administration of the water resources within a designated groundwater basin.

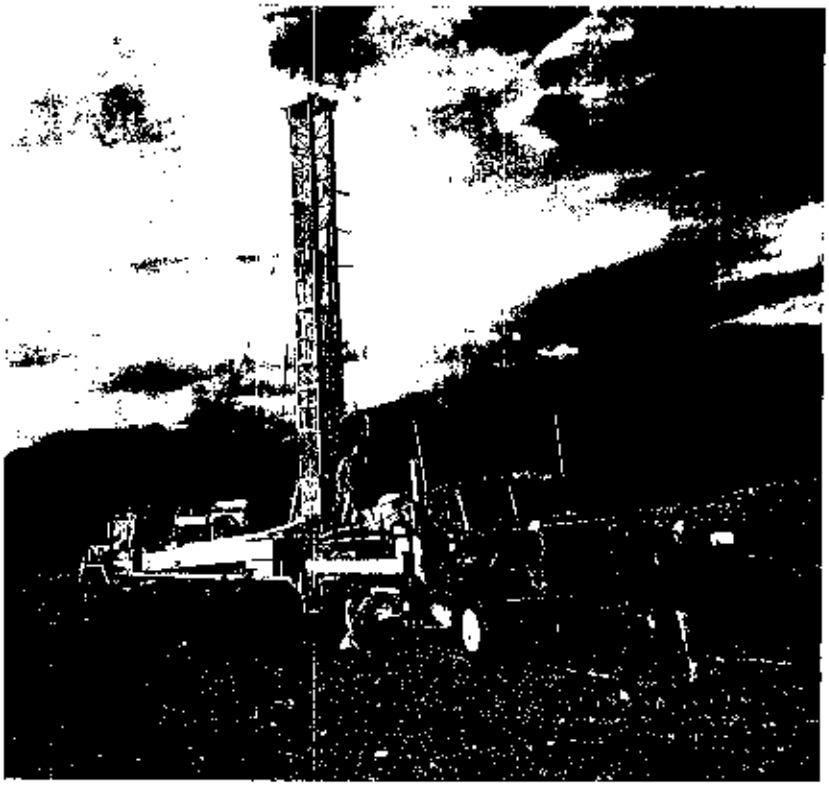
NEVADA GROUNDWATER SUMMARY

Values in acre-feet per year unless otherwise noted

Groundwater: (Groundwater budget for valley-fill reservoirs)

Groundwater recharge from precipitation	2,200,000
Perennial yield of valley-fill reservoirs	2,100,000
Groundwater stored in upper 100 feet of saturated valley fill (acre-feet)	250,000,000
Estimated transitional storage reserve (acre-feet)	84,000,000

Source: Nevada Division of Water Planning files



Drilling in the carbonate-rock aquifer province, Coyote Springs Valley
(Photo by Doug Maurer, U.S. Geological Survey)

GROUNDWATER BASIN INFORMATION

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Northwest Region					
1	Pueblo V.	118	2,000	5,923	7/92	N
2	Continental Lake V.	214	11,000	9,220	7/92	N
3	Gridley Lake V.	195	3,000	13,990	7/92	N
4	Virgin V.	494	6,000	9	7/92	N
5	Sage Hen V.	22	250	12	7/92	N
6	Guano V.	147	2,000	0	7/92	N
7	Swan Lake V.	226	Minor	0	7/92	N
8	Massacre Lake V.	176	3,000	8	7/92	N
9	Long V.	433	12,000	7,816	6/92	N
10	Macy Flat	27	250	0	7/92	N
11	Coleman V.	51	1,000	0	7/92	N
12	Mosquito V.	32	1,500	0	7/92	N
13	Warner V.	82	1,000	0	7/92	N
14	Surprise V.	214	2,500	0	7/92	N
15	Boulder V.	88	2,000	0	7/92	N
16	Duck Lake V.	533	8,000	2,082	7/92	N
	Black Rock Desert Region					
17	Pilgrim Flat	12	200	0	7/92	N
18	Painter Flat	31	1,200	0	7/92	N
19	Dry V.	39	100	0	7/92	N
20	Sano V.	12	25	0	7/92	N
21	Smoke Creek Desert	980	16,000	6,392	3/92	N
22	San Emidio Desert	305	2,500	7,440	7/92	Y
23	Granite Basin	9	200	0	7/92	N
24	Hualapai Flat	315	6,700	34,123	7/92	N
25	High Rock Lake V.	665	5,000	541	7/92	N
26	Mud Meadow	495	13,000	3,892	7/92	N
27	Summit Lake V.	60	1,000	12	7/92	N
28	Black Rock Desert	2,179	30,000	23,897	7/92	N
29	Pine Forest V.	528	11,000	40,990	7/92	Y
30	Kings River V.					
	(A) Rio King Subarea	300	17,000	60,217	7/92	Y
	(B) Sod House Subarea	113		6	4/92	Y
31	Desert V.	1,052	9,000	29,597	7/92	Y
32	Silver State V.	313	5,900	25,273	7/92	Y
33	Quinn River V.					
	(A) Orovada Subarea	632	60,000	83,123	7/92	Y
	(B) McDermitt Subarea	592		9,232	7/92	Y
	Snake River Basin					
34	Little Owyhee River Area	716	1,400	28	2/92	N
35	South Fork Owyhee River	1,310	8,000	3,054	6/92	N
36	Independence V.	345	12,000	16,345	7/92	N
37	Owyhee River Area	533	7,000	8,860	7/92	N
38	Bruneau River Area	514	10,000	0	7/92	N
39	Jarbidge River Area	278	12,000	56	7/92	N
40	Salmon River Area	1,218	10,000	8,172	7/92	Y
41	Goose Creek Area	316	1,700	958	2/92	N

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Humboldt River Basin					
42	Marys River Area	1,073		32,704	7/92	Y
43	Starr Valley Area	332	83,000	3,597	4/92	Y
44	North Fork Area	1,110		11,081	7/92	Y
45	Lamoille V.	257		3,674	7/92	Y
46	South Fork Area	99		31	2/92	Y
47	Huntington V.	787	25,000	8,124	6/92	Y
48	Dixie Creek - Ten Mile Creek Area	392		27,060	7/92	Y
49	Elko Segment	314	13,000[2]	29,755	7/92	Y
50	Susie Creek Area	223	6,000	169	2/92	Y
51	Maggie Creek Area	396		13,739	7/92	Y
52	Marys Creek Area	61	13,000[2]	1,940	2/92	Y
53	Pine V.	1,002	20,000	11,206	7/92	Y
54	Crescent V.	752	16,000	19,325	7/92	Y
55	Carico Lake V.	376	4,000	2,855	7/92	N
56	Upper Reese River V.	1,138	37,000	31,219	7/92	Y
57	Antelope V.	452	9,000	34,524	6/92	Y
58	Middle Reese River V.	319	14,000	50,784	6/92	Y
59	Lower Reese River V.	588	20,000	23,769	7/92	N
60	Whirlwind V.	94		5,871	6/92	Y
61	Boulder Flat	544	30,000	104,451	5/91	Y
62	Rock Creek V.	444	2,800	2,026	6/92	N
63	Willow Creek V.	405		5,022	6/92	N
64	Clovers Area	720		35,784	7/92	Y
65	Pumpernickel V.	299	72,000	27,756	7/92	N
66	Kelley Creek Area	301		29,647	7/92	Y
67	Little Humboldt V.	975		9,155	7/92	N
68	Hardscrabble Area	167	34,000	0	2/92	N
69	Paradise V.	600		105,112	7/92	Y
70	Winnemucca Segment	435	17,000	40,644	7/92	Y
71	Grass V.	520	13,000	42,938	7/92	Y
72	Imlay Area	771	3,000	7,604	7/92	Y
73	Lovelock V.	635	43,000	4,062	7/92	N
	(A) Oreana Subarea	98	2,000	5,296	2/92	Y
74	White Plains	164	100	47	2/92	Y
	West Central Region					
75	Brady Hot Springs	178	2,500	1,288	7/92	Y
76	Fernley Area	120	600	15,092	7/92	Y
77	Fireball Area	58	100	0	2/92	N
78	Granite Springs V.	967	4,500	784	2/92	N
79	Kumiva V.	333	500	2	2/92	N

[2] Combined perennial yield of Basins 49 & 52

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Truckee River Basin					
80	Winnemucca Lake V.	371	3,300	262	2/92	N
81	Pyramid Lake V.	672	7,000	55	2/92	N
82	Dodge Flat	92	2,100	5,221	7/92	N
83	Tracy Segment	285	6,000R	5,352	7/92	Y
84	Warm Springs Area	247	3,000	14,057	7/92	Y
85	Spanish Springs V.	76	1,000	10,029	7/92	Y
86	Sun V.	10	25	20	2/92	Y
87	Truckee Meadows	203	27,000R	79,765	7/92	Y
88	Pleasant V.	39	10,000R	10,945	7/92	Y
89	Washoe V.	82	15,000R	11,413	7/92	Y
90	Lake Tahoe Basin	139	Minor	1,862	3/92	Y
91	Truckee Canyon Segment	84	2,000	3,186	7/92	Y
	Western Region					
92	Lemmon V.					
	(A) Western Part	53	1,500	1,990	7/92	Y
	(B) Eastern Part	40		2,870	7/92	Y
93	Antelope V.	18	150	56	2/92	Y
94	Bedell Flat	53	300	127	2/92	Y
95	Dry V.	80	1,000	26	2/92	N
96	Newcomb Lake V.	9	200	0	7/92	N
97	Honey Lake V.	193	13,000	23,135	6/92	Y
98	Skedaddle Creek V.	43	200	0	7/92	N
99	Red Rock V.	58	1,000	898	2/92	Y
100	Cold Springs V.	30	500	1,162	7/92	Y
	(A) Long V.	25	NR	2,336	3/92	Y
	Carson River Basin					
101	Carson Desert	2,022	2,500	22,851	7/92	Y
	(A) Packard V.	160	710R	2,621	7/92	Y
102	Churchill V.	480	1,600	8,584	7/92	Y
103	Dayton V.	369	9,445	33,155	7/92	Y
104	Eagle V.	69	7,000	9,289	5/91	Y
105	Carson V.	419	49,000R	102,981	12/90	Y
	Walker River Basin					
106	Antelope V.	115	2,600	7,417	7/92	Y
107	Smith V.	479	17,000R	59,088	6/92	Y
108	Mason V.	316	25,000	149,175	10/90	Y
109	East Walker Area	586	5,500	9,008	7/92	N
110	Walker Lake					
	(A) Schurz Subarea	502	1,500	35	2/92	N
	(B) Lake Subarea	307	700	2,282	7/92	N
	(C) Whiskey Flat-Hawthorne Subarea	541	5,000	12,625	7/92	Y
	Central Region					
111	Alkali V.					
	(A) Northern Part	18	300	0	7/92	N
	(B) Southern Part	65	700	0	7/92	N
112	Mono V.	27	300	0	7/92	N
113	Huntoon V.	97	150	2,596	7/92	N

