Treasure Valley Future Water Demand

Prepared for

Idaho Water Resources Board

Submitted by:

WRIME

November 16, 2010

Table of Contents

Acronyms and Abbreviations

µg/L	micrograms per liter
af	acre feet
Boise Project	Boise Project Board of Control
CAMP	Comprehensive Aquifer Management Plan
C&I	Commercial and Industrial
Comm/Ind	Commercial/Industrial
COMPASS	Community Planning Association of Ada and Canyon Counties
CUAW	Consumptive Use of Applied Water
CWA	Clean Water Act
DEQ	Idaho Department of Environmental Quality
DCMI	Domestic, commercial, municipal, and industrial
DP	Distributed Parameter
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
gpcd	gallons per capita daily
IDC	IWFM Demand Calculator
ISDL	Idaho State Department of Labor
IDWR	Idaho Department of Water Resources
IWFM	Integrated Water Flow Model
IWRB	Idaho Water Resources Board
MCL	Maximum Contaminant Level
mg/L	milligrams per liter
NMID	Nampa-Meridian Irrigation District
NRCS	Natural Resource Conservation Service
PI	Pressurized Irrigation
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
SDWA	Safe Drinking Water Act

SFR	Single Family Residential
SIC	Standardized Industrial Codes
Statewide Program	Statewide Ambient Ground Water Quality Monitoring Program
Study	Future Water Demand Study
TMDL	Total Maximum Daily Loads
TVD	Treasure Valley Deep
TVHP	Treasure Valley Hydrologic Project
TVS	Treasure Valley Shallow
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UWI	United Water Idaho
VOCs	Volatile Organic Compounds
WUIP	Water Use Information Program

1 Introduction

1.1 Background

In 2008, the State of Idaho Legislature approved two bills establishing the Statewide Comprehensive Aquifer Planning and Management Program and the Aquifer Planning and Management Fund. This legislation authorized the Idaho Water Resources Board (IWRB) and the Idaho Department of Water Resources (IDWR) to conduct characterization and planning efforts for10 groundwater basins in the next 10 years.

Treasure Valley basin was identified as a priority basin and the IWRB embarked on technical studies and planning activities in this basin in 2008. The Future Water Demand Study (Study) of the Treasure Valley is one component of a suite of planning activities being conducted in the Treasure Valley. The results of this Study will be integrated with other basin characterization efforts and planning activities to develop the Treasure Valley Comprehensive Aquifer Management Plan (CAMP). The Study was conducted and developed in collaboration with the IDWR and the Treasure Valley CAMP Advisory Committee.

1.2 Purpose

The purpose of the Study is to estimate the future water demand in the Treasure Valley region in 10 year increments from 2010 to 2060.

The three water demand components identified for the Study are:

1. Domestic, commercial, municipal, and industrial (DCMI) demand
2. Agricultural water demand
3. Environmental and water quality needs or limitation regarding future water supplies

It is anticipated that the future water demand estimates from this study will be used in conjunction with other planning activities to develop water supply management scenarios to meet the overall CAMP goals.

The specific Study tasks were:

Task 1 - Develop Conceptual Framework and Methodology. In coordination with IDWR, develop mutually agreed upon conceptual framework and propose appropriate methodology for estimating future water demand in the Treasure Valley.

Task 2 – Perform Water Demand Study. Perform the tasks necessary to implement the proposed conceptual framework and methodology developed under Task 1. This includes the following five subtasks:

Subtask 2.1 – DCMI demand projection

Subtask 2.2 – Agricultural demand projection

Subtask 2.3 – Qualitative assessment of environmental and water quality needs

Subtask 2.4 –Qualitative assessment of potential water supplies through conservation

Subtask 2.5 –Development of GIS datasets

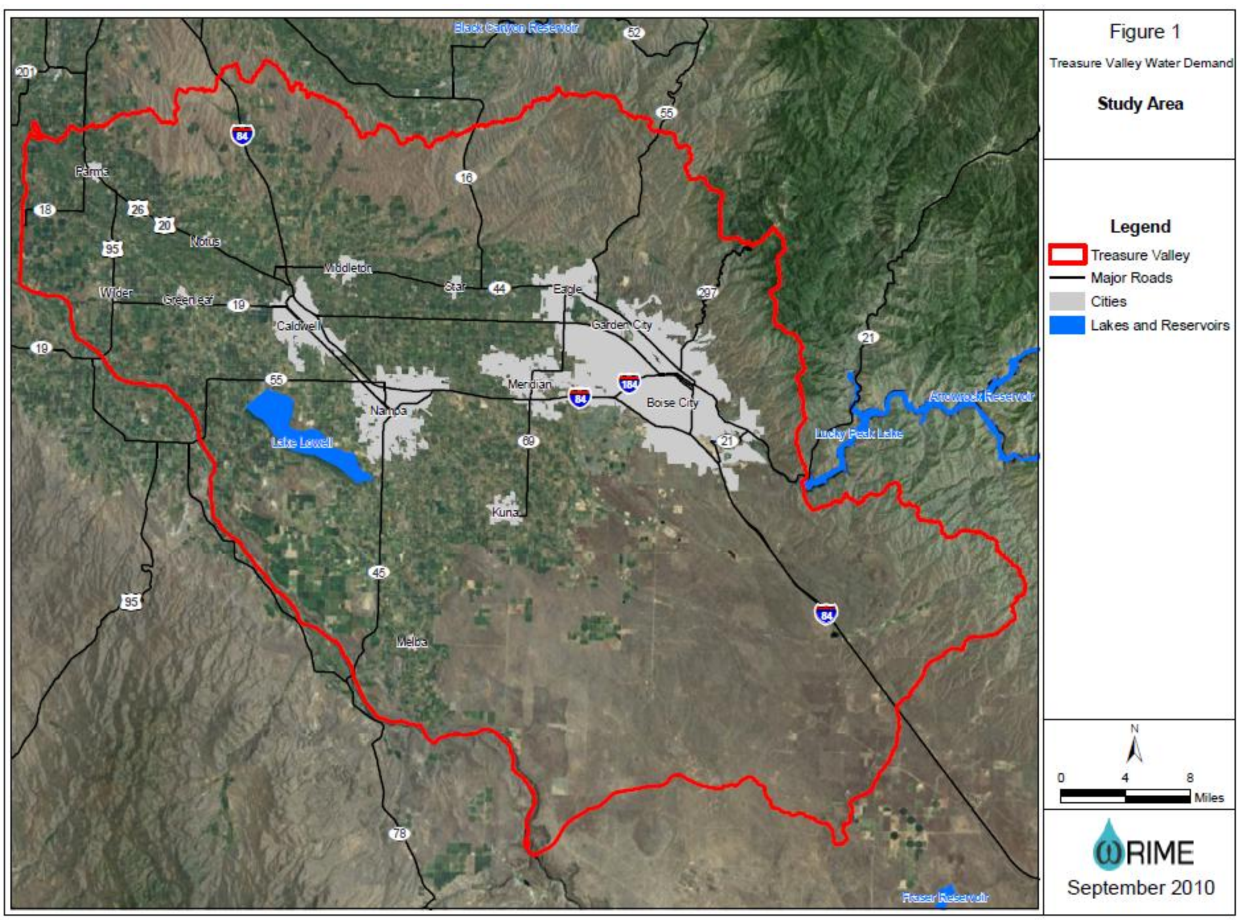
Task 3 – Presentations and Meetings. Give presentations to IDWR, the Idaho Legislature, the Advisory Committee and others and attend quarterly status report meetings with IDWR staff.

