

**Nevada State Water Plan
SUMMARY**

**Section 5
Water Use Assessment and Forecasts**

Introduction

This section of the Summary of the *Nevada State Water Plan* is intended to summarize the Nevada Division of Water Planning's water withdrawals forecasts by public supply and type of use categories and provide an overview of the methodology by which these forecasts were made. For detailed definitions of these source and use categories and a more extensive explanation of the water use forecast methodology including all equations used, see Part 2, Water Use and Forecasts, Section 5, Technical Supplement.

Forecasted Categories of Water Use

The water plan includes forecasts for fourteen categories of water withdrawals which comprise either unique forecasted water use categories, i.e., irrigation water withdrawals, or an aggregation of forecasted categories, i.e., total mining water withdrawals derived from processing water withdrawals and dewatering. Forecasts were made by the public supplied uses, i.e., municipal and industrial (M&I) withdrawals, and by the use of the water, e.g., domestic (residential) withdrawals. The following represents a listing of the water source or use categories presented in this plan:

Water Withdrawals by Public Supply Providers:

Total Municipal and Industrial (M&I) Water Withdrawals

Water Withdrawals by Type of Water Use:

Total Water Withdrawals

Total Domestic (Residential) Water Withdrawals

Domestic Public Supply Withdrawals

Domestic Self-Supplied Withdrawals

Commercial and Industrial Water Withdrawals

Thermoelectric Water Withdrawals

M&I Public Use and Losses

Total Mining Water Withdrawals

Mine Processing (Consumptive) Withdrawals

Mine Dewatering (Non-Consumptive) Withdrawals

Total Agricultural Water Withdrawals

Irrigation Withdrawals

Livestock (including Fisheries and Hatcheries) Withdrawals

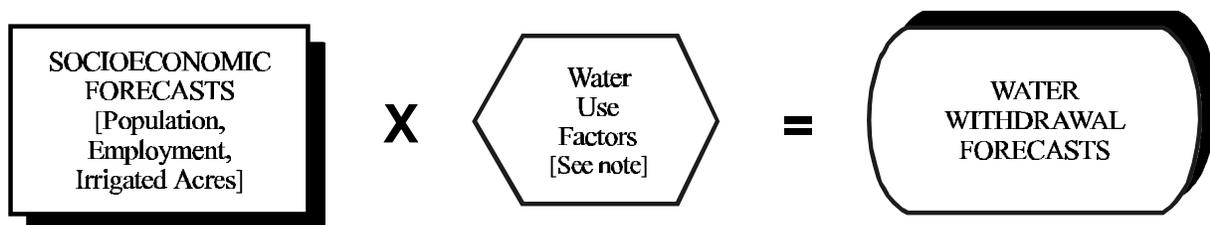
The Forecast Methodology

The forecast methodology developed for the water plan employs a relatively unique and innovative method of linking the forecasts of key socioeconomic variables, i.e., population, employment and irrigated acreage, to specific forecasts of water withdrawals through unique water use coefficients or factors. This process is depicted in its simplest form in Flow Chart 1. Basic Forecasting Methodology. Specifically, forecasts of population and employment (which were derived from the population forecasts), and irrigated acreage provide the means to develop the majority of water withdrawal forecasts for Nevada. The water use factors, which are measured from historical use patterns in terms of gallons per person or per worker per day for M&I, domestic, and commercial and industrial water uses, or in acre-feet per acre per year for irrigation water withdrawals, provide the means to more precisely link changes in the socioeconomic conditions with the resultant changes in water use. Only thermoelectric and mining water use forecasts required a different forecast methodology as explained below.

[*Note:* The terms “water withdrawal” and “water use” are used interchangeably in this forecast analysis. While assumed to have the same meaning in this presentation, the term “water withdrawal” represents the total amount of water withdrawn for a specific use category without reference to the amount of return flow. Thus, it does not measure consumptive use, which is water that is not returned to a source or able to be used again.]