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Central Region (cont'd)					
114	Teels Marsh V.	323	1,400	738	7/92	N
115	Adobe V.	15	150	0	7/92	N
116	Queen V.	65	600	0	7/92	N
117	Fish Lake V.	706	30,000	65,987	7/92	Y
118	Columbus Salt Marsh V.	370	4,000	2,299	7/92	N
119	Rhodes Salt Marsh V.	199	1,000	49	2/92	N
120	Garfield Flat	92	150	0	2/92	N
121	Soda Spring V.					
	(A) Eastern Part	246	600	3,591	7/92	Y
	(B) Western Part	130	200	478	7/92	Y
122	Gabbs V.	1,277	5,000	25,536	7/92	Y
123	Rawhide Flats	227	500	116	7/92	N
124	Fairview V.	285	250	55	7/92	Y
125	Stingaree V.	43	100	413	7/92	Y
126	Cowkick V.	110	800	820	7/92	Y
127	Eastgate Valley Area	216	4,000	231	7/92	Y
128	Dixie V.	1,303	15,000	37,435	7/92	Y
129	Buena Vista V.	742	10,000	33,456	7/92	Y
130	Pleasant V.	285	2,600	1,699	7/92	Y
131	Buffalo V.	504	8,000	8,890	7/92	N
132	Jersey V.	142	250	27	7/92	Y
133	Edwards Creek V.	416	8,000	11,811	7/92	N
134	Smith Creek V.	582	10,000	3,219	6/92	N
135	Ione V.	460	2,500	1,167	6/92	N
136	Monte Cristo V.	284	400	256	7/92	N
137	Big Smoky V.					
	(A) Tonopah Flat	1,603	6,000	29,514	7/92	Y
	(B) Northern Part	1,323	65,000	82,966	7/92	Y
138	Grass V.	595	13,000	4,683	6/92	N
139	Kobeh V.	868	16,000	28,923	7/92	Y
140	Monitor V.					
	(A) Northern Part	529	8,000	278	6/92	N
	(B) Southern Part	509	10,000	3,478	7/92	N
141	Ralston V.	971	6,000	3,471	7/92	Y
142	Alkali Spring V.	313	3,000	20,110	7/92	N
143	Clayton V.	555	20,000	21,399	7/92	N
144	Lida V.	535	350	214	7/92	N
145	Stonewall Flat	381	100	12	7/92	N
146	Sarcobatus Flat	812	3,000	1,977	7/92	Y
147	Gold Flat	684	1,900	95	7/92	N
148	Cactus Flat	403	300	619	7/92	N
149	Stone Cabin V.	985	2,000	2,237	7/92	Y
150	Little Fish Lake V.	434	10,000	0	2/92	N
151	Antelope V.	444	4,000	1,635	6/92	N
152	Stevens Basin	17	100	19	6/92	N
153	Diamond V.	752	30,000	134,176	7/92	Y
154	Newark V.	801	18,000	12,035	7/92	N
155	Little Smoky V.					
	(A) Northern Part	591	5,000	3,484	6/92	N
	(B) Central Part	57	100	4	6/92	N
	(C) Southern Part	510	1,000	24	6/92	N
156	Hot Creek V.	1,036	5,500	1,425	6/92	N
157	Kawich V.	350	2,200	8	7/92	N

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Central Region (cont'd)					
158	Emigrant V.					
	(A) Groom Lake V.	663	2,800	12	6/92	N
	(B) Papoose Lake V.	104	10	0	6/92	N
159	Yucca Flat	305	350	0	2/92	N
160	Frenchman Flat	463	16,000	0	2/92	N
161	Indian Springs V.	655	500	1,626	2/92	Y
162	Pahrump V.	789	12,000	78,065	7/92	Y
163	Mesquite V. (Sandy V.)	236	2,200	2,845	7/92	Y
164	Ivanpah V.					
	(A) Northern Part	253	700	3,039	7/92	Y
	(B) Southern Part	73	250	603	7/92	Y
165	Jean Lake V.	96	50	10	7/92	Y
166	Hidden Lake V.	34	Minor	7	7/92	Y
167	Eldorado V.	530	500	2,609	7/92	Y
168	Three Lakes V.	298	4,000	0	2/92	N
169	Tikapoo V.					
	(A) Northern Part	607	1,300	7	6/92	N
	(B) Southern Part	391	3,000	0	6/92	N
170	Penoyer V.					
	(Sand Spring V.)	700	4,000	19,168	6/92	Y
171	Coal V.	460	6,000	25	6/92	N
172	Gardner V.	493	6,000	366	1/92	N
173	Railroad V.					
	(A) Southern Part	603	2,800	5,329	7/92	N
	(B) Northern Part	2,149	75,000	40,820	7/92	N
174	Jakes V.	422	12,000	54	6/92	N
175	Long V.	651	6,000	3,307	7/92	N
176	Ruby V.	1,004	53,000	33,822	7/92	Y
177	Clover V.	464	10,000	21,060	7/92	Y
178	Butte V.					
	(A) Northern Part	271	6,000	110	7/92	N
	(B) Southern Part	739	14,000	318	6/92	N
179	Steptoe V.	1,942	70,000	78,531	7/92	Y
180	Cave V.	362	2,000	13	6/92	N
181	Dry Lake V.	882	2,500	56	6/92	N
182	Delamar V.	383	3,000	7	6/92	N
183	Lake V.	557	12,000	28,981	7/92	Y
184	Spring V.	1,661	100,000	24,778	7/92	N
185	Tippett V.	345	3,500	472	6/92	N
186	Antelope V.					
	(A) Southern Part	125	800	637	6/92	N
	(B) Northern Part	270	1,700	613	6/92	N
187	Goshute V.	954	11,000	10,617	6/92	Y
188	Independence V.					
	(Pequop V.)	562	9,000	2,042	7/92	Y
	Great Salt Lake Basin					
189	Thousand Springs V.					
	(A) Herrill Siding-Brush Creek Area	163	1,800	6,679	7/92	Y
	(B) Toano-Rock Spring Area	618	2,600	11,233	7/92	Y
	(C) Rocky Butte Area	183	1,400	415	6/92	Y
	(D) Montello-Cottonwood Creek Area	482	14,000	24,402	7/92	Y

GROUNDWATER BASIN INFORMATION (CONT'D)

No.	Region/Basin Name	Area, sq. miles[1]	Perennial Yield, AF/YR	Committed Resources, AF/YR	Committed Resources, Date	Designated (Yes/No)
	Great Salt Lake Basin (cont'd)					
190	Grouse Creek V.	55	350	33	6/92	N
191	Pilot Creek V.	326	4,500	2,772	7/92	Y
192	Great Salt Lake Desert	507	5,000	3,357	7/92	N
193	Deep Creek V.	208	2,000	0	2/92	N
194	Pleasant V.	75	1,500	976	6/92	N
195	Snake V.	777	25,000	12,389	7/92	N
196	Hamlin V.	413	5,000	368	6/92	N
	Escalante Desert					
197	Escalante Desert	106	1,000	2	6/92	N
	Colorado River Basin					
198	Dry V.	113	1,000	7,207	7/92	N
199	Rose V.	12	100	1,660	6/92	N
200	Eagle V.	52	300	297	6/92	N
201	Spring V.	287	4,100	1,164	6/92	N
202	Patterson V.	418	4,500	5,435	7/92	N
203	Panaca V.	334	9,000	28,134	7/92	Y
204	Clover V.	364	1,000	3,690	7/92	N
205	Lower Meadow V. Wash	979	5,000	29,680	7/92	Y
206	Kane Springs V.	234	Minor	0	2/92	N
207	White River V.	1,607	37,000	25,007	7/92	N
208	Pahroc V.	508	21,000	7	6/92	N
209	Pahranagat V.	768	25,000	9,714	7/92	N
210	Coyote Spring V.	657	18,000	0	6/92	Y
211	Three Lakes V.	311	5,000	521	7/92	Y
212	Las Vegas V.	1,564	25,000	91,257	12/91	Y
213	Colorado River V.	563	200R	1,606	7/92	Y
214	Piute V.	338	600	6,612	7/92	Y
215	Black Mountains Area	630	1,300	6,212	6/92	Y
216	Garnet V.	156	400	930	5/92	N
217	Hidden V.	80	200	0	2/92	N
218	California Wash	318	2,200	506	7/92	N
219	Muddy River Springs Area	91	37,000	8,328	6/92	Y
220	Lower Moapa V.	252	16,500	5,660	5/92	Y
221	Tule Desert	192	1,000	4	6/92	N
222	Virgin River V.	907	3,600R	13,307	7/92	Y
223	Gold Butte Area	533	500	92	7/92	N
224	Greasewood Area	108	300	5	7/92	N
	Death Valley Basin					
225	Mercury V.	110		0	2/92	N
226	Rock V.	82		0	2/92	N
227	Forty Mile Canyon					
	(A) Jackass Flats	279	24,000	56	7/92	N
	(B) Buckboard Mesa	240		0	2/92	N
228	Oasis V.	460		1,727	7/92	Y
229	Crater Flat	182		3,056	7/92	N
230	Amargosa Desert	896		42,026	7/92	Y
231	Grapevine Canyon	162	400	12	7/92	N
232	Oriental Wash	182	150	396	7/92	N

[1] Nevada portion only

R = Recharge to the basin

NR = Not Reported

Source: Nevada Division of Water Planning, Hydrographic Basin Summaries: 1992, July 1992.

WATER QUALITY

The chemical quality of the waters of the State can vary considerably depending upon location, time of year, climatic conditions, etc. A detailed discussion of the water quality in Nevada is beyond the scope of this booklet. For specific information on water quality in an area, please contact the Nevada Divisions of Environmental Protection or Water Planning.

Surface and Ground Water Quality

Water quality is affected by natural causes and/or human-induced contamination. Chemical constituent sources can be identified as point or nonpoint sources. A point source has a discernible discharge point, such as a municipal or industrial wastewater plant discharge pipe or percolation pond. A nonpoint source is a diffuse source with constituents entering the stream or aquifer from a widespread area, such as natural mineral deposits or irrigated lands.

The quality of the surface waters in Nevada has been improving due to the removal of point sources and more stringent standards being implemented on the remaining point sources by the Nevada Division of Environmental Protection (NDEP). Agricultural and rangeland nonpoint sources are contributing large sediment and nutrient loads to the waters of the State. The NDEP nonpoint source program is helping to further improve water quality by promoting better grazing and irrigation practices (NDEP, April 1992).

The quality of water from most groundwater aquifers in Nevada is suitable, or marginally suitable, for most uses. Most aquifers contain water with constituent concentrations that do not exceed State and national drinking water standards.

However, portions of some groundwater sources have constituent concentrations exceeding these standards. Excessive concentrations in groundwater result from both natural processes and human activities (USGS, 1988b).

Nevada Drinking Water Standards

The primary objective of the State's drinking water standards is to assure safe water for human consumption. The following table lists the maximum primary and secondary contaminant concentrations for drinking water. Primary standards limit contaminants which may affect consumer health. Secondary standards were developed to deal with the aesthetic qualities of drinking water.

PRIMARY REGULATIONS

Inorganic Chemicals	
Arsenic	0.05 mg/l
Barium	1 mg/l
Cadmium	0.010 mg/l
Chromium	0.05 mg/l
Lead	0.05 mg/l
Mercury	0.002 mg/l
Nitrate (as N)	10 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l
Fluoride	1.4-2.4 mg/l
Organic Chemicals	
Endrin	0.0002 mg/l
Lindane	0.004 mg/l
Methoxychlor	0.1 mg/l
Toxaphene	0.005 mg/l
2,4-D	0.1 mg/l
2,4,5-TP Silvex	0.001 mg/l
TTHM	0.10 mg/l
Turbidity	1-5 TU
Coliform Bacteria	1/100 ml (mean)
Radiological	
Radium 226 and 228	5 pCi/l
Gross Beta	4 mrem/year (50 pCi/l)
Gross Alpha	15 pCi/l
Sodium & Corrosivity	Monitoring only

SECONDARY REGULATIONS

Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Foaming agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 threshold odor number
pH	6.5-8.5
Sulfate	250 mg/l
TDS	500 mg/l
Zinc	5 mg/l

Water Use

Availability of water, which reflects the variable climate in the State, has always been a controlling factor in the settlement of Nevada. Water is used by virtually every sector of the State economy, e.g. public supply, rural domestic, irrigation and livestock, industrial and mining, and thermoelectric. This section presents information on past, current and possible future water use by these sectors.