Task 4 – Final Report, Project Management, and Coordination. Prepare monthly status reports and a final written report.

1.3 Study Area

The study area is shown in Figure 1. It overlies the Western Snake River Plain Aquifer and includes the lower Boise River basin and extends south to the Snake River. Urban development is concentrated in the eastern half of the Treasure Valley within Ada County. The largest cities include Boise, Nampa, Meridian, Kuna, Eagle, and Caldwell.

Figure 1. Map of Treasure Valley



1.4 Report Organization

The report is organized as follows:

Section 1: Introduction. Describes the background, purpose, and study area.

Section 2: Previous Studies and Existing Data. Presents the review and analysis of relevant previous studies, discusses data collection efforts, and presents the summary of current water use data.

Section 3: Water Demand Projections. Describes the approach and methodology for developing the future water demand. The analysis includes water demand for DCMI using land use and population projections and agricultural water demand estimates using the Irrigation Demand Calculator (IDC) Model.

Section 4: Environmental and Water Quality Constraints. Describes the water diversions and obligations under current and expected future environmental uses for water, and provides a qualitative analysis of potential impacts to water demand and supply due to water quality conditions and regulatory requirements.

Section 5: Assessment of Water Conservation and Re-Use Potential. Describes current water conservation plans, activities, and programs, and potential efforts that can be made to promote water conservation by water purveyors, irrigation districts, and the general public.

Section 6: Conclusion. Summarizes the results of the water demand projection and describes recommended action items for future updates.

2 Previous Studies and Existing Data

The purpose of reviewing the previous studies and the existing data of the Treasure Valley was to develop an understanding of the current and historical conditions of the basin. As part of this process, several meetings were also held with the members of the Treasure Valley CAMP Advisory Committee and other stakeholders to facilitate interpretation of the data.

This section of the report is organized as follows:

2.1 Previous Studies. Summarizes the findings and conclusions as they pertain to the current Study.

2.2 Existing Data. Presents the extensive data collection efforts and summarizes the key findings from data review and analysis. This section describes:

- Historical and current population trends;
- DCMI water system including dual system, seasonal residential indoor/outdoor water use, and current water supply by water purveyors; and
- Total acreage of land use for native, agricultural, urban, rural, riparian, and other categories

2.1 Previous Studies

There are numerous studies and planning documents for different urban and rural areas in the Treasure Valley. The review and understanding of these studies formed the basis for defining the approach for the Study.

The following are the key sources of information collected as part of this Study:

- *Domestic, Commercial, Municipal, and Industrial Water Demand Assessment and Forecast in Ada and Canyon Counties, 2001*
- *Treasure Valley Hydrologic Project Water Research Report Budget for the Treasure Valley Aquifer System For the Years 1996-2000*
- Cities and counties comprehensive plans
- Cities' water master plans
- *Community Planning Association of Ada and Canyon Counties* (*COMPASS) Demographic Projections* (2035 draft)
- Water master reports
- Irrigation district reports
- Water rights information
- Census data - historical and projected economic, demographic and population
- County assessors land use data
- IDWR land use surveys

- *Irrigation Demand Calculator: Spreadsheet Tool for Estimating Economic Demand for Irrigation Water*
- U.S. Geologic Survey (USGS) Water Use survey
- U.S. Department of Agriculture (USDA) National Agricultural Statistic Service
- USDA Agricultural Census
- Voluntary submission of proprietary information

A summary of the selected studies is provided as background material leading to the development of an approach for the Study.

Domestic, Commercial, Municipal, and Industrial Water Demand Assessment and Forecast in Ada and Canyon Counties, 2001

The Domestic, Commercial, Municipal, and Industrial Water Demand Assessment and Forecast in Ada and Canyon Counties, 2001 is a comprehensive study that published DCMI future water demand estimates for the years 2000 to 2025 using 1997 and 1998 data as the baseline. The projected water demand was disaggregated as single family residential (SFR), apartments, mobile homes, commercial and industrial, and parks/schools/golf courses. This report describes a cooperative effort between COMPASS, USGS, and IDWR to assess current DCMI water-use conditions and project future needs. The U.S. Bureau of Reclamation (USBR) provided the funding for the project.

The choice of approach depended primarily on data availability. For residential water use, individual records from United Water Idaho (UWI) were collected and compared to the estimated annual residential water deliveries as a function of weather, price, personal income, and time. The approach for Commercial and Industrial (C&I) water use also relied on UWI records. UWI water use records were matched to Idaho State Department of Labor (ISDL) employment records using business name and address. These data were sorted by standardized industrial codes (SIC) and an average water use per employee for each SIC code was calculated. For parks/ schools /golf courses, a water demand irrigation coefficient per acre was multiplied by acreage to obtain water use.

USGS Water Use Information Program and 2001 IDWR Forecasts

The USGS Water Use Information Program (WUIP) provided water use estimates for 2005. Estimates for Ada and Canyon County are compared to the 2001 IDWR forecasts in Table 2-1. Estimates from the two sources are very similar. The IDWR study forecast a somewhat higher water use for 2005 than what the WUIP estimated for the same year. The WUIP does not account for surface and groundwater withdrawals by domestic users. Domestic use rates per capita from public supplies are used to estimate water use for the population not served by public supplies (Maupin, 2010). This may account for the WUIP's smaller estimate of residential use. The IDWR 2001 method does not count mining use, which is primarily gravel mining in this region. For both sources, it is unclear how much water use for home gardens is being counted.

Table 2-1. Comparison of IDWR 2005 forecast with 2005 WUIP estimates

IDWR 2001	Acre Feet per Year
2005 Sum of SFR, apartments, mobile homes	82,626
2005 Residential water demand	85,294
2005 CMI	44,067
Total	**129,361**
2005 WUIP	
Domestic, total use (withdrawals and deliveries)	75,418
Other public deliveries	20,578
Self-supplied industry total	14,966
Mining	4,283
Golf	10,899
Total	**126,143**

United Water Idaho 2010 Demand Study

United Water Idaho is in the process of updating its service area and initiated a water demand study internally (Rhead, 2010). The draft population and water use projections were shared to assist in the development of this Study. The UWI study includes projected water use for residential, commercial, and other for its service area to the year 2065. The current service area is comprised primarily of the City of Boise, with approximately 15 percent of the service area extending into the county beyond the city.

The summary results of this unpublished study are shown in Figure 2-1 and Table 2-2.