Municipal and Industrial (M&I). Forecasts for M&I water withdrawals were based on forecasts

Flow Chart 1. Basic Forecast Methodology **Socioeconomic Forecasts to Water Withdrawal Forecasts**

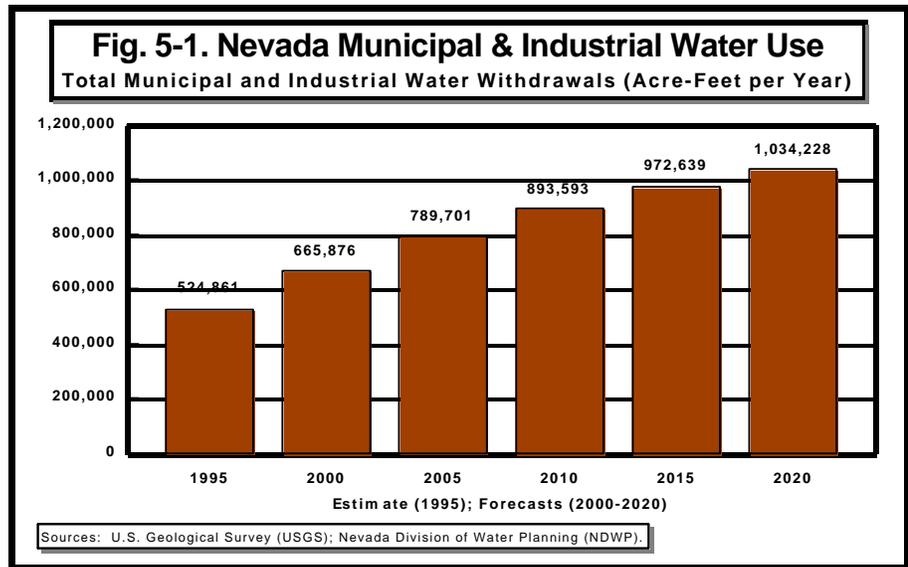


Note: Water Use Factors Measured in Gallons per Capita per Day,
Gallons per Employee per Day, or Acre-Feet per Acre per Year

Nevada Division of Water Planning/Socioeconomic Analysis and Planning

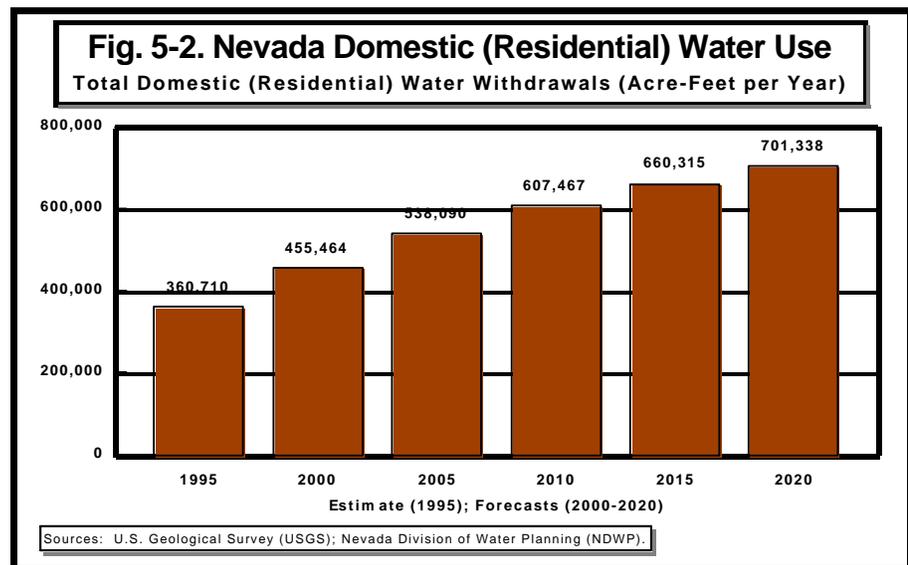
of the population being supplied water by public supply water systems. These forecasts were based on forecasts of total resident population. The estimates of the population on public supply water systems were made at the county level and were derived from 1995 water use characteristics and forecasts of the proportion of the population on public supply water systems. The population on

public supply water systems, times a county-unique M&I water use factor in gallons per capita (person) per day (GPCD), provided the forecasts for total M&I water withdrawals. Both M&I water withdrawals and domestic water withdrawals were additionally affected by the assumption of a changing proportion of the population being on public supply water systems. These forecasts were made for each county based on historical patterns.



Domestic (Residential). Total domestic or residential water withdrawals were estimated from the total resident population times a county-unique domestic water use factor measured in gallons per capita per day (GPCD). As with M&I water withdrawals, domestic water use forecasts were affected by the assumption of a changing proportion of each county’s population being on public supply water systems. In effect, total domestic water withdrawal forecasts under this assumption were based on the aggregation of (1) public supply domestic withdrawal forecasts and (2) self-supplied domestic water withdrawal forecasts using specific water use factors for each use type and a varying proportion of the population on public and self-supplied water systems.