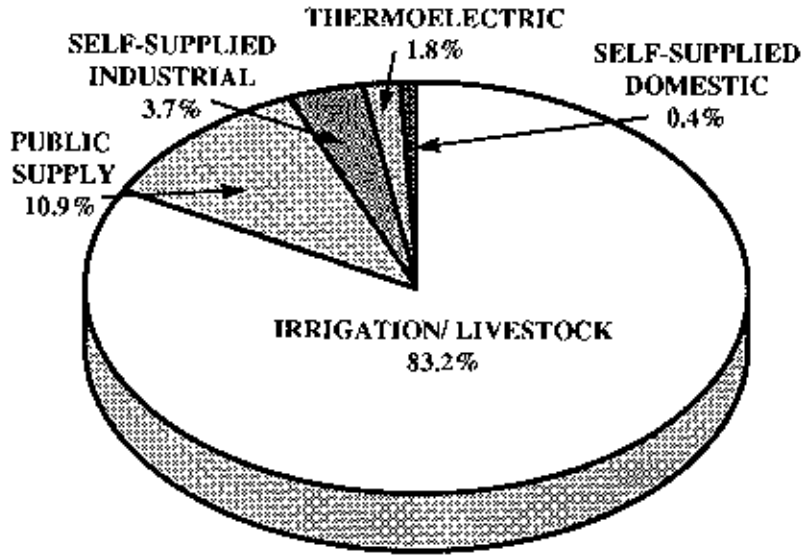
ESTIMATED WATER USE IN NEVADA IN 1,000 ACRE-FEET PER YEAR

Use Category	1980	1985	1990
Public Supply			
Withdrawn	258	323	439
Consumed	141	177	269
Self-supplied Domestic			
Withdrawn	12	13	15
Consumed	7	7	8
Irrigation/Livestock			
Withdrawn	3,485	3,780	3,360
Consumed	1,690	1,950	1,800
Self-supplied Industrial[1]			
Withdrawn	166	46	148
Consumed	74	26	65
Thermoelectric			
Withdrawn	105	27	74
Consumed	22	26	49
Total			
Withdrawn	4,026	4,190	4,036
Consumed	1,934	2,186	2,191

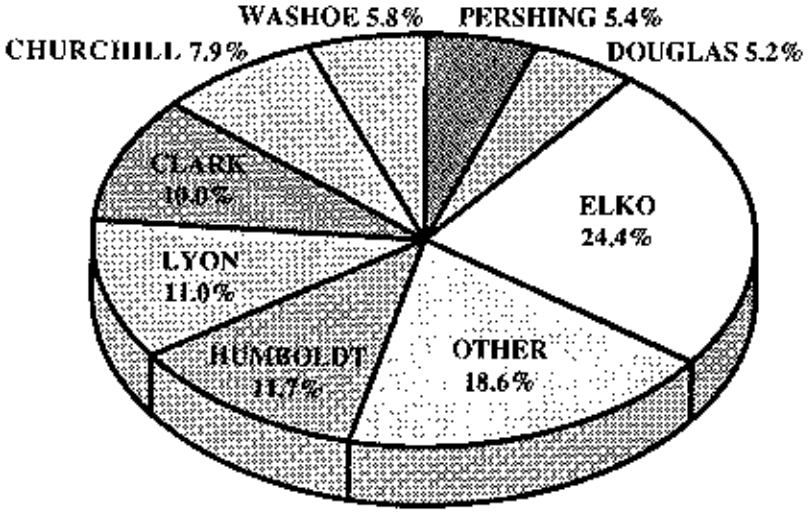
[1]Includes self-supplied industrial, commercial and mining uses. 1980 and 1985 values do not include mine pit dewatering amounts.

Sources: Crompton, J., Personal Communication, U.S. Geological Survey, June 1992.
Nevada Division of Water Planning, Forecast of County Municipal & Industrial Water Needs to the Year 2020, March 1992.
Nevada Division of Water Planning, Forecast of County Agricultural Water Needs to the Year 2020, March 1992.
Nevada Division of Water Planning, Mining Water Use in Nevada – 1990, May 1992.
U.S. Geological Survey, Estimated Use of Water in the United States in 1980, U.S. Geological Survey, 1983.
U.S. Geological Survey, Estimated Use of Water in the United States in 1985, U.S Geological Survey, 1988a.

Water Use



1990 STATEWIDE WATER WITHDRAWALS BY CATEGORY



1990 STATEWIDE WATER WITHDRAWALS BY COUNTY

Water Use

As shown on the following table, the irrigation/livestock sector withdraws more water per year than any other use category. Elko County withdrawals were the largest in the State with a majority of the County's water withdrawals used for irrigation.

Total water withdrawals are given in terms of gallons per capita (person) per day (gpcd) for each county. As expected the rural counties with agricultural and mining activities had the highest water use per person. For planning purposes, agricultural, mining and industrial water use is not usually reported in "gpcd" as these water uses are independent of the county/area population. Typically, per capita water use figures are utilized by planners for systems where a significant portion of the water use can be attributed to people, such as municipal water systems.

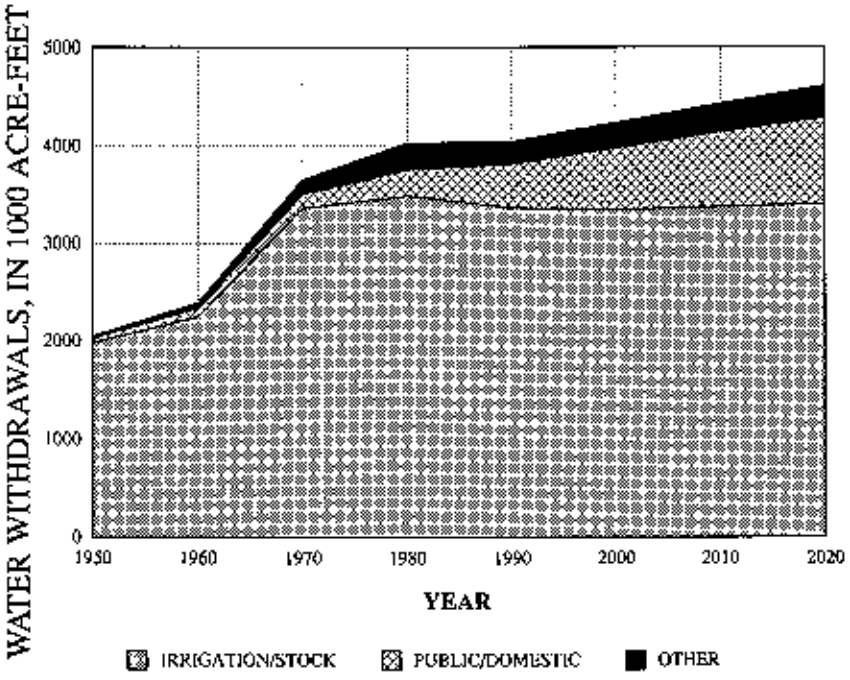
1990 TOTAL WATER WITHDRAWALS BY COUNTY AND CATEGORY

	Total Withdrawals, 1000 af/yr					
County	Public Supply and Domestic	Irrigation/ Livestock	Other[1]	Total	Population	Withdrawals, gpcd
Carson City	11.8	6.3	0.2	18.3	40,443	405
Churchill	4.2	288.1	26.3	31.6	17,938	15,855
Clark	311.7	41.3	50.4	403.4	741,459	485
Douglas	10.2	197.6	0.5	208.3	27,637	6,730
Elko	12.4	960.8	9.8	983.0	33,530	26,170
Esmeralda	0.3	40.3	12.8	53.4	1,344	35,470
Eureka	0.5	121.2	30.4	152.1	1,547	87,775
Humboldt	3.8	434.0	32.3	470.1	12,844	32,675
Lander	1.1	156.3	18.6	176.0	6,266	25,075
Lincoln	1.8	57.7	0.1	59.6	3,775	14,095
Lyon	5.2	432.8	5.9	443.9	20,001	19,815
Mineral	2.4	29.3	1.4	33.1	6,475	4,565
Nye	5.6	121.0	7.8	134.4	17,781	6,750
Pershing	1.4	216.5	1.7	219.6	4,336	45,215
Storey	0.4	1.3	3.5	5.2	2,526	1,840
Washoe	78.2	140.9	13.9	233.0	254,667	815
White Pine	3.4	114.6	6.0	124.0	9,264	11,950
State Total	454.3	3,360.0	221.7	4,036.0	1,201,833	3,000

[1]Industrial and thermoelectric
Note: Figures may not add to totals due to independent rounding.

Water Use

Forecasts of water use by various sectors have been performed by the Division of Water Planning. These estimates indicate that total withdrawals may increase by about 15% by the Year 2020. It is anticipated that withdrawals by each of the main water use sectors will increase during this period, with public-supply use experiencing the largest increase over the next 30 years. However agricultural water use will continue to represent a major portion of total Statewide water use.



HISTORIC AND PROJECTED TOTAL STATEWIDE WATER WITHDRAWALS

Water Use

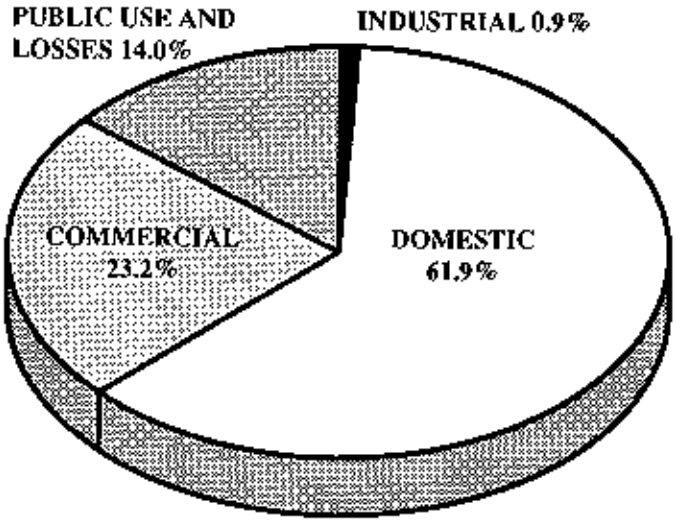
PUBLIC-SUPPLY WATER USE

As used in this booklet, public supply refers to water withdrawn by public and private water suppliers and delivered to domestic, commercial, and industrial uses. Public-supply water use is often referred to as municipal and industrial (M&I) water use.

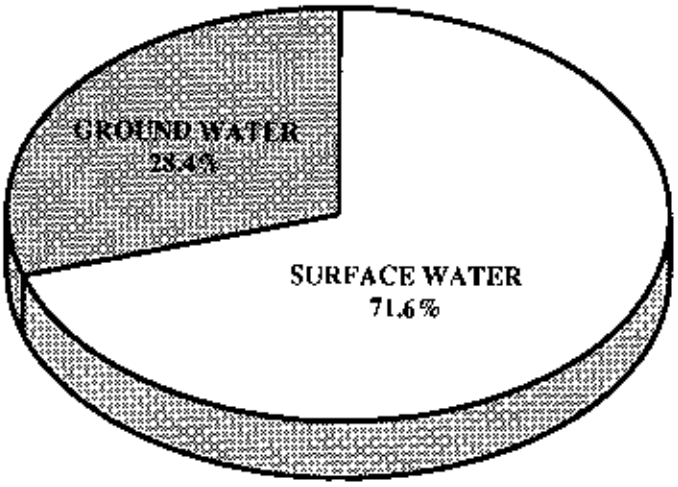
Approximately 93% of the State's population is served by public-supply systems. Population is a major factor affecting the amount of water needed for a particular public system. A common approach to reporting public water use is in terms of gallons per capita (person) per day (gpcd), allowing one to project the future water use of various water purveyors. The average Statewide public-supply water use was 320 gpcd in 1990. Of this total, 200 gpcd is attributed to residential (domestic) deliveries with 45% of this water used indoors and 55% used outdoors.

The following table presents water use information for selected public-supply water purveyors in Nevada. As the State's population grows, the demand for water by public-supply systems will increase. Estimates of future water demands of these purveyors and the 17 counties follow. For several of the selected purveyors, future water demands will exceed current water supplies within the next 30 years. The major purveyors, such as the Las Vegas Valley Water District, Westpac Utilities and others, are currently pursuing plans to increase water supplies to meet these demands. For the other systems in need of additional supplies, the Nevada Division of Water Planning is providing planning assistance as requested.