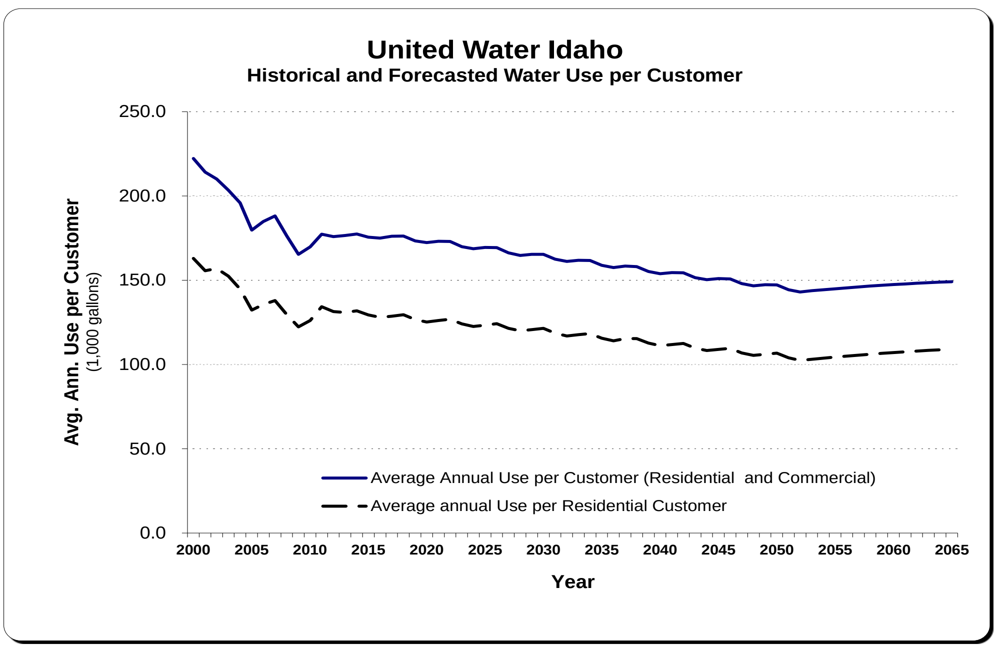


Figure 2-1. United Water Idaho Forecasted Water Use per Customer

Table 2-2. United Water Idaho Water Demand Projections

	2010	2020	2030	2040	2050	2060
United Water	44,038	52,431	66,390	77,851	91,947	111,534

Other Reports and Studies

A brief discussion on a few reports and studies is provided here for the purpose of reference only.

Treasure Valley Hydrologic Project Water Research Report Budget for the Treasure Valley Aquifer System For the Years 1996-2000 Report (TVHP) (IDWR, 2004) contains information on water budgets for the Treasure Valley's shallow aquifer system for calendar years 1996 and 2000. Budget components in this comparison include total river diversions, farm delivery on gravity-irrigated lands, precipitation on gravity-irrigated lands, evapotranspiration on gravity irrigated lands, canal losses, on-farm infiltration on both gravity-irrigated and sprinkler-irrigated lands, groundwater pumping, lake seepage, surface-water drain returns to the rivers, and total sub-surface discharge to the rivers.

A Distributed Parameter Water Budget Data Base for the Lower Boise Valley (DP) (IDWR, 2008) provides a geographic information system (GIS) database containing details of the spatial and temporal distribution of groundwater and surface-water usage in the "lower" Boise River. The water budget is divided into three main parts are aligned with three broad land-use categories in the Lower Boise Valley — irrigated agricultural lands; residential, commercial, and public-recreation lands; and dry lands and water-bodies valley, the area downstream from Lucky Peak Dam.

The water demand estimates for gravity-irrigated land from the TVHP and DP reports are summarily presented in Table 2-3.

Table 2-3. Water demand estimates from TVHP and DP reports

Report	Year	River Delivery for Irrigation (AF)	Groundwater Pumping for Irrigation (AF)	Total (AF)
TVHP	1996	1,083,600	71,900	1,155,500
	2000	1,156,700	53,000	1,209,700
DP	Average 1967-1997	1,154,760	128,962	1,283,722

Two other studies useful in understanding the various irrigation systems in Idaho and their irrigation efficiencies are:

- *Irrigation Systems for Idaho* (Neibling H., 1997), which provides information about different irrigation systems used in Idaho and their application efficiencies; and
- *Agro-Hydrology and Irrigation Efficiency* (Allen et al., 2008), which also contains information about irrigation efficiencies.

2.2 Data Collection and Existing Conditions

This section summarizes data collection efforts for this Study and provides the current state or "existing conditions" of land use, water use, and population in the Treasure Valley. For the purpose of defining existing conditions, it was decided to use data from the year 2009 as representative data, when available. When an entity was not able to provide data for the year 2009, an average of previous years was used.

Population, Water Use, and Land Use Data Collection

Population

Historical population data for Ada and Canyon counties were collected from 1900 to 2009. The historical growth was compared to the average growth trends at the state and national levels. Ada and Canyon counties are the most populated counties in the state, and both have an above average rate of growth when compared with the rest of the state. Overall, the State of Idaho has consistently outpaced the national average growth. Figure 2-2 shows the historical growth of Idaho compared to the United States as a whole.