Commercial and Industrial. Commercial and industrial water withdrawals were based on the forecasted level of employment, which was estimated for each county from that county’s population forecast and a county-unique employment-to-population ratio. The commercial and industrial water use forecast was then derived from the employment forecast multiplied by a commercial water use factor measured in gallons per employee per day (GPED). Since mining water use was forecast separately using a different methodology, county-specific forecasts



of the number of mining workers were subtracted from the forecasts of total county employment. Also, the historical commercial and industrial water use factor was calculated omitting mining workers and mining water use.

Public Use and Losses. Water withdrawals for public use and losses was assumed to be a constant percentage of each counties' M&I water withdrawal amount. Therefore, forecasts of this water use were based on forecasts of M&I water withdrawals, with the county-unique percentage factors remaining constant throughout the forecasts period.

Irrigation and Livestock. Irrigation water withdrawal forecasts were made using forecasts of county irrigated acreage multiplied by an irrigated acreage water requirement factor in acre-feet per acre per year. Livestock water withdrawal forecasts were based upon a constant ratio (percentage) of livestock water withdrawals to irrigation water withdrawals. Total agricultural water withdrawal forecasts represented the sum of irrigation water withdrawals and livestock water withdrawals.

Thermoelectric. Thermoelectric (including geothermal) water withdrawal forecasts did not lend themselves to the use of the water use factor method described above. In addition, power production across the state is generally not dependent upon the socioeconomic conditions in any one county due to the power plant's widespread distribution system. Consequently, these forecasts were based primarily on general population trends and increasing demands for electrical power in the diverse markets served by these power production plants, particularly from extensive mining operations in some of the rural counties.

Mining. Mining water withdrawal forecasts (including both consumptive and non-consumptive withdrawals, such as mine dewatering), also presented a unique forecasting environment and did not lend itself to the use of water use factors based on mineral production, mining employment, or other socioeconomic factors. These forecasts were therefore based principally on the projected state of Nevada's gold industry, and specifically on the market price of gold, the grade of available ore bodies which influences the type of processing required and the amount of water used in processing, the level of economically-recoverable gold reserves, the nature of production (underground mining versus open-pit mining), and the continued need for mining dewatering in relation to future mining operations.

Summary of Water Withdrawals by Use Category

Table 5–1. Nevada Water Withdrawal Forecast Summary, presents historical estimates (1995) and forecasts (2000–2020) of water withdrawals by major water use categories along with each categories' percentage share of total statewide water withdrawals. Water for domestic, commercial and industrial and thermoelectric use categories include water from both public and self-supplied sources. Public use and losses are assumed to be from public supply water sources only. It should be noted that these water withdrawal forecasts are based on the most current available data on water use and assume current levels of water conservation. Therefore, these forecasts do not explicitly incorporate the use of new technologies or changes in policy and pricing actions, or changes in conservation practices which would alter the water use rates used to develop these forecasts.

The water use forecasts presented in Table 5–1 show that Nevada’s total water withdrawals for all sectors and use categories is expected to increase by 8.6 percent from 1995’s estimated 4,041,385 acre-feet of total water withdrawals to approximately 4,391,000 acre-feet of annual water withdrawals by the year 2020, an increase of nearly 350,000 acre-feet. The state’s total municipal and industrial water withdrawals, which as a source of water are presented separately in Table 5–2, are expected to grow by nearly 509,400 acre-feet from 524,861 acre-feet in 1995 to approximately 1,034,200 acre-feet by 2020, an increase of 97.0 percent. This trend is expected to increase M&I’s share of the state’s total water withdrawals from 13.0 percent in 1995 to 23.6 percent by the year 2020. However, on a statewide basis, it is expected that much of the increased demand in water resources for M&I, domestic, and commercial and industrial needs will be offset by declines in agricultural water withdrawals, especially from reduced irrigation water requirements.

**Table 5–1. Nevada Water Withdrawal Forecast Summary
Estimated (1995) and Forecasted (2000–2020) Water Use by Use Type
Acre Feet per Year and Percent of Statewide Total Water Withdrawals**