Water Use



1990 PUBLIC SUPPLY WATER DELIVERIES BY CATEGORY



1990 PUBLIC WATER WITHDRAWALS BY SOURCE

1990 FRESHWATER USE DATA FOR SELECTED WATER PURVEYORS

County/Water Purveyor	Population	Total Withdrawals (mgd)	Total Withdrawals (gpcd)	Residential Deliveries (gpcd)
Carson City				
Carson City Water	34,300	8.507	248	169
Churchill				
Fallon City Water	6,370	1.733	272	218
Clark				
Big Bend Water (Laughlin)	5,580	3.406	610	251
Boulder City Water	14,050	5.925	422	275
Henderson City Water	70,390	22.726	323	202
Las Vegas Valley Water District	592,040	201.062	340	197
Logandale (Moapa Valley Water)	5,000	1.771	354	154
Mesquite-Farmstead Water Assoc.	2,900	0.879	463	315[1]
North Las Vegas	84,580	24.270	286	213
Douglas				
Gardnerville Ranchos GID	7,550	2.286	303	276
Gardnerville Town Water	2,950	0.982	333	227[1]
Indian Hills GID	1,850	0.285	154	116
Kingsbury GID	1,500	1.283	855	497
Minden Town Water	2,200	0.928	422	288
Round Hill GID	1,005	0.245	244	222
Topaz Mutual Co, Inc.	1,440	0.170	118	110
Elko				
Carlin Utilities	2,870	0.694	242	165[1]
Elko City Water	18,000	5.318	295	201[1]
Spring Creek Utilities	5,130	1.328	259	212
Wells Municipal Water	1,250	0.894	717	489[1]
Wendover Town Water	2,200	1.745	793	556[1]
Esmeralda				
Goldfield Town Water	500	0.108	216	146[1]
Eureka				
Eureka Water Association	900	0.274	306	209[1]
Humboldt				
McDermitt Water	225	0.107	476	324[1]
Orovada Water District	120	0.055	458	317[1]
Winnemucca City Water	7,500	2.268	302	220
Lander				
Lander Co. Sewer & Water Dist. 1	5,000	0.820	164	112[1]
Lincoln				
Alamo Sewer and Water GID	525	0.275	524	358[1]
Caliente Town Water	1,220	0.576	472	366
Panaca-Farmstead Water Assoc.	800	0.400	499	359[2]
Pioche Public Utilities	475	0.163	343	234[1]

1990 FRESHWATER USE DATA FOR SELECTED WATER PURVEYORS (CONT'D)

County/Water Purveyor	Population	Total Withdrawals (mgd)	Total Withdrawals (gpcd)	Residential Deliveries (gpcd)
Lyon				
Dayton Town Utilities	1,825	0.571	313	152
Fernley Utilities	5,800	1.332	230	157[1]
Stagecoach GID	910	0.151	166	146
Yerington City Water	2,750	0.722	263	145
Mineral				
Hawthorne Utilities	5,000	1.091	218	123
Mina Water System	480	0.059	123	313
Nye				
Beatty Water & Sanitation Dist.	2,200	0.418	190	129[1]
Central Nevada Utilities	2,100	1.420	676	456[1]
Gabbs Town Water	720	0.220	305	208[1]
Tonopah Water System	4,475	0.794	177	65[2]
Pershing				
Lovelock Water System	3,250	1.075	330	222[2]
Storey				
Storey Co. Water District	1,150	0.196	170	115[1]
Washoe				
Incline Village GID	10,990	2.904	264	165
Purely Utilities	2,670	0.848	318	261
Reno-Park Water Company	3,060	0.423	138	123
Sun Valley Water	9,900	1.309	132	105
Westpac Utilities	191,000	56.366	295	180
Washoe County Utilities	8,945	2.456	275	265
White Pine				
Ely Municipal Water	6,500	2.583	397	298[1]
AVERAGE			320	200

[1] Assumed 75% of deliveries were for residential use

[2] System serves several residential dwellings with in-house businesses that are considered commercial by water purveyor

Source: Nevada Division of Water Planning, Forecast of County Municipal & Industrial Water Needs to the Year 2020, March 1992.

Water Use

WATER USE AROUND THE HOUSE

	Without Water Saving Fixtures, in gallons	With Water Saving Fixtures, in gallons
Toilet, per flush	3.5 – 7	1.6
Showerhead, per 5 minutes	15 – 40	10 – 12.5
Kitchen/lavatory faucet, 5 minutes	14 – 35	11
Dishwasher, per load	14	9.5 – 12
Washing machine, per full load	55	42 – 47.5

ESTIMATED RESIDENTIAL WATER USE IN NEVADA

Average annual residential use.....200 gpcd
- Outdoor use.....110 gpcd
- Indoor use .....90 gpcd
- Dishwashing.....3.5%
- Toilet.....21.3%
- Faucets.....22.1%
- Laundry 25.4%
- Showers/baths.....27.7%

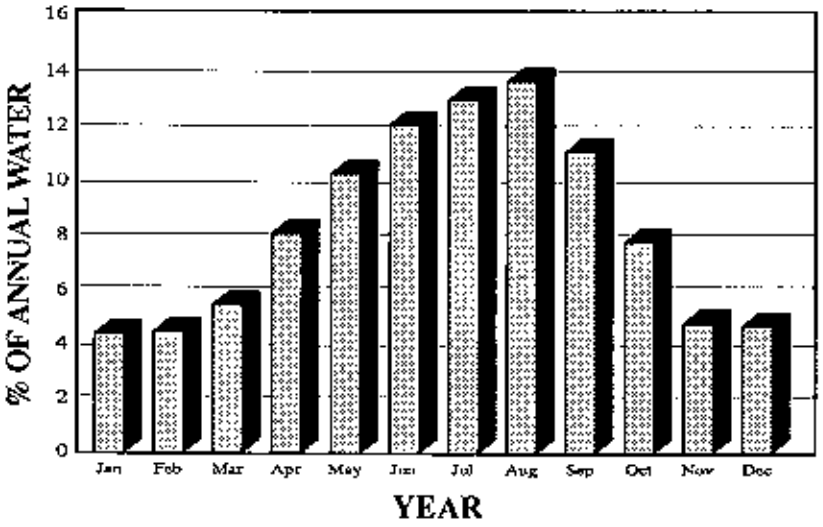
Sources: California Dept. of Water Resources, WaterPlan: Benefit/Cost Analysis Software for Water Management Planning – Water Conservation Assumptions, Oct. 1989.

Gupta, V.L. and D.E. Carlson, Residential Water Consumption in Reno-Sparks, Nevada, Desert Research Institute Publication No.41059,University of Nevada System, 1978.

Vickers, A., "Water-Use Efficiency Standards for Plumbing Fixtures: Benefits of National Legislation," American Water Works Association Journal, Vol. 82, No. 5, May 1990.

Westpac Utilities, Water Conservation Plan for Reno/Sparks Metropolitan Area – Draft Report, Reno, Nevada, March 1992.

Water Use



MONTHLY WATER USE DISTRIBUTION FOR TYPICAL PUBLIC-SUPPLY SYSTEM IN NEVADA

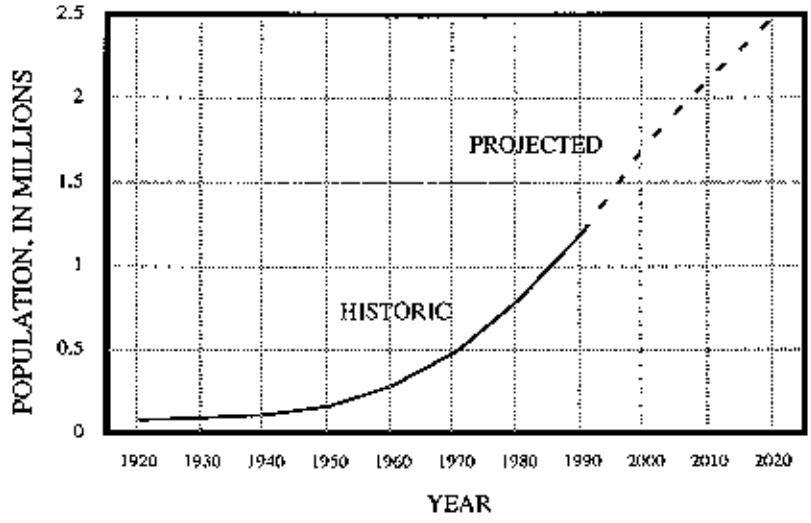
Boulder City, Nevada (Photo by Nev. Div. of Water Planning)

POPULATION AND M&I WATER USE (FRESHWATER AND REUSE) FORECASTS

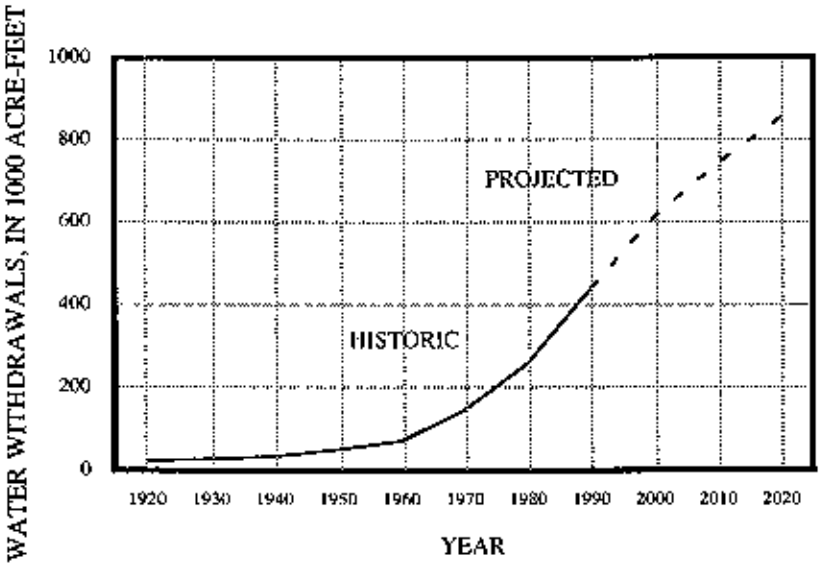
County	Population			
	1990	2000	2010	2020
Carson City	40,443	55,000	65,850	75,800
Churchill	17,938	25,000	30,250	35,100
Clark	741,459	1,096,700	1,362,100	1,606,200
Douglas	27,637	40,550	50,200	59,100
Elko	33,530	46,650	56,500	65,600
Esmeralda	1,344	1,850	2,250	2,600
Eureka	1,547	2,150	2,650	3,050
Humboldt	12,844	17,900	21,700	25,150
Lander	6,266	8,750	10,550	12,250
Lincoln	3,775	5,250	6,350	7,350
Lyon	20,001	27,900	33,700	39,100
Mineral	6,475	9,050	10,950	12,650
Nye	17,781	24,750	30,000	34,800
Pershing	4,336	6,050	7,350	8,500
Storey	2,526	3,550	4,250	4,950
Washoe	254,667	343,500	409,750	470,650
White Pine	9,264	12,900	15,600	18,150
State Total	1,201,833	1,727,500	2,120,000	2,481,000

County	Total Water Demand (1000 acre-feet per year)			
	1990	2000	2010	2020
Carson City	11.3	15.4	18.6	21.6
Churchill	2.6	3.5	4.3	4.9
Clark	307.6	431.8	522.4	600.5
Douglas	9.3	12.8	15.8	18.6
Elko	11.6	15.6	18.9	21.9
Esmeralda	0.2	0.2	0.3	0.3
Eureka	0.4	0.5	0.6	0.7
Humboldt	3.2	4.5	5.4	6.3
Lander	0.9	1.3	1.6	1.9
Lincoln	1.7	2.3	2.8	3.2
Lyon	3.9	5.9	8.2	10.6
Mineral	2.3	2.9	3.3	3.6
Nye	4.2	5.5	6.5	7.4
Pershing	1.2	1.7	2.1	2.4
Storey	0.3	0.5	0.6	0.7
Washoe	75.2	103.9	123.9	142.3
White Pine	3.2	4.8	5.9	6.8
State Total	439.2	613.1	741.0	853.9

Source: Nevada Division of Water Planning, Forecast of Municipal & Industrial Water Needs in the Year 2020, March 1992.
Note: Figures may not add to totals due to independent rounding.



HISTORIC AND PROJECTED STATEWIDE POPULATION



HISTORIC AND PROJECTED STATEWIDE M&I WATER USE

POPULATION FORECASTS FOR SELECTED WATER PURVEYORS (1990-2020)

County	Water Purveyor	Population 1990	2000	2010	2020
Carson City	Carson City Water	34,300	48,600	60,300	72,000
Churchill	Fallon City Water	6,370	10,200	13,000	15,600
Clark	Big Bend Water (Laughlin)[1]	5,582	17,522	28,040	35,352
	Boulder City Water[1]	14,054	19,277	23,430	26,327
	Henderson City Water[1]	70,387	126,901	175,471	215,816
	Las Vegas Valley Water Dist.[1]	592,038	805,416	947,223	1,072,437
	Nellis Air Force Base[1]	9,000	9,000	9,000	9,000
	N. Las Vegas City Water[1]	84,583	119,437	148,290	175,422
	Total[1]	775,644	1,097,553	1,331,454	1,534,354
	Mesquite-Farmstead Water	1,900	3,613	4,958	5,895
	Moapa Valley Water	5,000	6,900	8,400	9,600
Douglas	Gardnerville City Water	2,950	4,730	6,520	8,300
	Gardnerville Ranchos GID	7,545	10,600	13,000	15,300
	Minden City Water	2,200	3,530	4,850	6,175
Elko	Carlin City Water	2,870	3,650	4,250	4,800
	Elko City Water[2]	18,000	27,000	34,000	41,000
	Wells City Water	1,247	1,280	1,300	1,320
	Wendover City Water	2,200	3,100	3,700	4,300
Esmeralda	Goldfield City Water	500	680	830	960
Eureka	Eureka Water Association	896	1,250	1,550	1,750
Humboldt	Winnemucca City Water	7,500	9,500	11,000	12,400
Lander	Lander Co. Sewer/Water Dist. #1	5,000	7,000	8,400	9,800

[1] Population projections provided by WRMI Technical Committee (January, 1992).
[2] Population projections provided by F. Konakis, Elko City Engineer.