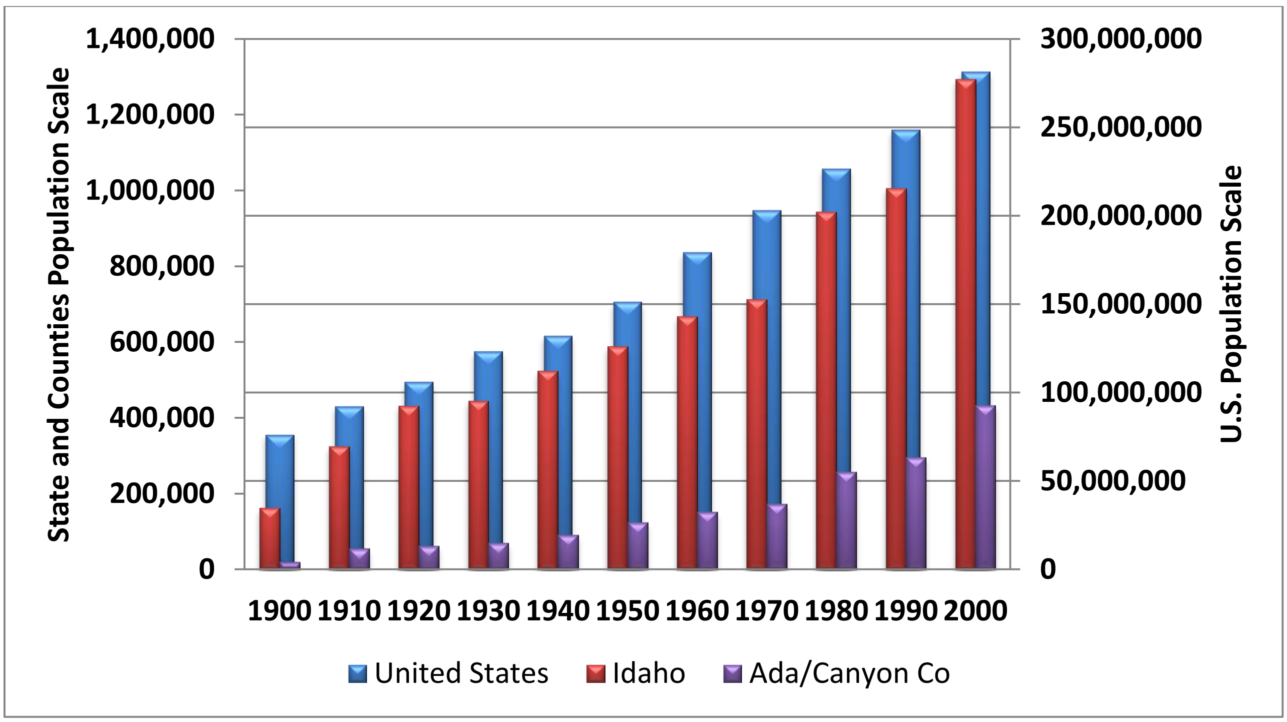


Figure 2-2. National Average Population Comparison

Historically, there has been an exponential rate of growth within Ada and Canyon counties. Each county has experienced a rate of growth twice as high as the national average in some years. The historic population data (presented in Tables 2-4 and 2- 5) show the historic trends of relative population growth for the cities. The long-term population growth rate for Ada and Canyon counties is approximately 4.25 percent from 1900 to 2000. The estimated growth rate from 2000 to 2010 indicates that Canyon County may be experiencing a faster growth rate than Ada. This trend may become significant in future land use planning and water supply management.

Table 2-4. Ada County Historical Population

Ada County								
Year	Boise	Garden	Kuna	Eagle	Meridian	Star	Total	% Change
1900	5,957				200		**11,559**	
1910	17,358		150	151	619		**29,088**	151.6
1920	21,393		366	412	1,013		**35,213**	21.1
1930	21,544		398	412	1,004		**37,925**	7.7
1940	26,130		443	250	1,465		**50,401**	32.9
1950	34,393	764	534	250	1,810		**70,649**	40.2
1960	34,481	1,681	576	200	2,081		**93,460**	32.3
1970	74,990	2,368	593	359	2,616		**112,230**	20.1
1980	102,249	4,571	1,767	2,620	6,658		**173,036**	54.2
1990	125,738	6,369	1,955	3,327	9,596		**205,775**	18.9
2000	185,787	10,624	5,382	11,085	34,919	1,795	**300,906**	46.2
2008	198,638	11,562	12,785	13,618	59,832	2,205	**380,920**	26.6
2009	205,707	11,891	14,500	14,342	68,516	2,322	**384,656**	1.0

1. Population estimates for 2009 based on a linear interpolation Census data for the years 2000 and 2007.
2. Census population for the county includes people residing outside of the cities listed.

Table 2-5. Canyon County Historical Population

Canyon County							
Year	Caldwell	Nampa	Parma	Wilder	Middleton	Total	% Change
1900	997	799	62			7,497	
1910	3,543	4,205	338			25,323	237.8
1920	5,106	7,621	583			26,932	6.4
1930	4,974	8,206	750			30,930	14.8
1940	7,272	12,149	1,085			40,987	32.5
1950	10,487	16,185	1,396			53,597	30.8
1960	12,230	18,897	1,295			57,662	7.6
1970	14,219	20,768	1,228			61,288	6.3
1980	17,669	25,112	1,820			83,756	36.7
1990	18,400	28,365	1,597			90,076	7.5
2000	25,967	51,867	1,771	1,462	2,978	131,441	45.9
2007	39,889	79,249	1,831	1,608	3,276	179,381	36.5
2009	**43,281**	**81,241**	**1,881**	**1,486**	**5,781**	**186,615**	**4.0**

1. Canyon County total population includes cities of Greenleaf, Melba, and Notus (not shown)
2. Census population for the county includes people residing outside of the cities listed.

Water Use

Groundwater pumping and surface water diversion records were collected to define water use under existing conditions. In Treasure Valley, surface water is primarily used for agricultural irrigation but is also used for domestic use, both potable and non-potable. Groundwater is the primary source of water for urban areas. Urban water users are categorized as residential, commercial, industrial, municipal, institutional, and urban agricultural (parks, greenspace, etc.). Most of the developed urban areas are served by either public water systems or private water companies with a significant number of industrial and rural residential or subdivisions on independent private pumps. Water purveyors base water rates on two classifications: residential and commercial. The data collected usually had water delivery records available for these two classifications.

Dual System

Idaho features a dual water system with two separate distribution systems that supply potable water through one distribution network and non-potable water through another. These two systems work independently of each other within the same service area.

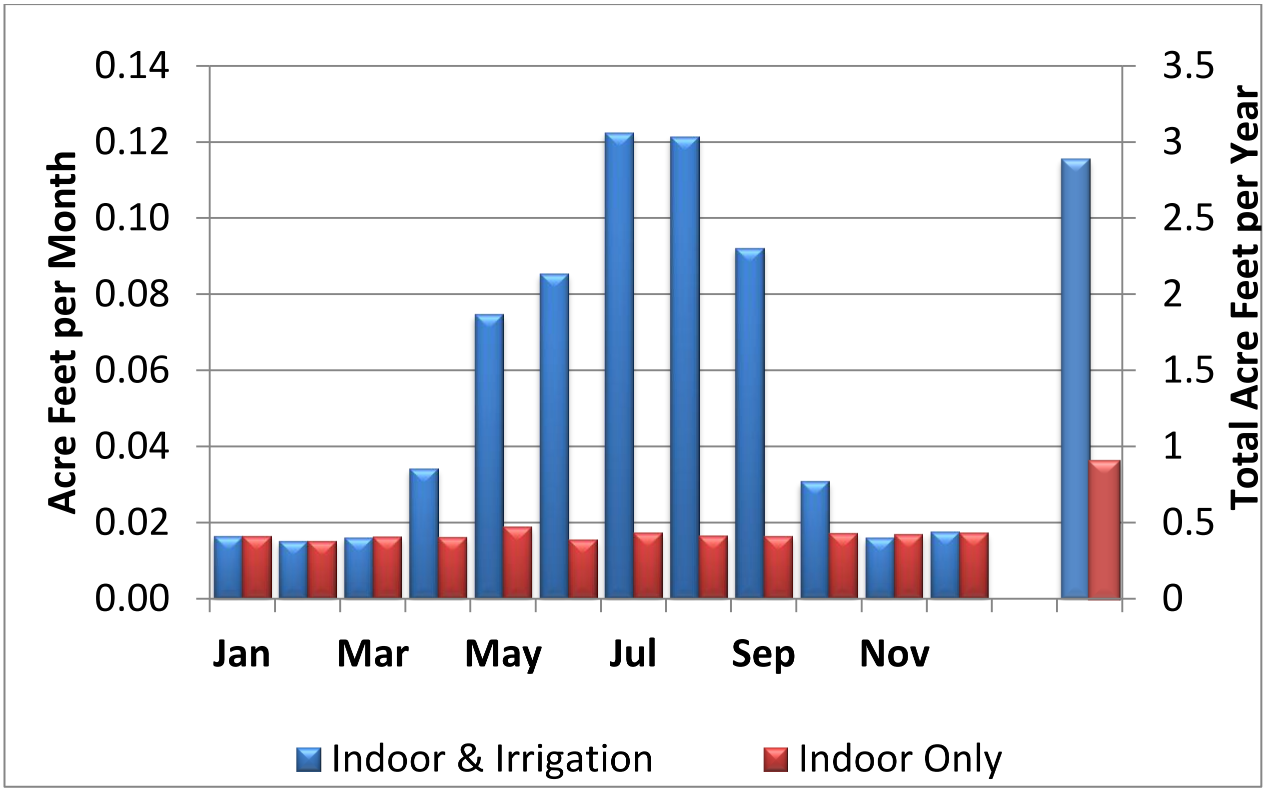
Residential water use includes indoor and outdoor. Water purveyors provide potable water for indoor and outdoor use. Some water purveyor and irrigation districts provide non-potable water to residential outdoor user to irrigate landscaping. There are two delivery methods of domestic irrigation: pressurized irrigation and gravity flow irrigation. Pressurized irrigation (PI) is a closed and separate system from the potable water supply. Water is either pumped from the canal into the pressurized system or distributed by gravity flow. Some systems in Nampa use groundwater to supply PI water. In gravity flow irrigation, canal water is diverted into subdivisions to flood irrigate residential landscapes. The irrigation districts that use both methods to supply water report that both provide the same water delivery efficiency.