Total Nevada	1995	2000	2005	2010	2015	2020
Domestic (Residential) Withdrawals[1] Percent of Total Withdrawals	360,710 8.9%	455,464 10.7%	538,090 12.4%	607,467 13.8%	660,315 15.0%	701,338 16.0%
Commercial & Industrial Withdrawals[2] Percent of Total Withdrawals	172,407 4.3%	220,355 5.2%	261,880 6.0%	296,905 6.8%	323,811 7.4%	344,919 7.8%
Public Use and Losses[3] Percent of Total Withdrawals	48,472 1.2%	61,195 1.4%	72,313 1.7%	81,707 1.9%	88,930 2.0%	94,582 2.2%
Thermoelectric Withdrawals[4] Percent of Total Withdrawals	65,449 1.6%	67,085 1.6%	68,427 1.6%	69,522 1.6%	70,412 1.6%	71,223 1.6%
Total Mining Use[5] Percent of Total Withdrawals	274,434 6.8%	278,996 6.6%	282,708 6.5%	284,965 6.5%	283,764 6.4%	277,566 6.3%
Total Agriculture Withdrawals[6] Percent of Total Withdrawals	3,119,914 77.2%	3,167,378 74.5%	3,115,872 71.8%	3,052,038 69.5%	2,976,780 67.6%	2,901,522 66.1%
Total Water Withdrawals (Use)	4,041,385	4,250,474	4,339,289	4,392,604	4,404,012	4,391,150

Notes: “Water Withdrawal” and “Water Use” are equivalent terms, but are not the same as consumptive use; they do not account for return flows. Figures for total Nevada are based on an aggregation of individual county water withdrawal estimates and forecasts.

[1] Total domestic withdrawals include the total residential use, both indoors and outdoors (i.e., residential landscaping).

[2] Commercial and Industrial water withdrawals include both public supply and self-supplied withdrawals.

[3] Public use and losses are forecast as a fixed percent of total municipal and industrial (M&I) water use based on historical trends.

[4] Thermoelectric withdrawals include water used for geothermal power plants and cooling water for conventional power plants.

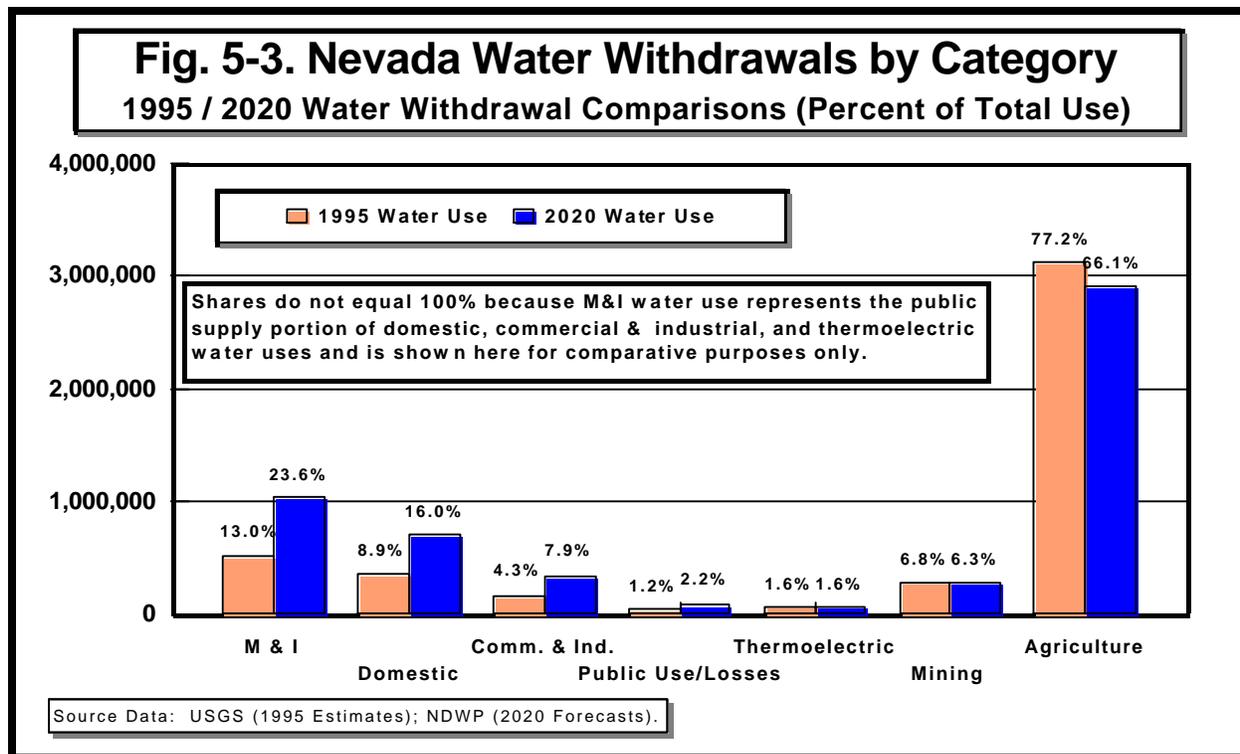
[5] Total mining withdrawals include both consumptive and non-consumptive uses (i.e., processing and mining dewatering).