FRESHWATER WITHDRAWAL FORECASTS FOR SELECTED PURVEYORS (1990-2020)

Values in 1,000 acre-feet per year

County	Water Purveyor	Freshwater Use 1990	2000	2010	2020	Current Water Supply
Carson City	Carson City Water[1]	9.5	11.9	16.0	19.4	16.3
Churchill	Fallon City Water	1.9	3.1	3.9	4.7	3.9
Clark	Big Bend Water (Laughlin)[2]	3.8	10.7	16.6	20.3	
	Boulder City Water[2]	6.6	9.2	12.0	14.5	
	Henderson City Water[2]	25.5	47.5	69.8	84.3	
	Las Vegas Valley Water Dist.[2]	225.2	303.1	346.7	377.9	
	Nellis Air Force Base[2]	4.3	4.8	4.8	4.8	
	N. Las Vegas City Water[2]	27.1	31.7	43.7	52.9	
	Total[3]	292.6	406.9	493.6	554.6	452.6
	Mesquite-Farmstead Water	1.0	1.9	2.6	3.1	9.2
	Moapa Valley Water (Logandale)	2.0	2.7	3.3	3.8	4.4
Douglas	Gardnerville City Water	1.1	1.6	2.2	2.8	7.1
	Gardnerville Ranchos GID	2.6	3.2	4.0	4.6	4.6
	Minden City Water[4]	1.0	1.4	2.0	2.5	12.4
Elko	Carlin City Water	0.8	1.2	1.4	1.6	4.5
	Elko City Water[5]	6.0	9.8	12.4	14.9	17.2
	Wells City Water[6]	1.0	0.7	0.7	0.7	7.1
	Wendover City Water[7]	2.0	3.2	3.8	4.4	4.4
Esmeralda	Goldfield City Water	0.1	0.1	0.2	0.2	0.1
Eureka	Eureka Water Association[8]	0.3	0.4	0.5	0.5	1.5
Humboldt	Winnemucca City Water	2.5	3.2	3.7	4.2	5.9
Lander	Lander Co. Sewer/Water Dist. #1	0.9	1.3	1.6	1.8	2.9

[1] By the Year 2020, Carson City plans on having the necessary water rights and facilities to withdraw 22,331 AF/YR.

[2] Water use projections provided by WRMI Technical Committee (January, 1992).

[3] The WRMI Technical Committee projected available supply (at full allocation) for the major purveyors in Southern Nevada to be approximately 452,557 AF/YR. With conservation measures, this supply will meet demands until the Year 2006. The proposed Cooperative Water Project is planned to increase availability by 250,000 AF/YR.

[4] The water supply was calculated by expanding the diversion rate, actual supply may be less.

[5] Water use projections provided by F. Kotakis, Elko City Engineer.

[6] Water meters were installed in 1990. It was assumed that per capita water demands will decrease from 790 gpcd to 500 gpcd.

[7] Additional groundwater rights have been applied for which will increase available supply in excess of the Year 2020 demands.

[8] Reported available water supply without vested rights is 712 AF/YR. With vested rights included, available supply is 1,515 AF/YR.

POPULATION FORECASTS FOR SELECTED WATER PURVEYORS (1990-2020) (CONT'D)

County	Water Purveyor	Population 1990	2000	2010	2020
Lincoln	Alamo City Water[3]	525	920	1,150	500
	Caliente City Water	1,220	1,680	2,030	2,350
	Panaca-Farmstead Water[3]	802	950	1,140	1,370
	Pioche Public Utilities[3]	475	860	1,030	1,240
Lyon	Dayton City Water	1,824	4,500	7,000	9,500
	Fernley City Water	5,800	9,000	12,300	16,000
	Yerington City Water	2,750	3,700	4,800	5,930
Mineral	Hawthorne City Water	5,000	7,000	8,500	9,800
Nye	Beatty City Water	2,200	2,600	3,000	3,400
	Central Nevada Utilities (Pahrump)	2,100	4,100	6,100	8,100
	Gabbs City Water	721	740	760	780
	Tonopah City Water	4,475	5,800	6,800	7,700
Pershing	Lovelock City Water	3,250	5,000	6,000	6,900
	Imlay City Water	260	345	430	515
Storey	Virginia City Water	1,150	1,600	2,000	2,300
Washoe	Incline Village GID[4]	10,990	14,560	16,086	16,853
	Purity Water[5]	2,670	4,100	5,300	6,200
	Sun Valley Water[5]	9,900	13,900	16,600	19,500
	Washoe County Utilities[5]	8,945	15,900	19,400	22,900
	Westpac[5]	191,000	225,000	262,000	304,000
White Pine	Ely City Water	6,500	9,100	10,900	12,700

[3] Population projections from "Water Supply and Demand Studies of Various Community Areas within Lincoln County, Nevada", R.O. Anderson, March 4, 1991.

[4] Population projections were provided by Incline Village GID. Population growth is due in part to increased duration of occupancy of existing dwelling (transition from seasonal residency to more permanent residency).

[5] Population projections from "Regional Water Resources Plan" Regional Water Planning and Advisory Board, July , 1990.

Source: Nevada Division of Water Planning, Forecast of County Municipal & Industrial Water Needs to the Year 2020, March 1992.

FRESHWATER WITHDRAWAL FORECASTS FOR SELECTED PURVEYORS (1990-2020)

Values in 1,000 acre-feet per year

County	Water Purveyor	Freshwater Use 1990	2000	2010	2020	Current Water Supply
Lincoln	Alamo City Water[9]	0.3	0.5	0.7	0.9	0.9
	Caliente City Water	0.6	0.9	1.1	1.2	6.7
	Panaca-Farmstead Water[9]	0.5	0.4	0.5	0.6	1.3
	Pioche Public Utilities[9]	0.2	0.3	0.4	0.5	2.0
Lyon	Dayton City Water	0.6	1.3	2.0	2.8	2.5
	Fernley City Water	1.5	2.8	3.8	4.9	7.8
	Yerington City Water	0.8	1.1	1.5	1.8	4.0
Mineral	Hawthorne City Water	1.2	1.6	2.0	2.3	3.1
Nye	Beatty City Water	0.5	0.6	0.7	0.8	1.2
	Central Nevada Utilities (Pahrump)	1.6	3.0	4.5	5.9	18.2
	Gabbs City Water	0.2	0.3	0.3	0.3	0.3
	Tonopah City Water[10]	0.9	1.2	1.4	1.6	1.6
Pershing	Lovelock City Water[11]	1.2	2.0	2.4	2.7	3.8
	Imlay City Water	0.1	0.1	0.1	0.1	0.6
Storey	Virginia City Water[12]	0.2	0.4	0.5	0.5	...
Washoe	Incline Village GID[13]	3.3	4.3	4.7	5.0	4.0
	Purity Water[14]	1.0	1.4	1.8	2.1	2.1
	Sun Valley Water[14,15]	1.5	1.6	1.9	2.2	---
	Washoe County Utilities[14]	2.8	4.5	5.4	6.4	6.7
	Westpac[14,16]	63.2	75.9	88.6	101.2	77.3
White Pine	Ely City Water	2.9	4.2	5.1	6.0	6.5

[9] Water use projections from "Water Supply and Demand Studies of Various Community Areas within Lincoln County, Nevada", R.O. Anderson, March 4, 1991.

[10] Additional groundwater rights have been applied for which will increase available supply in excess of demands in the Year 2020.

[11] Current water supply may be limited by perennial yield.

[12] The State is in the process of writing a contract for the delivery of water from the Marlette Lake System to the Storey County Water System. The contract will provide for the delivery of sufficient water to meet the Year 2020 demands.

[13] In 1990, per capita water use was 390 gpcd. According to Incline Village GID, increased water use in the future will be attributed to increased domestic use. For projection purposes, 150 gpcd was assumed for that population over the 1990 population.

[14] Water use projections from "Regional Water Resources Plan", Regional Water Planning and Advisory Board, July 1990.

[15] Westpac Utilities wholesales water to Sun Valley Water.

[16] According to R. Squires, Westpac, the total available supply for Westpac as of September 1, 1991 is 77,313 AF/YR. New subdivisions and other projects to be served by Westpac are required to turn over sufficient water rights to Reno, Sparks, or Washoe County. These rights are then contracted or leased to Westpac, increasing Westpac's total available supply. With the advent of the negotiated settlement (Public Law 101-618), Westpac is projected to have 119,000 AF/YR within the next 40 years. In addition, Westpac is considering numerous alternatives to further increase total available supply as required to meet future needs.

Water Use

MINING WATER USE

During the 1980's, the Nevada mineral industry experienced tremendous growth with total mineral production (excluding geothermal and petroleum) reaching an all-time high of $2.7 billion in 1990 (Nevada Bureau of Mines & Geology, 1991). This recent growth would not have occurred without the availability of economic water supplies for mineral extraction and concentration.

Minerals mined in Nevada can be divided into two categories, metals and industrial minerals. Metals mined in Nevada include gold, silver, lead, zinc, molybdenum and copper. Industrial minerals include aggregate, barite, cement, clay, gypsum, lime, diatomite, lithium carbonate and silica. Water use varies widely among operations and is dependent upon the mineral being recovered and the recovery process employed. The following table provides county water use estimates for the major metal and industrial mineral operations.

Future mineral production and water usage by mines in Nevada is difficult to predict because of the volatile nature of the industry. With gold and silver operations accounting for over 70% of the State mining water use, any significant future changes in gold and silver production will impact total mining water use. Large metal mining operations in Northern Nevada are currently contemplating significant mine dewatering operations on the order of over 100,000 acre-feet annually by the turn of the century. Implementation of these plans could double current mining water withdrawals.

1990 MINING WATER USE ESTIMATES

County	Withdrawals		Consumptive Use	
	(mgd)	(af/yr)	(mgd)	(af/yr)
Carson City	0.003	3	0.003	3
Churchill	0.081	90	0.078	87
Clark	2.892	3,239	2.141	2,399
Douglas	0.121	136	0.117	131
Elko	3.930	4,402	3.526	3,950
Esmeralda	11.392	12,761	8.870	9,936
Eureka	22.993	25,755	11.114	12,499
Humboldt	24.233	27,144	6.216	6,963
Lander	16.587	18,580	6.647	7,445
Lincoln	0.103	115	0.100	112
Lyon	2.481	2,779	0.956	1,071
Mineral	1.226	1,374	1.208	1,353
Nye	6.518	7,301	6.471	7,248
Pershing	1.490	1,669	1.432	1,604
Storey	0.205	230	0.184	206
Washoe	2.175	2,436	0.786	881
White Pine	2.615	2,930	2.524	2,828
State Total	99.045	110,944	52.380	58,666

Source: Nevada Division of Water Planning, Mining Water Use in Nevada – 1990, May 1992.

Barrick Goldstrike mine and mill (Photo by American Barrick Resources)

Water Use

AGRICULTURAL WATER USE

In 1990 irrigation accounted for about 83 percent of total water withdrawals in Nevada. Irrigated crops grown in Nevada include alfalfa and other hay, winter and spring wheat, potatoes, alfalfa seed, and vegetables. Harvested croplands account for approximately 70 percent of all irrigated lands, with the remaining 30 percent being irrigated pasture. Actual irrigated acreage amounts vary from year to year depending upon several factors, including water availability. Over the last 20 years, total irrigated acreage has fluctuated between 711,000 acres and 882,000 acres, with current (1990) levels at approximately 766,200 acres.

Nevada has experienced rapid population growth during the past three decades. As a result, pressure is being exerted on agricultural water right holders to sell their water rights to other users. Population projections by the Nevada Division of Water Planning suggest Nevada's population may double by the Year 2020 further increasing the competition for water supplies. Responsible planning will be needed to meet the future needs of agriculture. To assist in the planning process, the Division of Water Planning has forecasted future irrigation water needs for each of the counties. The results of these forecasts are presented in the following table.