Domestic irrigation water delivery records were requested from all water providers; however, only a few providers had records of water delivery for specific purposes. The irrigation districts deliver water based on water rights, not intended use. Data was collected from Boise Project Board of Control (Boise Project), Nampa-Meridian Irrigation District (NMID), City of Nampa, and UWI. Water diversion and delivery records are maintained based on the methods used to deliver water to the subdivisions.

Two Seasons of Water Use

Domestic water use varies throughout the year. Increased water use during summer months for outdoor irrigation brings a distinct change in water use patterns. Figure 2-3 shows the monthly water use. The red bars indicated a relatively steady consumption year-round for indoor use. The blue bars are a combination of indoor and outdoor use. The difference between the two is the water estimated to be used for outdoor irrigation. The range of data received for domestic irrigation ranged from 2 to 4 acre feet (af) per year. The Boise Project recorded an average water delivery of 2.5 af/year. UWI estimates range from 1.8 to 2.4 af/year and other district's water use estimates range from 3 to 4 af/year.

Figure 2-3. Indoor/Outdoor Water Use Comparison



Current Domestic Water Use

Current water use was defined from 1999 to 2009 data. The trends from 1999 to 2009 indicated a reduction in water use due to conservation efforts, education, changes in plumbing code, and drought awareness from the general public. An additional factor may have been the increased use of surface water for domestic irrigation reducing the burden from municipal and private water suppliers. In general, water production and use data was complete and readily available from the water districts in Treasure Valley. When current and complete water use and production records were not available, assumptions were made to determine a likely distribution of water use based on historical data or the average data from similarly sized community.

Table 2-6 shows the annual water produced and delivered by user type. User categories include all residential customers (single family, multiple family, mobile home, etc.), commercial and industrial, and other (fire protection, municipal, parks and green spaces, etc.) supplied by the public water system. Users on private pumping are not shown in Table 2-6. The column “unaccounted water” in Table 2-6 is the difference between water produced and water delivered. This is assumed to be mostly due to operational system losses, such as water flushing or leaks. The average annual percent of unaccounted water use (loss) ranged from under 5 percent for UWI to 43 percent for the City of Kuna. The national average for system losses is 10 percent to 12 percent. During the data collection process, it was discovered that a “large” leak was under repair by Garden City. City officials estimated that up to 20 percent of the water produced was lost due to this leak; however, they anticipate the water loss will be less than 10 percent in the next year and in future years.

Table 2-6. Urban Water Production and Use under Existing Conditions (af/ year)

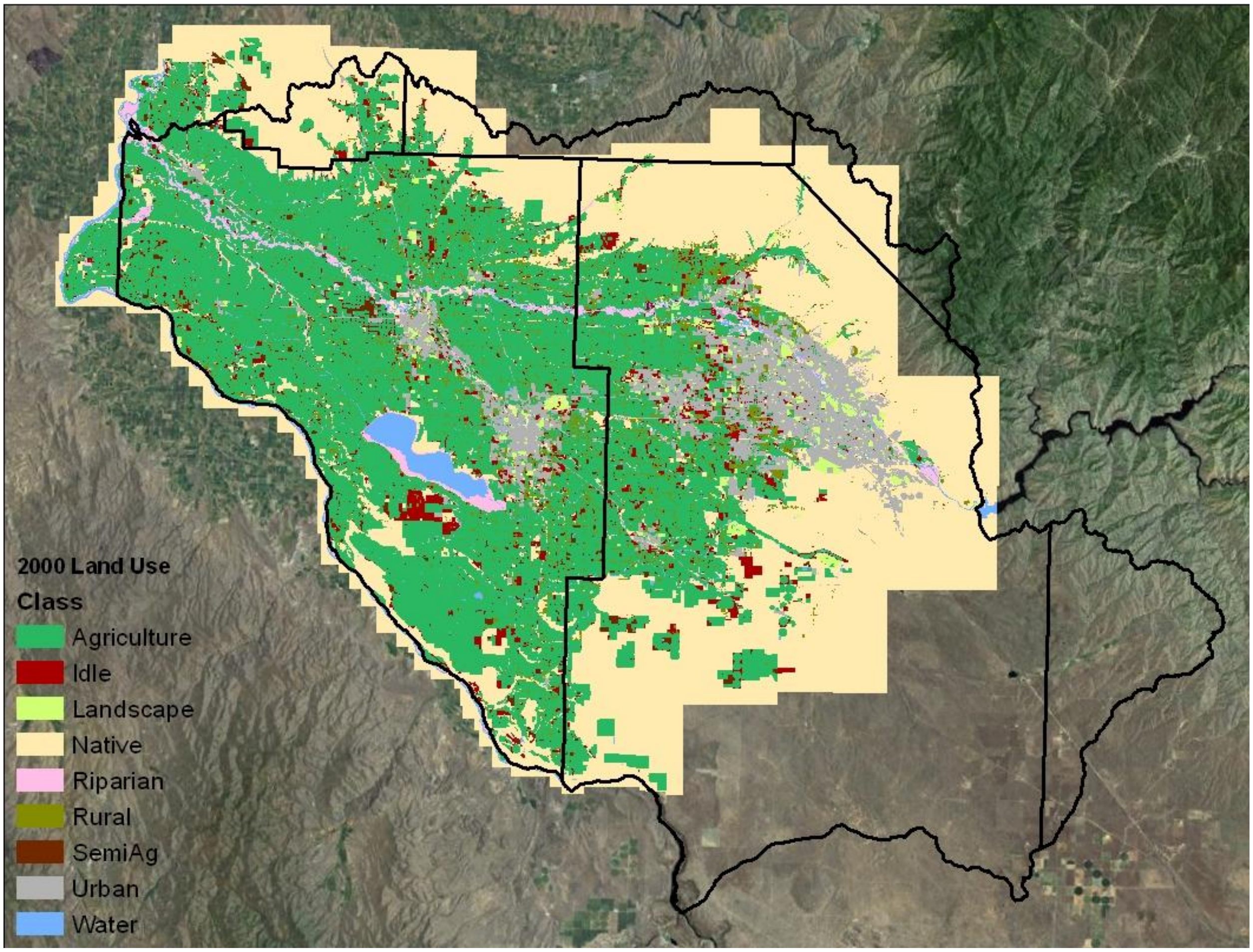
	Agency	Production	Delivered	Residential	Comm/Ind	Other [1]	Unaccounted Water[2]
Ada	**Boise**	47,746	45,066	29,346	15,226	494	6%
	Capitol Water Corp [3]	2,845	2,418	***1,773***	***484***	***161***	15%
	United Water Idaho	44,901	42,648	27,573	14,742	333	5%
	Eagle	2,989	2,713	1,987	725		9%
	Eagle Water Co	2,599	2,345	1,657	687		10%
	United Water Idaho	390	335	297	38		14%
	Garden City	4,342	2,848	1,823	1,025		34%
	Kuna	2,668	1,561	1,391	127	43	41%
	Kuna (excl. Mayfield)	2,419	1,387	1,260	127	20	43%
	Mayfield Springs WC [3]	255	255	255			0%
	Meridian	9,350	8,910	8,465	356	89	5%
	Star	1,135	965	***965***			15%
Canyon	**Caldwell**	5,565	5,119	3,333	1,729	56	8%
	Greenleaf [4,5,6]	110	94	***77***	***15***	***2***	15%
	Melba [4,5,6]	69	59	***48***	***9***	***1***	15%
	Middleton [4,5,6]	597	507	***418***	***81***	***8***	15%
	Nampa [4,5,6]	8,500	7,200	***5,925***	***1,155***	***120***	15%
	Notus [4,5,6]	77	65	***54***	***10***	***1***	15%
	Parma [4,5,6]	226	192	***158***	***31***	***3***	15%
	Wilder [4,5,6]	190	162	***133***	***26***	***3***	15%