[6] Total agriculture withdrawals include both irrigation water withdrawals and livestock water use.

Source Data: Nevada State Demographer; Nevada Department of Employment, Training and Rehabilitation (DETR); U.S. Geological Survey (USGS); and Nevada Division of Water Planning (NDWP); Irrigated acreage and 1995 irrigation water withdrawals based on USGS estimates modified by NDWP; Forecasts through 2020 based on 1995 water usage rates and NDWP forecasts of population, employment, general business and economic conditions and estimated irrigated acreage.

Total domestic (residential) water withdrawals are expected to increase by over 340,000 acre-feet, or 94 percent over the forecast horizon, from an estimated 360,710 acre-feet of water withdrawals

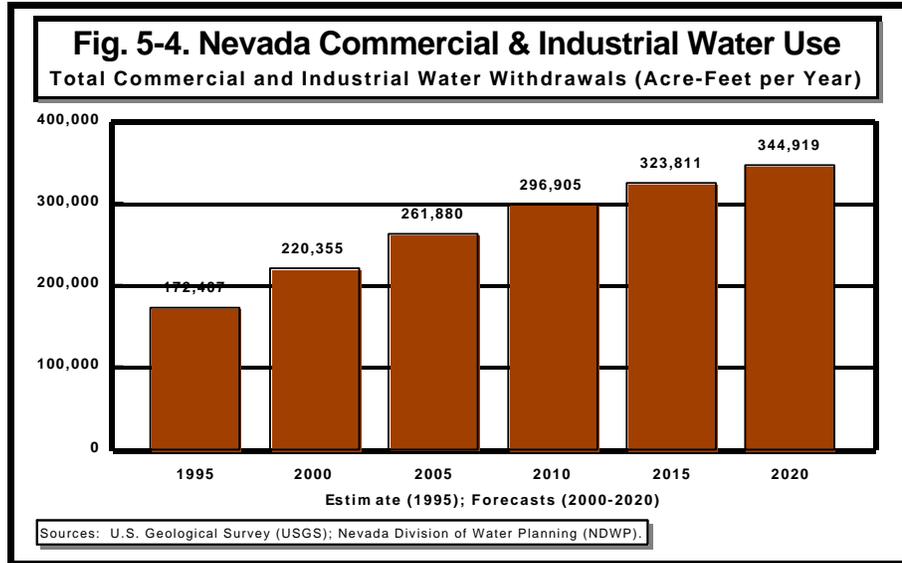
in 1995 to a forecasted 701,000 acre-feet by the year 2020. This will raise the share of domestic water withdrawals from 8.9 percent of total water withdrawals in 1995 to 16.0 percent by 2020. Within total domestic, public supply domestic water withdrawals are expected to increase by 331,000 acre-feet, or nearly 97 percent, from an estimated 342,605 acre-feet in 1995 to a forecasted 674,000 acre-feet by 2020. Self-supplied domestic water withdrawals are forecasted to increase by 9,700 acre-feet, or 53 percent, from an estimated 18,105 acre-feet in 1995 to nearly 28,000 acre-feet by 2020. Commercial and industrial water withdrawals are expected to increase by 172,500 acre-feet, or 100 percent by 2020, from an estimated 172,407 acre-feet in 1995 to a forecasted 345,000 acre-feet of water withdrawals by the year 2020. This will increase commercial and industrial water withdrawals' share of statewide total withdrawals from 4.3 percent in 1995 to 7.9 percent by 2020. Statewide total public use and losses, which are forecasted here as a constant percent of total municipal and industrial (M&I) withdrawals, are projected to increase by 95 percent from 48,472



acre-feet in 1995 to 94,600 acre-feet by the year 2020. This will increase this category's share of total water use from 1.2 percent in 1995 to 2.2 percent by 2020. Thermoelectric water withdrawals are predicted to increase modestly throughout the forecast period based on rising population, continued mining activity, and other electrical energy demands. Total thermoelectric water withdrawals are expected to increase by 5,800 acre-feet, or 8.8 percent between 1995 and 2020 from 65,449 acre-feet to 71,200 acre-feet. As a share of statewide total water withdrawals, thermoelectric is expected to remain constant at 1.6 percent.