IRRIGATION WATER WITHDRAWALS AND CONSUMPTIVE USE FORECASTS

County	Withdrawals (af/yr) 1990	2000	2010	2020
Carson City	6,300	5,670	4,830	4,200
Churchill	286,700	235,000	235,000	235,000
Clark	40,880	34,160	27,440	20,720
Douglas	197,000	194,500	191,500	189,000
Elko	956,120	996,380	1,036,480	1,076,660
Esmeralda	39,990	39,990	39,990	39,990
Eureka	120,840	120,840	120,840	120,840
Humboldt	432,180	432,180	432,180	432,180
Lander	155,250	161,100	167,400	173,250
Lincoln	57,400	60,600	63,960	67,240
Lyon	431,500	431,500	431,500	431,500
Mineral	29,150	30,475	32,065	33,390
Nye	120,540	117,600	115,080	112,140
Pershing	215,730	215,730	215,730	215,730
Storey	1,280	1,280	1,280	1,280
Washoe	139,950	132,075	124,425	116,550
White Pine	113,900	113,900	113,900	113,900
State Total	3,344,710	3,322,980	3,353,600	3,383,570

County	Consumptive Use (af/yr) 1990	2000	2010	2020
Carson City	3,150	2,835	2,415	2,100
Churchill	176,900	145,000	145,000	145,000
Clark	26,280	21,960	17,640	13,320
Douglas	90,620	89,470	88,000	86,940
Elko	513,040	534,600	556,160	577,720
Esmeralda	25,110	25,110	25,110	25,110
Eureka	73,140	73,140	73,140	73,140
Humboldt	226,380	226,380	226,380	226,380
Lander	82,800	85,920	89,280	92,400
Lincoln	37,800	39,960	42,120	44,280
Lyon	198,490	198,490	198,490	198,490
Mineral	13,750	14,375	15,125	15,750
Nye	77,490	75,600	73,980	72,090
Pershing	110,160	110,160	110,160	110,160
Storey	640	640	640	640
Washoe	68,420	64,570	60,830	56,980
White Pine	70,350	70,350	70,350	70,350
State Total	1,794,520	1,778,560	1,794,910	1,810,850

Source: Nevada Division of Water Planning, Forecast of County Agricultural Water Need to the Year 2020, March 1992

REUSE OF WASTEWATER TREATMENT PLANT EFFLUENT

Increasingly stringent wastewater discharge requirements coupled with scarce supplies of freshwater are inducing municipalities and industries to seek alternative uses of wastewater rather than treatment and subsequent discharge to a stream or to a groundwater aquifer. The most common use of treated wastewater is land application for irrigation of agricultural land or urban areas, such as golf courses.

The reuse of wastewater treatment plant effluent has increased in Nevada in recent years. In 1979 there were approximately 12 reuse application sites (Division of Water Planning, Sept. 1979). By 1990 the number had increased to over 20. Current uses of reclaimed wastewater effluent in Nevada include agricultural irrigation, golf course and landscape irrigation, industrial uses, wetlands applications, and construction water. In 1990 public wastewater treatment facilities discharged approximately 150 mgd (170,000 af/year). Of this amount, only about 9 percent was reclaimed directly for the above uses. However, if one takes into account the effluent that is discharged to a river, such as the Truckee and Colorado Rivers, and later diverted by other users, the effluent reuse percentage exceeds 90%.

1990 RECLAIMED WATER USE IN NEVADA

County	Total Releases from Public Sewage Treatment Facilities (mgd)	(1000 af)	Reclaimed Water Use (mgd)	(1000 af)
Carson City	3.80	4.26	2.48	2.78
Churchill	1.18	1.32	0.01	0.01
Clark	104.98	117.59	4.34	4.86
Douglas	3.48	3.90	3.38	3.79
Elko	3.84	4.30	0.99	1.11
Esmeralda	0.03	0.03	0.00	0.00
Eureka	0.06	0.07	0.00	0.00
Humboldt	0.89	1.00	0.00	0.00
Lander	0.46	0.52	0.00	0.00
Lincoln	0.31	0.35	0.00	0.00
Lyon	0.95	1.06	0.32	0.36
Mineral	0.49	0.55	0.00	0.00
Nye	0.76	0.85	0.07	0.08
Pershing	0.25	0.28	0.00	0.00
Storey	0.10	0.11	0.00	0.00
Washoe	29.40	32.93	1.32	1.48
White Pine	1.25	1.40	0.37	0.41
State Total	152.23	170.52	13.28	14.88

Source: Reports filed with Nevada Division of Environmental Protection

Irrigating Carson City golf course with reclaimed water
(Photo by Nev. Div. of Water Planning)

Water Issues

The following is a summary of some of the water issues concerning Nevadans statewide. The information presented is meant to provide a brief overview of each issue. If the reader desires additional information please contact the Division of Water Planning.

Negotiated Settlement (Public Law 101-618)

The latest effort to resolve long-standing disputes over water and water rights on the Truckee River has been the enactment of congressional settlement legislation for the Truckee and Carson Rivers. This legislation, known as Public Law 101-618 or the Fallon Paiute Shoshone Tribal Settlement Act and the Truckee-Carson-Pyramid Lake Water Rights Settlement Act, was approved by the 101st Congress at the end of its 1990 session (California Dept. of Water Resources, June 1991). Main topics covered by the legislation are:

- An interstate allocation between California and Nevada is made of the use of waters of the Truckee and Carson Rivers. Provisions are made for transfer of water and water rights.

- A number of contingencies are placed on the effective date of the legislation, and the various parties involved are required to dismiss assorted litigation.

- A new operating agreement is to be negotiated for the Truckee River. The agreement will include a water rights agreement negotiated by Sierra Pacific Power Company and the Pyramid Lake Paiute Tribe and ratified by the federal government.

- The Newlands Project is reauthorized to serve additional purposes, including recreation, fish and wildlife,

and as a municipal water supply for the Fallon area. An efficiency study of the Newlands Project is required. The Secretary of the Interior is directed to enforce Newlands Project compliance with OCAP (Operating Criteria and Procedures).

- A recovery program is to be developed for the Pyramid Lake cui-ui and Lahontan cutthroat trout. Water right acquisitions are authorized. Provisions are made for a study on improving stream channel conditions in the lower Truckee River above Pyramid Lake. A tribal economic development fund of $40 million is established for the Pyramid Lake Paiute Tribe. Another fund of $25 million is established for the lake's fishery.

- A water rights purchase program is authorized for the Lahontan Valley wetlands with the intent of sustaining a long-term average of 25,000 acres of wetlands.

- The Fallon Paiute Shoshone Tribal Settlement Act establishes a settlement fund for this Tribe totaling $43 million. The Tribe is authorized to purchase land and water rights to consolidate tribal holdings within the reservation.

Pyramid Lake Cui-ui Recovery Program

The cui-ui is a lake sucker found only in Pyramid Lake and was federally listed as endangered on March 11, 1967. Reduction of Truckee River inflow to Pyramid Lake, caused by upstream storage and diversions of water, was the primary agent producing conditions which led to the endangered status of cui-ui.

The first cui-ui recovery plan was written in 1978 by a Cui-ui Recovery Team composed of representatives from the U.S. Fish and Wildlife Service, Nevada Department of Wildlife, and Pyramid Lake Paiute Indian Tribe. This plan was updated in 1980 and revised in 1984, and since that time has guided recovery actions. Pursuant to the Endangered Species Act, the current Cui-ui Recovery Team has revised the recovery plan. The Recovery Plan identifies a variety of conservation measures which, if implemented individually or in combination, could result in reclassification or recovery of the cui-ui (U.S. Fish and Wildlife Service, 1992).

Pyramid Lake (Photo by Steve Van Denburgh, U.S. Geological Survey)

Truckee River Operating Agreement

The Truckee River is currently operated in accordance with the 1935 Truckee River Agreement, the 1944 Orr Ditch Decree and various flood criteria. Since that time, conditions on the Truckee River have changed, e.g. new reservoirs have been built or acquired by Truckee River water users, and the Lahontan cutthroat and the cui-ui have been classified as threatened and endangered species, respectively. For the last decade efforts have been made to establish a new river operating agreement which would provide additional drought storage for municipal use and additional river flows when needed to support cui-ui spawning.

In 1989, the Pyramid Lake Paiute Tribe and Sierra Pacific Power Company signed a Preliminary Settlement Agreement, which if certain conditions were satisfied would allow water to be stored in Stampede Reservoir and used by Sierra Pacific for drought supplies in drought years, and by the Tribe for fish purposes in normal and wet years. In 1990, Congress passed Public Law 101-618, referred to as the Negotiated Settlement. When conditions of Public Law 101-618 are fulfilled, the Preliminary Settlement Agreement will take effect and the Truckee River will be operated in accordance with a new agreement known as the Truckee River Operating Agreement or TROA. This new agreement will incorporate provisions of the 1989 Preliminary Settlement Agreement and Public Law 101-618.

Currently members of several California, Nevada and Federal agencies as well as Sierra Pacific Power Company, Pyramid Lake Paiute Tribe, Truckee-Carson Irrigation District, Washoe County Water Conservation District and others are engaged in drafting an operating agreement and conducting environmental evaluations. The schedule prepared by the U.S. Bureau of Reclamation indicates that a final operating agreement and all environmental analysis will be completed by the end of 1995 (Moser, July 1992).

Lahontan Valley Wetlands

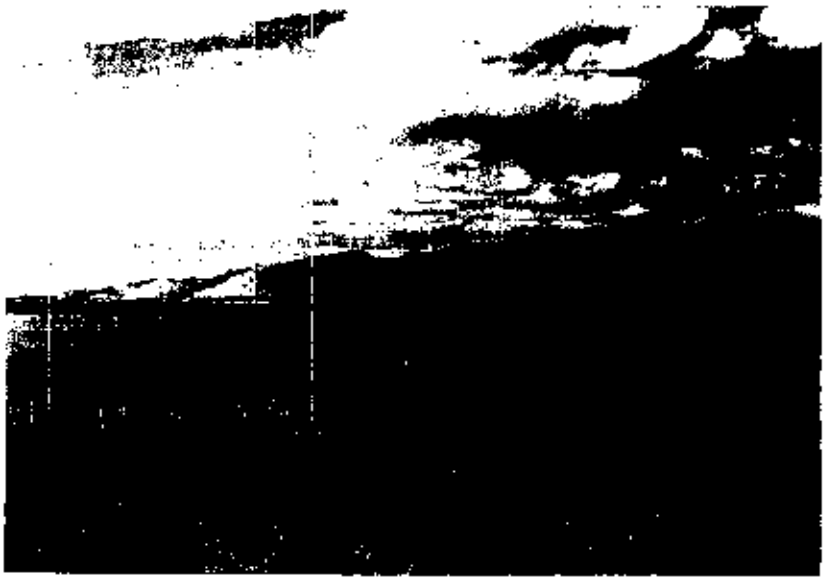
Located in Northern Nevada, near Fallon, the Stillwater National Wildlife Refuge and Management Area and the Lahontan Valley Wetlands represent a critical wetland ecosystem in Nevada and a key "steppingstone" on the Pacific flyway.

Efforts are underway to increase the quantity and quality of water entering the Lahontan Valley Wetlands. Section 206 of Public Law 101-618 authorized and directed the U.S. Secretary of the Interior, in conjunction with the State of Nevada and other parties, to acquire by purchase or other means sufficient water and water rights to sustain, on a long term average, approximately 25,000 acres of primary wetland habitat within Lahontan Valley. The three primary wetland areas have been identified as the Stillwater National Wildlife Refuge and Management Area, Carson Lake and Pasture, and Fallon tribal land wetlands.

The U.S. Fish and Wildlife Service has begun the Environmental Impact Statement process to examine environmental, economic, and social effects of converting agricultural water from the Newlands Project to environmental uses as needed to maintain 25,000 acres of wetlands.

Newlands Project Operating Criteria and Procedures

The Newlands Project, one of the first Bureau of Reclamation projects, provides water for irrigation, incidental domestic, and other water needs to a defined service area in the lower Carson River basin near Fallon. Water for the project is



Stillwater wetlands (Photo by Nev. Div. of Water Planning)

supplied from the Truckee and Carson Rivers. Water from the Truckee River is diverted at Derby Dam and conveyed to the project via the Truckee Canal.

Competition for the limited water supplies of the Truckee and Carson Rivers has led to a number of lawsuits. One of the major disputes is known as the OCAP litigation, named after the Operating Criteria and Procedures for the Newlands Project. The OCAP originally arose from the efforts of

the Bureau of Reclamation to develop a method of Newlands Project operation that would maximize the use of Carson River water in the project and minimize the diversion of Truckee River water to the project. The concept was a response to the 1967 listing of the Pyramid Lake cui-ui as an endangered species under the Federal Endangered Species Act. A 1973 decision, resulting from litigation instigated by the Pyramid Lake Paiute Tribe, held that water was being wasted in the Newlands Project and that the Bureau of Reclamation was required to deliver to Pyramid Lake the water in excess of valid Newlands Project rights. Subsequently, the Bureau of Reclamation began to issue an interim OCAP each year.