1. Other includes: municipal, green space irrigation, etc.
2. Unaccounted water is the percent difference between water production and water delivered and includes: fire protection, system flushing, water loss to the system, etc.
3. Historical water production and delivery records provided by the agency water purveyor. Annual Public Utilities Commission reports were used for private water companies if the information was not available directly from purveyor.
4. Water production for 2009 was not available; the average of 2006 to 2008 was used.
5. Water delivery was estimated at an average loss of 15 percent from production rates.
6. The average water delivered to residential, commercial, and other was calculated from similar sized agencies.

Land Use

A current land use profile was developed from information collected from the cities' comprehensive plans, the county assessors' parcel maps, and land use maps from IDWR, USDA, and Natural Resource Conservation Service (NRCS). IDWR has the land cover and vegetation maps for Boise River basin for years 1994 and 2000. Figure 2-4 shows the land use coverage designated as 2000 level land use.

Figure 2-4. Year 2000 Land Use Map for the Treasure Valley



Land use acreages and classifications were extracted and consolidated from the available data collected. Table 2-7 summarizes the land use acreages for years 1994, 2000, and 2010 (exiting conditions). IDWR land use coverage for 1994 and 2000 were used to estimate the 1994 and 2000 land use acreages respectively. For 2010 land use acreages, it was assumed all 2000 urban land use types remained the same and that all 2000 non-urbanized areas intersecting U.S. Census Bureau "U.S. Populated Place Areas" converted to urban. Over half of the Treasure Valley is undeveloped. Agricultural land use is approximately three times larger than current urban development.

Table 2-7. Acreages for Land Use for Years 1994, 2000, and 2010 (existing conditions)

	Native	Agricultural	Urban[1]	Rural[2]	Riparian	Other	Total
1994	580,136	361,155	42,724	38,633	14,171	41,743	1,078,562
2000	561,085	358,045	52,914	48,079	12,932	45,506	1,078,562
2010 (Existing Conditions)	551,822	348,025	78,904	48,078	11,929	39,805	1,078,562

1. Includes residential, commercial, recreation, and municipal areas within the existing city limits in Treasure Valley
2. Includes all the rural residential area within and outside of the existing city limits in Treasure Valley

Residential use comprises 80 percent of the current urban land use within Treasure Valley. Ada County, which is the most populous, has an overall smaller percentage of commercial and industrial land use within the urban area compared to Canyon County. A comparison of the total amount of water delivered for commercial/industrial use of similarly reported commercial acreage within Ada and Canyon counties indicates that either the industries within Ada County require larger volumes of water in relation to their place of business (i.e. construction industry), or that the total acreage may be under reported.

The urban land use classification is further broken into three categories by city: residential, commercial/industrial, and other. The categories were selected to maintain consistency with reported water use data. . Urban land use for each of these categories is summarized in Table 2-8. Residential includes single-family, multi-family, and mobile homes located within the 2010 city limits. Residential does not include rural residential units within the city limits. Commercial/Industrial (Comm/Ind) includes all places of business including commercial office spaces, industrial factories, junk yard, petroleum tank yard, etc. within the city limits. Other includes municipal and parks and recreation.

Table 2-8. Urban Land Use by Category[1], 2010 (acres)

	Agency	Residential	Comm/Ind	Other
Ada	**Boise**	28,962	7,379	3,518
	Eagle	4,838	202	458
	Garden City	1,631	777	148
	Kuna	1,143	107	133
	Meridian	5,424	1,438	495
	Star	389	13	32
	Urban Total	**42,386**	**9,916**	**4,785**
Canyon	**Caldwell**	4,674	1,629	573
	Greenleaf	378	17	25
	Melba	128	30	35
	Middleton	924	51	83
	Nampa	8,299	2,707	1,188
	Notus	185	40	9
	Parma	336	181	77
	Wilder	162	39	46
	Urban Total	**15,086**	**4,694**	**2,037**
Treasure Valley Urban		**57,472**	**14,610**	**6,821**

1. Acreages for 2010 were estimated from cities' comprehensive plans, the county assessors' parcel maps, and land use maps from IDWR, USDA, and NRCS.

3 Water Demand Projections: DCMI and Agricultural

Water is the defining element in continued and sustainable development of Treasure Valley. The total water demand in the Treasure Valley is comprised of two elements: (1) Domestic, Municipal, Industrial, and Commercial (DCMI) water demand and (2) Agricultural water demand. It is estimated that substantial amount of additional water will be needed by 2030 to meet the growing DCMI demand in the Valley. However, the impact of agricultural to urban land use conversion on the total water demand in the Valley is not fully known. Therefore, the key goal of the current Study is to estimate the future total water demand, inclusive of DCMI and agricultural demands, in 10-year increments up to 2060.