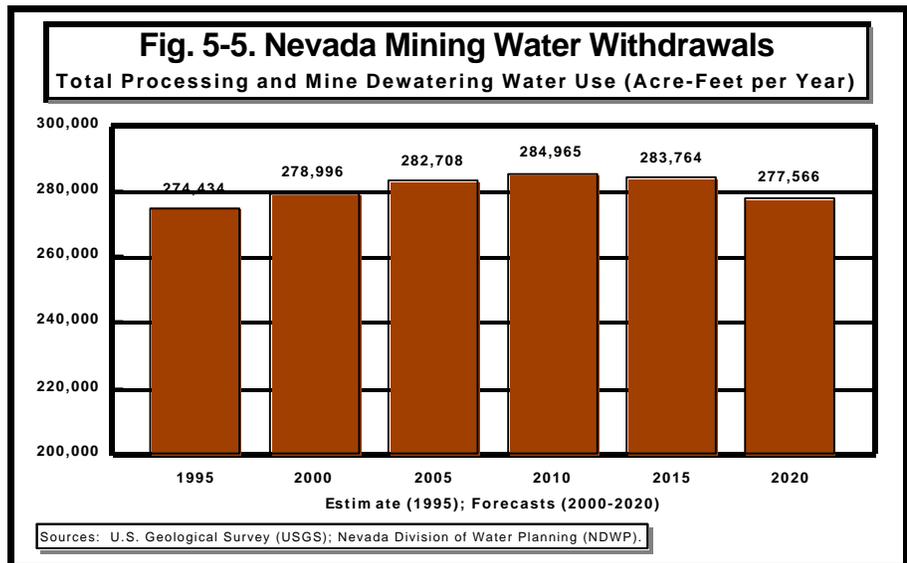
Total mining water withdrawals are expected to peak around the year 2010 at nearly 285,000 acre-feet, an increase of 10,500 acre-feet, or 3.8 percent from 1995's estimated mining water withdrawals.

As more of Nevada gold mining goes underground, total mining water withdrawals are expected to decline slightly to approximately 277,600 acre-feet by 2020, a decrease of 7,400 acre-feet, or 2.6 percent from water withdrawals forecasted for 2010. Most of this decline occurs in mine dewatering as mining operations and mine processing water withdrawals are expected to decline only modestly after the year 2010. Mining water withdrawals are projected to show a slight decline in both the amount and share of water withdrawn between 1995 and 2020 from 6.8 percent of statewide total water withdrawals in 1995 to 6.3 percent by 2020.



The most dramatic declines in water use patterns in the state are expected in agriculture and specifically in irrigation water withdrawals. Based on patterns in forecasted total irrigated acreage determined from individual county forecasts, total agricultural water withdrawals, including both irrigation and livestock water withdrawals, are forecasted to peak around the year 2000 at approximately at 3.167 million acre-feet and then decline by some 266,000 acre-feet, or 8.4 percent, to 2.902 million acre-feet by the year 2020. This decline is based solely on forecasted trends in irrigated acreage. Annual water use for irrigation is expected to decline by 218,179 acre-feet, or 7.0 percent, from an estimated 3,113,585 acre-feet in 1995 to a forecasted 2,895,000 acre-feet by 2020.

Agriculture’s share of statewide total water withdrawals is expected to decline from an estimated 77.2 percent in 1995 to 66.1 percent by the year 2020. This decline assumes that levels of irrigated acreage will remain relatively stable or show modest declines in Nevada’s rural counties. It also assumes the continued conversion of irrigated farmlands into

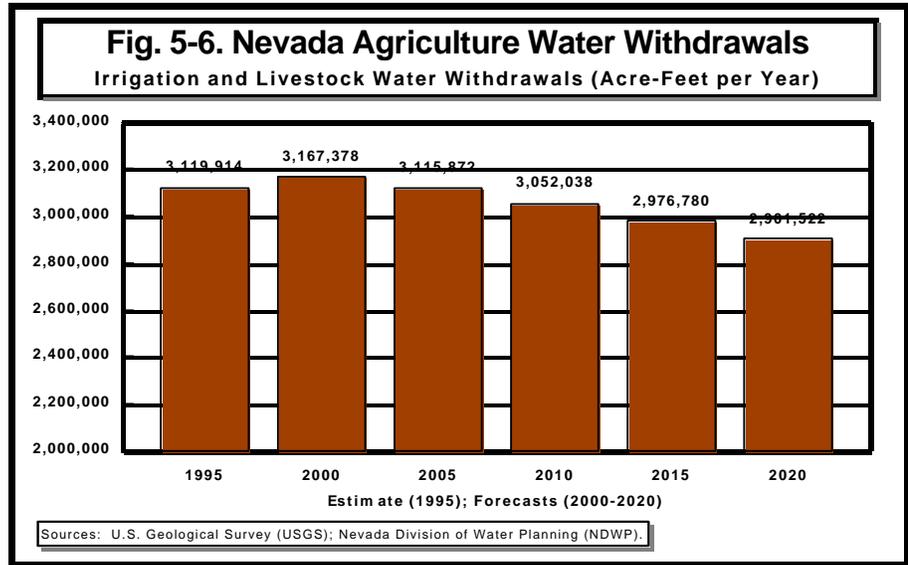


urban lands and residential tracts and commercial businesses in the state’s more urbanized counties.