On April 15, 1988, the Secretary of the Interior adopted Operating Criteria and Procedures (OCAP) for the Newlands Project. This OCAP contains rules and incentives to ensure reasonable, efficient water management on the project through reliance on local control and initiatives. Public Law 101-618 directs the Secretary of the Interior to enforce compliance with OCAP. Compliance is measured based upon facts which can be readily determined and reviewed by the Truckee-Carson Irrigation District and the U.S. Bureau of Reclamation.

Walker Lake

Walker Lake, a remnant of the ancient Lake Lahontan at the terminus of Walker River, is rapidly declining in both volume and quality. Since 1920 the surface elevation of Walker Lake has dropped over 110 feet, and the alkalinity of the water is increasing to a point which affects the longevity

Cutting alfalfa in the Newlands Project (Photo by Nev. Div. of Water Planning)

of the existing cutthroat trout population. If the current trend continues, trout habitat in the lake will no longer exist (Cooper and Koch, 1984).

Walker Lake water levels are expected to decline for several more decades. An average annual lake inflow of about 100,000 acre-feet (Rush, 1974) and average annual evaporation of about 150,000 acre-feet (based upon 1990 water surface area) results in an annual deficit of about 50,000 acre-feet. The Division of Water Planning has estimated that Walker Lake is likely to reach equilibrium (evaporation losses = lake inflow) in about 50 to 100 years. At that time, the total

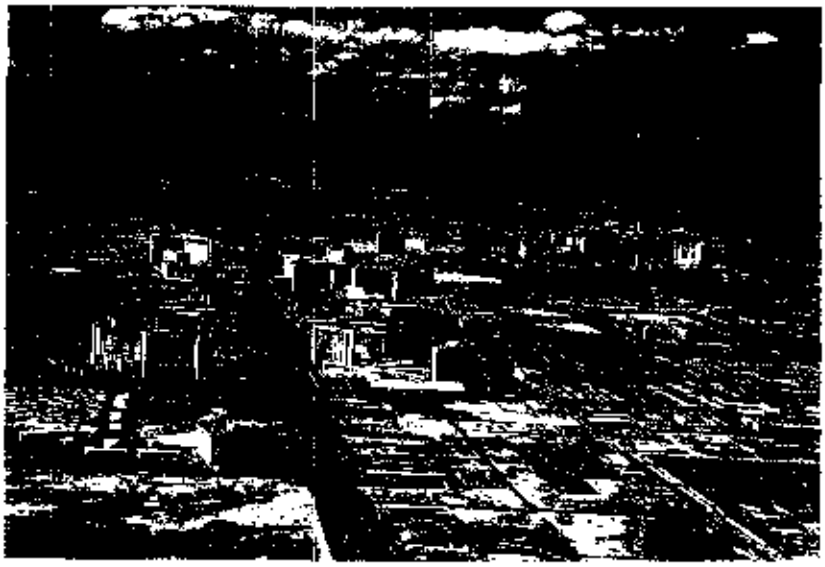
water volume of the lake will be about one-fourth of the current volume and the lake will cease to exist as a viable fishery.

Cooperative Water Project

The Cooperative Water Project (CWP) is a proposed water supply project to meet future water needs in the Las Vegas area. Water use projections performed for Southern Nevada have indicated that the region's available water supply will not be able to support projected development beyond 2002. Implementation of a responsible water conservation program will further extend that time until 2006 (WRMI, January 1991).

Realizing that the available water in the region may soon be inadequate for projected needs, the Las Vegas Valley Water District filed 146 applications for unappropriated water in 28 basins in four counties. After preliminary evaluations of the available supply were made, applications in 7 of these basins were withdrawn. Before CWP can become a reality, it will first be necessary for the State Engineer to grant water right permits for these applications.

The project goal is to develop about 250,000 acre-feet, 180,000 acre-feet of groundwater and 70,000 acre-feet of water from the Virgin River. This may require as much as 1,000 miles of pipeline, 200 or more groundwater production wells, monitoring wells, desalinization facilities, numerous pumping plants, and associated electrical facilities. The CWP is scheduled to bring water into the valley by 2007 (Katzer and others, March 31, 1992). It is anticipated that the CWP will provide sufficient additional water to meet Southern Nevada's needs beyond the Year 2030 (with conservation).



Las Vegas, Nevada (Photo by Steve Van Denburgh, U.S. Geological Survey)

Desalination of Virgin River Water

Under the proposed Cooperative Water Project (CWP), up to 70,000 acre-feet of Virgin River water would be diverted to meet future water needs in the Las Vegas area. Virgin River water is highly saline at 1,500 to 3,500 milligrams per liter (mg/l), exceeding the State drinking-water standard of 1,000 mg/l. Desalination of these waters will be necessary to produce a potable water supply. In order to minimize desalting requirements, water would be diverted from the Virgin River during high flow months (November through April), desalinated and then piped to entities in Las Vegas Valley. This would reduce the salt loading of the Colorado River which has a monetary benefit to downstream users, and would also supply a source of needed potable water. The cost of desalting Virgin River water would hopefully be paid by the federal government to meet salinity treaty obligations with Mexico.

Another option for utilization of Virgin River water is to allow the water to flow naturally down to the Colorado River for diversion at the existing intakes of the Southern Nevada Water System, which presently serves the Las Vegas area. This "wheeling" of water would alleviate the need for direct desalination of Virgin River water due to dilution by the greater flow of the Colorado River. However, there are political, institutional and legal issues which must be resolved before this can occur.

Truckee Meadows Project (Honey Lake Valley)

The Truckee Meadows Project (TMP) is designed to import groundwater from the Fish Springs Ranch area in the Nevada portion of the Honey Lake Valley, located approximately 35 miles north of Reno. TMP is uniquely organized in that a private company, Western Water Development Company, provided the initial capital to verify the viability of the project for a public entity. Thereafter Washoe County is in the process of implementing the project.

In June of 1989 Washoe County filed the necessary applications with the State Engineer for the interbasin transfer. On March 1, 1991, following extensive public hearings, approval was granted to transport 13,000 acre-feet of water from Honey Lake Valley to the Reno-Sparks area.

The proposed project consists of approximately 10 wells, 39 miles of buried water pipeline 36" in diameter, pump booster station, storage tanks, and necessary distribution system to Lemmon and Spanish Springs Valleys, an area north and adjacent to Reno and Sparks. Upon completion of the EIS (Environmental Impact Statement) process, financing for construction will be obtained from the State Board for Financing Water Projects. Delivery of materials and construction are anticipated to take from 9 to 12 months. Project costs have been estimated at $85 million for engineering, construction,

and contingencies; $30.5 million for associated water rights, and $2 million for annual operating expenses (Holt, July 1992).

Bodie Dam Project

During the 1985 legislative session, Assembly Bill 289 was passed which established a Committee to Study the Carson River which "...shall collect and evaluate information concerning the hydrology of the Carson River and its tributaries and the feasibility of constructing reservoirs, to be used for multiple purposes, in the Carson River basin above Lahontan Reservoir." Kennedy/Jenks/Chilton Consulting Engineers (KJC) was selected to perform the needed professional services required to fulfill the objectives established by this committee.

During average years, Carson River water users in Douglas and Lyon Counties and Carson City currently have sufficient water supplies for existing needs. KJC has estimated that by the Year 2010, additional water resources will be needed in these areas. In 1987 KJC recommended the Bodie Dam Project for meeting future demands in Douglas and Lyon Counties and Carson City. The proposed Bodie Dam would be located on the East Fork of the Carson River downstream of the California-Nevada state line. Bodie Dam would be either an earth fill or roller compacted concrete dam approximately 200 feet in height and would impound approximately 50,000 acre-feet of water. Bodie Reservoir would be filled through water rights acquired downstream, and would provide approximately 36,000 acre-feet of additional water each year for use in Douglas and Lyon Counties and Carson City. In addition, the Bodie Dam Project would provide flood control and recreational benefits.

The 1989 Legislature restructured the Carson Water Subconservancy District to expand the authority of the District and directed it to continue water supply investigations with particular emphasis on the proposed Bodie Dam. Since that time, the District has completed preliminary geologic reconnaissance and foundation studies, additional population and water demand forecasts, and a review of regulatory and permitting requirements. Further development of the Bodie Dam Project is pending completion of the Douglas County master planning process currently underway (Forest, July 1992).

Safe Drinking Water Act

The Safe Drinking Water Act of 1974 provides for the safety of drinking water supplies throughout the United States by establishing and enforcing national drinking water quality standards. Congress authorized the Environmental Protection Agency (EPA) to support state and local community drinking water programs by providing financial and technical assistance to undertake research and study efforts.

Under the Safe Drinking Water Act (SDWA), EPA has the primary responsibility of establishing the national standards; the States are responsible for enforcing the standards and otherwise supervising public water supply systems and sources of drinking water.

In response to mandates of the 1986 amendments to SDWA, EPA is developing, proposing, and adopting new drinking water regulations that are significantly changing water treatment practices and water utility operations. Since passage of the 1986 amendments, regulations for volatile organic chemicals, fluoride, surface water treatment, total coliform bacteria, synthetic organic and inorganic chemicals, and lead and copper have been promulgated by EPA. Additional regulations regarding radionuclides (radon), other synthetic organic and inorganic chemicals, and disinfection are anticipated.

The cost of these new regulations to water systems in Nevada is significant. It has been estimated that $100 to $170 million in capital improvements are needed throughout the State for compliance with these latest regulations. Financial assistance for SDWA compliance projects is available through a State loan/grant program established by AB 197 and AB 198. This program is administered by the State Board for Financing Water Projects.

Drought

As Nevada is the driest State in the Nation, drought is relatively common and expected. Every 6 out of 10 years, the major rivers in the State experience below average flows. For most of Nevada, which depends mostly on streamflow for water supply, a drought is considered to be a period of 2 or more consecutive years in which streamflow is much less than average. The most significant droughts were during 1928-37, 1953-55, 1959-62, 1976-77, and 1987-92. Droughts can magnify quality problems for surface and groundwater sources. By decreasing streamflow, droughts tend to lessen the quality of remaining water for human and wildlife uses. Droughts also can cause more reliance on groundwater sources which may stress the resource beyond its long-term potential.

In 1987 Governor Bryan formed the Drought Review and Reporting Committee (DRRC) to inform the citizens of Nevada about climatological conditions and the severity of the current drought. As the drought progressed the DRRC helped produce a State Drought Plan that outlines the State and Federal actions that can be taken during various stages of drought. Following is a summary of drought impacts during the period 1987-1992.

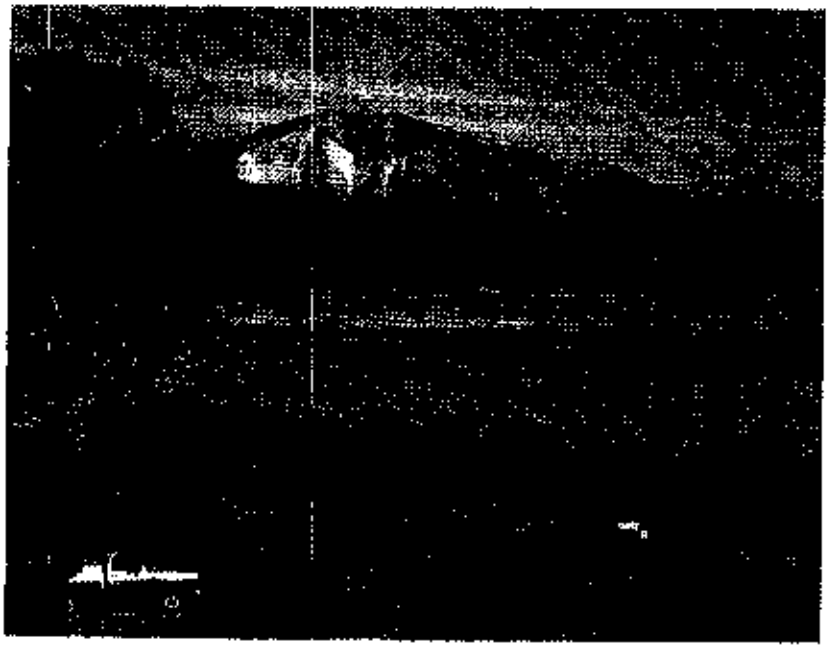
1987-1992 Drought Impact Summary

Municipalities in Nevada have done very well coping with the drought. Two small towns (Midas and Tuscarora) have had their springs dry up resulting in temporary water hauling operations to provide drinking water. Both of these towns are switching to more reliable groundwater supplies. Frugal water management and water conservation efforts have allowed the citizens of Reno and Sparks to continue outdoor watering, even with their main source of water (Truckee River) greatly reduced.