As discussed in Section 2, there is a general lack of consistent data about future growth, land use, and water operations in Treasure Valley, especially beyond the year 2030. Many of the general build-out plans are also in a state of flux as they are being revised and updated. As a result, a single unified method for projecting water demand cannot be applied throughout the Valley. It was decided to make use of the best available data and develop a customized approach for calculating the future water demand in collaboration with IDWR and the Treasure Valley CAMP Advisory Committee.

A preliminary approach was developed and presented on April 28, 2010 with initial results to IDWR and the Treasure Valley CAMP Advisory Committee. Based on the comments and feedback on this preliminary approach, a series of meetings was conducted with the Advisory Committee and stakeholders and additional data were collected, compiled, and reviewed. This preliminary approach was further refined based on these interactions and a final approach and methodology, with summary results, was presented to the CAMP Advisory Committee on July 29, 2010. This final approach was used to calculate the future water demand estimates for both DCMI and agricultural demands.

The results of the water demand calculation are presented in this section of the report. This section is organized as follows:

Section 3.1 Approach and Methodology. Presents a description of the customized approach developed for the current Study on the basis of different standard methods used previously in the Treasure Valley, such as Land Use Projection and Population Projection.

Section 3.2 DCMI Demand Projections. Presents the DCMI estimates calculated by using the approach described in Section 3.1. Detailed tables and estimation steps are provided throughout the section.

Section 3.3 Agricultural Demand Projections. Presents the 2010 to 2060 estimates for agricultural water use computed on the basis of consumptive use.

Section 3.4 Total Water Demand. Summarizes the total future water demand estimates.

3.1 Approach and Methodology for Water Demand Projection

As presented in Section 2, several water planning and investigation studies have been conducted in the past by Idaho Water Resource Research Institute (IWRRI), IDWR, and others. These studies estimated the current and future water demands at different levels of development. It is very important to leverage the information provided in these past studies. As a result, the general methodology for the current Study is defined at the outset to consist of the following steps:

- Estimate future DCMI using previously used methodologies in Idaho with necessary modifications after reviewing newly available data and information
- Estimate agricultural water demand using a consumptive use model with geographic information system (GIS) analysis of current land uses and projected future land use patterns

Approach for DCMI Water Demand Projection

A detailed analysis of existing data and build-out and city impact area maps for future planning horizons was not sufficient to reliably estimates future water demands with a single method. It was determined instead that a combination of methods would be required for calculating different components of the DCMI demand.

For the purposes of future projections, DCMI demand is broken down into six categories based on the available data and estimation methodology:

1. Domestic irrigation water demand
2. Recreational water demand
3. Urban water demand
4. Rural residential water demand
5. Commercial and industrial (private pumpers) water demand
6. Livestock water demand

The data used for estimating demands for these categories are: baseline water use data, population projections, land use projections, employment estimates for different industry categories, and livestock inventories. The computational flow diagram in Figure 3-1 summarily presents how these DCMI water demand components are estimated using different methods and data sets. It should be noted that all current information and data available from the cities and water purveyors are fully utilized and preserved during this process of calculation. For example, UWI provided its projected water demand data up to 2065; its estimated water demands in 10-year increments are preserved in the overall calculation by separating its service area and carrying forward its data with the rest of the sub areas within the Treasure Valley. It is not intended for the assumptions in this study to override existing work, but to use all work consistent with generally accepted and up-to-date water demand or demographic projections.

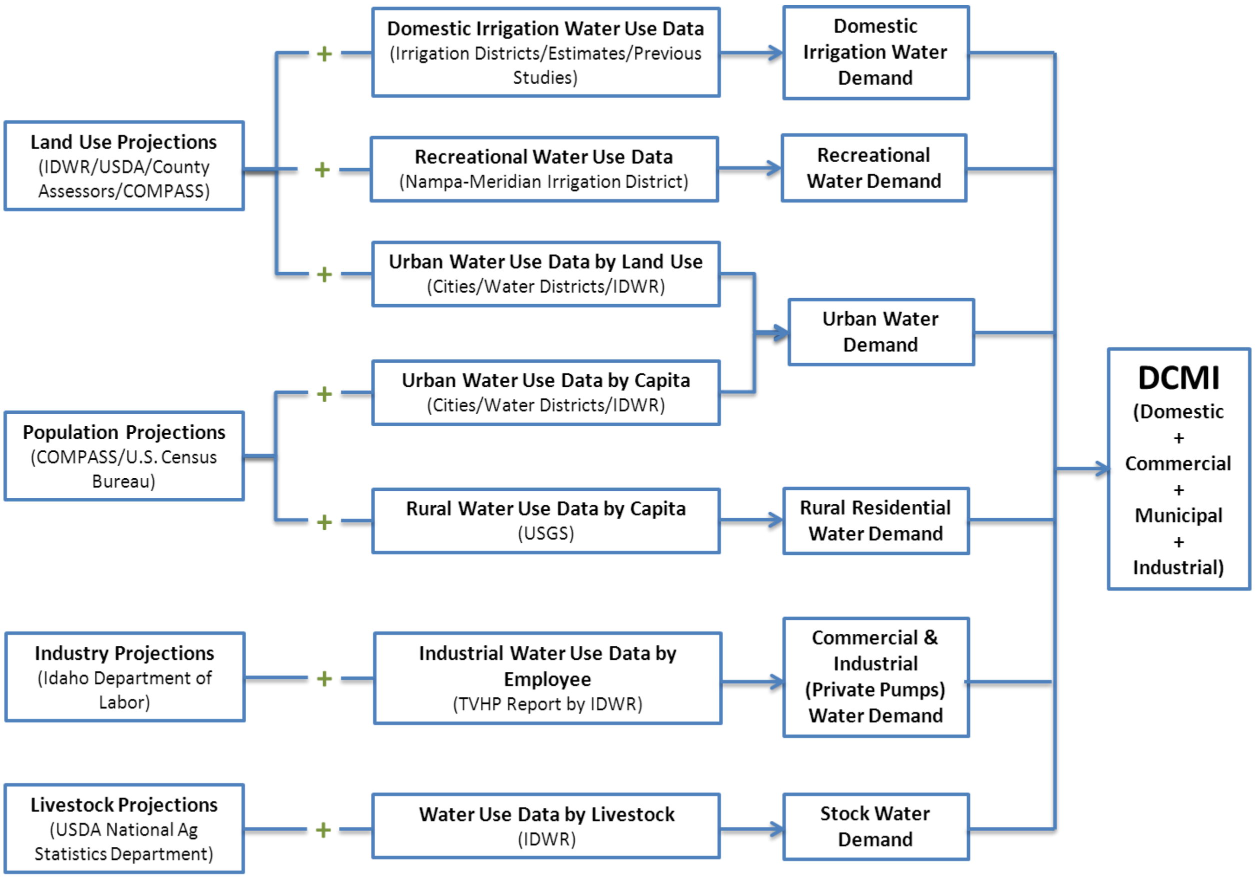
As shown in Figure 3-1, the domestic irrigation water demand, recreational water demand, and urban water demand were estimated using land use projections. These projections are based on land use surveys from IDWR, USDA, county assessors, and the cities' defined areas of impact and planned areas of impact. A GIS analysis of these maps was conducted to develop the land use projections for different land use types from 2010 to 2060 in 10-year increments. The domestic irrigation water use rates were estimated from baseline land use acreages and data provided by irrigation districts and previous studies. These rates were multiplied by the projected land use acreages to obtain the domestic irrigation water demand. Similarly, recreational water demand was estimated using the recreational water use rates, estimated from baseline land use acreages and NMID's water use data, multiplied by projected land use acreages. Water use data from various cities, water districts, and IDWR were collected and divided by baseline land use acreages to estimate the urban water use rate. This rate was multiplied by the projected land use acreages to estimate urban water demand.