Table 5–2. Municipal & Industrial (M&I) Water Withdrawals, presents estimated (1995) and forecasted (2000 to 2020) municipal and industrial (M&I) water withdrawals for Nevada. M&I water use consists of withdrawals from

public supply water systems for domestic, commercial and industrial and thermoelectric uses. Table 5–2 also presents the population growth assumptions, the estimated population on public supply water systems, and the statewide average water use factors derived from the development of the statewide forecasts for M&I water use. All figures contained within this table represent the aggregation of trends and forecasts contained for Nevada’s individual counties. The table also presents an estimate of consumptive use based on 1995 consumptive use patterns.

The socioeconomic forecast calls for a near doubling in Nevada’s resident population from 1995 to the year 2020. Nevada’s estimated 1995 total population of 1,579,150 persons is expected to increase by 1,467,700 persons, or 92.9 percent, to an expected 3,046,846 persons by the year 2020. In addition, based on individual county population forecasts and related socioeconomic trends, the proportion of Nevada’s population on public supply water systems is expected to increase from 94.2 percent of the state’s total resident population in 1995 to 95.4 percent of the state’s total population by the year 2020. Based on higher usage rates typical of public supply system water users, and an increasingly larger proportion of the population coming onto public supply water systems, the statewide average M&I water use factor is expected to increase from 315.0 gallons per capita per day (GPCD) in 1995 to 317.6 GPCD by the year 2020. As a result of these changes, statewide M&I water withdrawals are expected to increase from 524,861 acre-feet in 1995 to 1,034,200 acre-feet by 2020, an increase of 509,400 acre-feet or 97.0 percent. [Note: These forecasts for M&I water withdrawals do not take into account future water conservation efforts.]



**Table 5–2. Municipal & Industrial (M&I) Water Withdrawals
Estimates and Forecasts of Total Public Supply Water Withdrawals
(Water withdrawals in acre-feet per year; Use factors in gallons per person per day)**

Total Nevada	1995	2000	2005	2010	2015	2020
Resident Population (persons)[1]	1,579,150	1,986,257	2,341,374	2,640,306	2,868,979	3,046,846
Percent Population on Public Supply[2]	94.2%	94.6%	94.8%	95.0%	95.2%	95.4%
Population on Public Supply[3]	1,487,636	1,878,477	2,221,592	2,510,991	2,733,001	2,906,882
Population Self Supplied	91,514	107,780	119,783	129,315	135,978	139,964
Municipal & Industrial (M&I) Factor[4]	315.0	316.5	317.3	317.7	317.7	317.6
Municipal & Industrial Withdrawals[5]	524,861	665,876	789,701	893,593	972,639	1,034,228
Percent of Total Water Withdrawals	13.0%	15.7%	18.2%	20.3%	22.1%	23.6%
M&I Consumptive Use[6]	196,444	249,223	295,568	334,452	364,037	387,089
Public Use and Losses[7]	48,472	61,195	72,313	81,707	88,930	94,582
As a Percent of Total M&I Use[7]	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%
Percent of Total Water Withdrawals	1.2%	1.4%	1.7%	1.9%	2.0%	2.2%

Notes: One acre-foot equals approximately 325,851 gallons. Water withdrawals and water use are equivalent terms, but are not the same as consumptive use as they do not account for return flows. Total Nevada figures represent an aggregation of individual county estimates and forecasts. As aggregated into the total Nevada figures, population forecasts for Clark County are based on population forecasts adopted by the Clark County Department of Comprehensive Planning; population forecasts for Washoe County are based on population forecasts adopted by the Washoe County Department of Community Development.

[1] 1995's population estimate was developed by the Nevada State Demographer; population forecasts for the years 2000–2020 were developed by the Nevada Division of Water Planning (NDWP) along with individual county inputs.

[2] The percent of population on public supply water systems for 1995 was based on estimated made by the U.S. Geological Survey (USGS); changes to this percent over the plan's forecast horizon were estimated by NDWP.

[3] The total Nevada figure was based on aggregation of individual county estimates and forecasts.

[4] M&I water use factor was based on an aggregation of individual county trends and varies with both the proportion of the population on public supply water systems and individual county water use characteristics.