Agriculture has been severely impacted by the drought. Crop and livestock losses for 1991 totaled more than $22 million. Emergency programs provided to farmers have totaled $6 million. In 1992 Lovelock Irrigation District received only 5% of their required water, Truckee-Carson Irrigation District 30%, and the Walker River Irrigation District 40%. Losses in 1992 are expected to exceed those of 1991.

Fish and wildlife have been significantly stressed due to the drought. Many of Nevada's wetland areas are either dry or are severely diminished. These wetlands are important resting stops for migratory birds. The limited availability of food and habitat will stress the birds during migration and increase mortality rates. The drought has resulted in minimum pools in most of Nevada's reservoirs. The fisheries in these pools are significantly stressed due to increases in temperature and oxygen depletion.

Water-based recreation has been severely impacted at Lahontan, Rye Patch and several other smaller Nevada reservoirs. Visitor counts at these reservoirs are low, and boating access is limited or nonexistent.



Dry Washoe Lake-1992 (Photo by Nev. Div. of Water Planning)

Water Conservation

The rapidly growing population and economy of Nevada will require ever increasing amounts of water in the future, however available sources for meeting these needs are limited. Part of the solution is the implementation of water conservation measures. The ability of conservation measures to extend supplies, and delay and/or reduce the need for future supply development has been documented.

Water Issues

Water conservation will continue to be a critical component of overall water management. As William O. Maddaus (May 1990) notes, "the time is past when [water supply] needs can be met simply by building more water storage and delivery systems." The challenge facing water suppliers in today's political, environmental, and economic climate, he concludes, "is to fully integrate our findings on demand management into long-range water supply planning."

Recognizing the need for conservation, the 1991 State Legislature passed Assembly Bill (AB) 359 and Senate Bill (SB) 360. AB 359 requires each county and city to impose certain minimum standards for plumbing fixtures, by building codes or ordinance, for new residential, commercial, or industrial construction beginning on or after March 1, 1992.

In accordance with SB 360, each supplier of water for municipal, industrial or domestic purposes is required to adopt a water conservation plan based on the climate and the living conditions of its service area. The plan is to include provisions relating to:

- Increasing public awareness of the State's limited water supply and the need to conserve;
- Identifying and reducing leakage in water supplies, inaccuracies in water meters, and high pressure situations;
- Increasing the reuse of wastewater treatment plant effluent;

- Contingency plan for drought conditions that ensures an adequate supply of potable water; and

- Adoption of a plan to provide incentives to encourage water conservation; to retrofit existing structures with reduced flow plumbing fixtures; and for installation of landscaping that uses a minimal amount of water.

Environmental Issues

Carson River Mercury Site. Various studies have indicated that Carson River sediment, water, and aquatic biota contain higher than background mercury levels. The source of this mercury has been traced to the historic Comstock Lode mills which used mercury to separate silver and gold from the ore. Since 1985, a fish consumption health advisory has been issued for portions of the Carson River and Lahontan Reservoir because of elevated mercury levels in game fish.

In August 1990, the U.S. Environmental Protection Agency (EPA) listed the Carson River Mercury Site (CRMS) as a Superfund site because of the potential threat to human health and the area environment. CRMS includes a 100-mile stretch of the Carson River beginning below Carson City and extending downstream below Lahontan Reservoir to Stillwater National Wildlife Refuge; and tailing piles and sediments in Gold, Sixmile, and Sevenmile Canyons. Currently, studies are underway to identify the extent of the problem and the human health and ecological risks.

Leaking Underground Storage Tanks. Leaking Underground Storage Tank (LUST) systems threaten human health and the environment by contaminating groundwater and possibly causing fires or explosions. In response to the increasing number of leaking tanks and the resulting environmental damage, federal regulations were developed which set minimum installation standards. These standards have been designed to prevent leaks and spills from Underground Storage Tank (UST) systems. The majority of tanks affected by these regulations store petroleum products. In accordance with the regulations, all tank systems must have leak detection installed by December 1993. By December 1998 all unprotected tank systems must be upgraded with corrosion protection and have spill and overfill devices, or be replaced or removed using proper installation or closure methods.

The State of Nevada has adopted the federal regulations, and requires certification for tank installers, testers, and cleanup consultants. In Nevada, there are over 9,000 USTs (at about 3,000 sites) registered with the Nevada Division of Environmental Protection. Of these, about 3,300 USTs have been identified as LUSTs. About 2,600 LUSTs have been cleaned up and closed in accordance with the regulations. Cleanup has been initiated on the other 700 LUSTs. In July 1989, Nevada adopted a Petroleum Fund to provide monies for LUST cleanup activities. Taxes on the sale of petroleum products and UST registration fees generate money for the Petroleum Fund.

Sparks Fuel/Solvent Site. Operations of the Santa Fe Pipe-line and the Southern Pacific Railroad (SFPL/SFRR) and others have significantly impacted soils and groundwater quality in a localized area in East Sparks through releases of hydrocarbon products. In certain areas, over 2 feet of free floating

product (diesel and jet fuel) is present on the groundwater. This problem extends approximately 4,000 feet from the SFPL/SFRR properties to the Sparks gravel pit owned by Helms Construction Company.

In their gravel operations, Helms Construction dewaters the pit resulting in a 100 foot reduction in groundwater levels in the Sparks area. This operation results in the discharge of approximately 6 million gallons of water per day to the Truckee River. Due to Helm's dewatering activities, hydrocarbon product flows towards the pit where it discharges. Water quality data has indicated that no hydrocarbon product is discharged to the Truckee River by the dewatering system due to the sump configuration at the pumps and use of on-site detention basins.

On November 21, 1990, NDEP received notification from Helms Construction of their intent to discontinue dewatering activities. However, this termination may cause contamination of up to 60 feet (vertically) and 2,000 feet (laterally) of previously uncontaminated soils. Also, changes in the groundwater gradient, associated with the termination of dewatering, may result in hydrocarbon discharges to the Truckee River. In January 1991, NDEP filed a complaint in District Court against the ten responsible parties to delineate the plume and conduct remediation and continue the pumping of Helm's Pit. In August 1991, the U.S. Environmental Protection Agency (EPA) ordered the responsible parties to develop a workplan for the delineation of the contaminant plume, determination of any imminent and substantial health and environmental threats, and the commencement of removal activities. The workplan was approved by EPA in October 1991.

Nonpoint Source Pollution. Nonpoint sources (NPS) of water pollution were recognized by the U.S. Congress as a major contributor of pollution to waters of the Nation. Section 319 of the 1987 Clean Water Act established provisions to control NPS. NPS, or diffuse source pollution, is associated with agricultural, construction, mining, urban and silvicultural activities. Examples of NPS are irrigation return flows, septic tank discharge, urban runoff, and erosion from disturbed areas. Control of NPS is achieved through implementation of Best Management Practices (BMPs). BMPs may be defined as methods or measures taken to improve the management of a NPS so as to control its contaminant contribution to a stream or aquifer.

In response to NPS problems in the State, the Nevada Division of Environmental Protection (NDEP) is developing a BMP Handbook to serve as a guide for planning NPS controls. In addition, the Nonpoint Source Task Force was formed to promote and coordinate interagency NPS water quality activities in the State of Nevada. Some of the objectives of the NPS Task Force are to: 1) design and implement projects and programs consistent with the Nevada NPS Management Program; 2) educate the public about NPS problems and solutions; and 3) promote state-of-the-art BMPs for NPS control. Funding for NPS control development is available through a grant program administered by NDEP.

Wellhead Protection Program. The Wellhead Protection (WHP) Program was established by the 1986 Amendments to the Safe Drinking Water Act (SDWA). The purpose of the program is to protect public groundwater supplies from contamination and prevent the need for costly treatment of water to meet drinking water standards. The program is based upon the concept that the development and application of land-use controls and other preventative measures can protect groundwater.

A comprehensive WHP Program comprises several distinct and essential elements: 1) specification of roles and duties of State agencies, local government entities, and public water suppliers; 2) delineation of the wellhead protection area (WHPA) for each well; 3) identification of potential sources of contaminants within each WHPA; 4) development of management approaches to protect the water supply within the WHPA; 5) contingency planning for the provision of alternate drinking water supplies in the event of well or wellfield contamination; 6) consideration of all potential contaminant sources within the expected wellhead area of a new water well; and 7) provisions for public participation.

The Nevada Division of Environmental Protection (NDEP) is encouraging water purveyors in the State to develop a WHP Program for their area. As part of this voluntary program, NDEP is providing technical and possibly financial support for WHP Program development. Currently, the cities of Fernley, Battle Mountain and Carson City are actively developing WHP Programs.

Endangered and Threatened Species

Nevada is among the top ten states in the number of federally listed endangered and threatened species. Over 300 additional organisms in the State are candidates for listing. Most of the listed animals and plants are water-dependent species associated with streams, springs, or wetlands. Protection and recovery of these elements of our diverse natural heritage will be challenging as demands for Nevada's waters continue to grow.

General Information

DEFINITIONS

ACRE-FOOT (AF): The volume of water required to cover 1 acre of area at a depth of 1 foot.

ACTIVE STORAGE: The volume of water in a reservoir below the maximum controllable level and above the minimum controllable level that can be released under gravity. In general, it is the volume of water between the outlet works and the spillway crest. In some instances, minimum pool operating constraints may prevent lowering the reservoir to the level of the outlet works, and the water below the minimum pool level is not considered to be in active storage.

AQUIFER: A geologic formation, group of formations, or part of a formation that contains enough saturated permeable material to yield significant quantities of water to wells and springs.

ARTIFICIAL RECHARGE: The addition of water to the groundwater reservoir by human activities, such as injection wells or induced infiltration from spreading basins.

BASIN: A part of the surface of the earth that is drained by a river and its tributaries.

BENEFICIAL USE: The use of water for any purpose from which benefits are derived, such as for irrigation, hydroelectric power, industrial and domestic use. Benefits vary with locality and custom, and what constitutes beneficial use is often defined by statute or by court decision.

CONSUMPTIVE USE: The portion of water withdrawn from a surface or groundwater source that is consumed for a particular use (i.e. irrigation, domestic needs, and industry), and does not return to its original source or another body of water.

DOMESTIC WATER USE: The use of water primarily for household purposes, and the irrigation of gardens, lawns, and shrubbery surrounding a residence.

DROUGHT: Although there is no universally accepted quantitative definition of drought, it may be defined as a period of abnormally dry weather sufficiently prolonged to cause a serious hydrological imbalance.

EVAPOTRANSPIRATION: The volume of water evaporated and transpired from soil and plant surfaces (essentially the same as "consumptive use" except that it does not include the water retained in the plant tissue).

GAGING STATION: A particular site on a stream, canal, lake or reservoir where systematic observations of water levels or flow are made.

GROUNDWATER RECHARGE: Inflow to a groundwater aquifer. Sources of inflow could be precipitation, streams, irrigation, and artificial recharge.

M&I WATER USE: M&I (municipal and industrial) water use includes residential (domestic), commercial, and industrial uses; public uses such as parks and golf courses; and unaccounted for losses in the water transmission and delivery pipelines. M&I water is delivered by public supply systems as operated by public entities or private water purveyors.

PERENNIAL YIELD: The amount of usable water from a groundwater aquifer that can be economically withdrawn and consumed each year for an indefinite period of time. It can not exceed the natural recharge to that aquifer and ultimately is limited to the maximum amount of discharge that can be utilized for beneficial use.

RETURN FLOW: That part of a diverted flow which is not consumptively used and returns to its original source or another body of water.

TRANSITIONAL STORAGE RESERVE: The quantity of water in storage in a particular groundwater aquifer that is extracted during the transition period between natural equilibrium conditions and new equilibrium conditions with groundwater pumped at perennial yield levels.

General Information

WATER EQUIVALENTS TABLE

1 cubic foot.....7.48 gallons .....62.4 pounds
1 acre-foot .....43,560 cubic feet .....325,851 gallons

1 cubic foot per second (cfs).....449 gallons per minute (gpm)
1 cfs for 24 hours.....1.9835 acre-feet
for 30 days .....59.5 acre-feet
for 1 year.....724 acre-feet

1 million gallons.....3.07 acre-feet
1 million gallons per day (mgd) .....1,120 acre-feet per year
1 mgd .....1.55 cfs
1,000 gpm .....4.42 acre-feet per day

ABBREVIATIONS

AF = acre-feet
AF/YR = acre-feet per year
CFS = cubic feet per second
GPCD = gallons per capita (per person) per day
MGD = million gallons per day
mg/l = milligrams per liter (parts per million, ppm)
pCi/l = picocuries per liter

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