[5] Total M&I water use includes all public supplied water for domestic, commercial, industrial and thermoelectric uses; includes the effects of a variable population on public supply water systems.

[6] M&I consumptive water use was estimated from a fixed 37.4 percent of total M&I estimated and forecasted water withdrawals. The consumptive use factors are presented for all water use categories in Fig. 5–7, Nevada Consumptive Water Use Analysis.

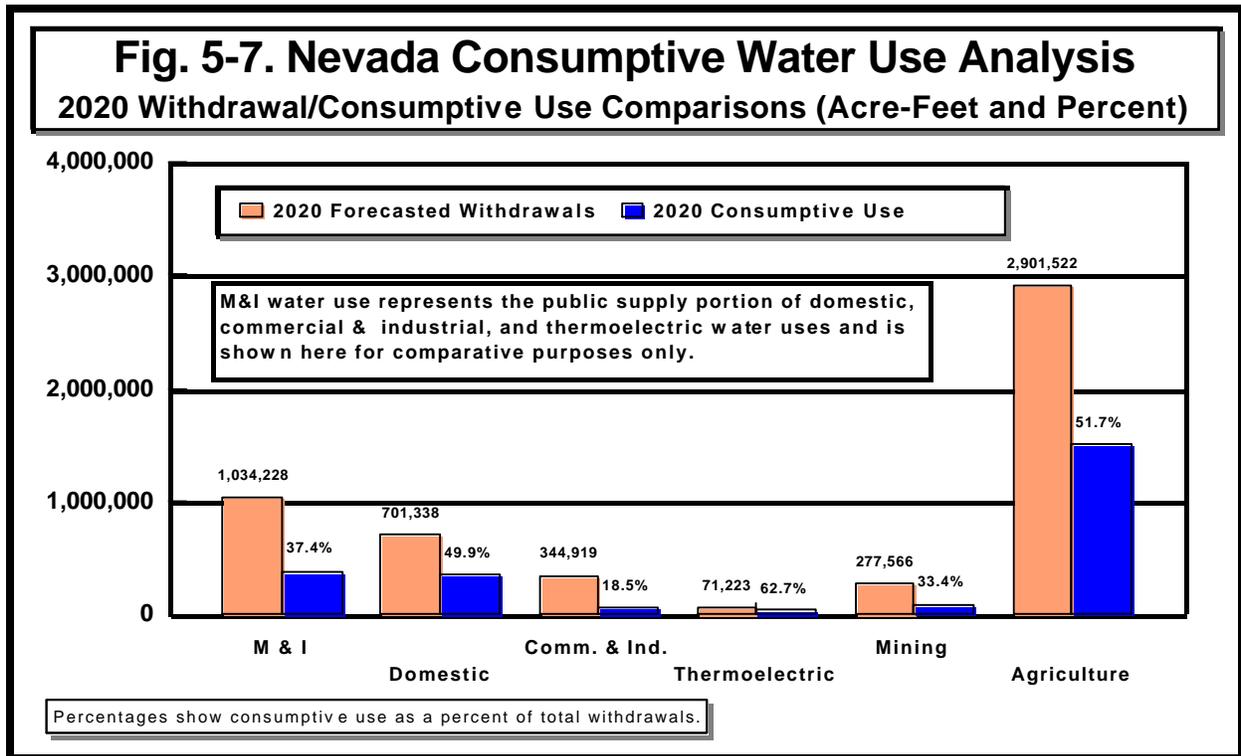
[7] Forecasts for public use and losses were based on a fixed percent of total M&I water withdrawals for each county. The Nevada figure was based on the aggregation of the county totals and while shown here as a fixed 9.2 percent of M&I withdrawals, this figure actually varies slightly over the forecast horizon based on individual county growth patterns, but does not show here due to rounding.

Source Data: Nevada State Demographer; U.S. Geological Survey (USGS); Nevada Division of Water Planning (NDWP).

Consumptive Use Forecasts

Fig. 5–7. Nevada Consumptive Water Use Analysis, presents estimates of consumptive water use by principal source and use category based on total water withdrawals for these same categories. The data presented in this graph are based on historical relationships between water withdrawals and respective consumptive use patterns. The statewide total consumptive use figure, representing the summation of all categories of water withdrawals, is expected to decrease from 48.4 percent of total water withdrawals in 1995 to 46.8 percent by 2020 as water use patterns change across the various

water use categories primarily from agriculture (with a consumptive use estimated at 51.7 percent including both irrigation and livestock consumptive uses) to municipal and industrial which has an average consumptive use estimated at 37.4 percent, thereby providing nearly a 63 percent return flow from total M&I water withdrawals.



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