Because population projection data were readily available, it was decided to estimate urban water demand by using the population projections and multiplying the population number by the urban per capita water use rate. This population-based estimate was used to cross check the urban water demand estimate developed by using the land use data as described above.

Population projections were used to develop the rural residential water demand because the granularity in the source land use data was inadequate for this use. COMPASS has forecasts of population growth in Ada and Canyon counties for 2010 to 2035. For this study, the population data was projected for the next 50 years using the current U.S. Census Bureau population estimates and the average population growth rate COMPASS. This population projection data were multiplied by the rural water use rates per capita obtained from USGS for Ada and Canyon counties to estimate the rural residential water demand.

There was insufficient data to estimate the commercial/industrial (private pumps) water demand and livestock water demand using the land use based method. A multi-step process was used for commercial/industrial demand projections. First, employee census data for different industry categories were obtained from the Idaho Department of Labor. Then, water use rates provided in the TVHP report by IDWR were multiplied by employee count of each industry category. Finally, all the estimates for each category were summed to estimate the water demand for self-supplied commercial and industrial water demand. A similar approach was used for livestock water demand estimates. Livestock inventory from USDA National Agricultural Statistics Department and water use rates from IDWR were used together to estimate livestock water demand estimates.

Figure 3-1. DCMI Methodology Flow Diagram



Approach for Agriculture Water Demand Projection

Agricultural water demand was estimated based on the consumptive use methodology, in 10-year increments. The IDC model was used to estimate water demand. This model simulates routing of precipitation runoff and irrigation tail water through the root zone and computes land use based water demands. It predicts the agricultural water demand based on crop acreages, crop and soil properties, irrigation management practices, and precipitation patterns. Agricultural water demand for each crop is based on the crop consumptive use of applied water, seasonal application efficiency of the crop, and the amount of irrigation water re-used.

Consumptive Use of Applied Water (CUAW) is the applied water needed for crop production under optimum agricultural conditions with:

- No water stresses
- Minimum deep percolation
- Minimum soil moisture requirements

These conditions are maintained by keeping the soil moisture at the root zone between the field capacity and the minimum soil moisture requirements.

The rate of applied water required for optimum agricultural conditions, CUAW, can be obtained from the following equation:

$CUAW = S_{min} + E - (S_b + P_e)$

Where,

S_{min} = minimum soil moisture requirement,

E = evapotranspiration,

S_b = beginning soil moisture, and

P_e = effective precipitation or infiltrated precipitation.

Evapotranspiration and precipitation takes into account climate change scenarios, as discussed earlier. The above equation represents the amount of water that should be added to the root zone to maintain the optimum agricultural conditions. However, not all of the irrigation water contributes to crop CUAW and a portion always becomes deep percolation or return flow. Therefore, irrigation efficiency was taken into account for computation of the agricultural water demand:

$$\text{Agricultural Water Demand} = \text{CUAW} / \text{Irrigation Efficiency}$$

The IDC model computes CUAW at various user defined time steps (e.g., daily, monthly) and allows the user to divide the study area into multiple subregions. Using GIS datasets, the land use characteristics in the study area including crop acreages, urban land, riparian vegetation, and native vegetation land are defined for each subregion. Soil properties, crop properties, and initial soil moisture contents are also specified for each subregion. The IDC also calculates infiltration through the root and soil zones for estimation of deep percolation and recharge from rainfall and applied water.

3.2 DCMI Projection Results

The approach described in Section 3.1 was applied to develop the DCMI water demand projections in Treasure Valley for 2010 to 2060 in 10-year increments. Two methods were used to calculate the DCMI components: land use based method and population based method. The results of these two methods are summarized below with necessary tables and figures.

Land Use Based Method Results

The land use based method is used for calculating the following components of DCMI:

1. Urban water demand
2. Domestic irrigation water demand
3. Recreational water demand

Land use projections for the next 50 years in 10 years increments were developed by using a GIS analysis of existing land use maps, future build-out maps, and city impact area maps. Baseline (2010) acreages were estimated from cities' comprehensive plans, the county assessors' parcel maps, and land use maps from IDWR, USDA, and NRCS as described in Section 2. The acreages for 2035 and 2060 were estimated by using baseline land use information, COMPASS population projections, U.S. Populated Place Areas coverage based on US Census Bureau data, and information provided by the Ada and Canyon counties assessor offices for their development plans. The acreages for 2020 and 2030 were developed by linear interpolation between 2010 and 2035. Similarly, the acreages for 2040 and 2050 were developed by linear interpolation using acreages from 2035 and 2060. The projected urban land use data is shown in Table 3-1.

Table 3-1. Projected Urban Land Use (Acres)

	Agency	2010	2020	2030	2040	2050	2060
Ada	**Boise**	39,858	46,021	52,183	58,159	64,876	71,284
	Eagle	5,498	7,715	9,932	12,618	15,799	18,972
	Garden City	2,556	2,764	2,971	3,156	3,356	3,543
	Kuna	1,383	6,282	11,180	14,240	15,511	16,766
	Meridian	7,357	12,687	18,016	23,754	30,167	36,492
	Star	434	1,659	2,885	3,883	4,661	5,437
	Urban Total	**57,087**	**77,127**	**97,168**	**115,809**	**134,372**	**152,494**
Canyon	**Caldwell**	6,876	9,183	11,490	15,112	20,323	25,442
	Greenleaf	420	420	420	3,814	10,698	17,550
	Melba	193	193	193	622	1,485	2,346
	Middleton	1,058	1,491	1,923	5,375	11,985	18,550
	Nampa	12,194	15,772	19,350	25,131	33,464	41,680
	Notus	235	235	235	1,907	5,298	8,674
	Parma	594	594	594	2,824	7,406	11,947
	Wilder	247	247	247	1,657	4,546	7,413
	Urban Total	**21,817**	**28,134**	**34,452**	**56,442**	**95,205**	**133,601**
Treasure Valley Urban[1]		**78,904**	**105,262**	**131,620**	**172,251**	**229,576**	**286,095**

1. Urban land use projections include residential, municipal, commercial, recreation, and industrial land use within existing city limits in Treasure Valley

The projected land use was multiplied by the water use rate by land use category to estimate water demand. Table 3-2 shows the current average annual water use by land use category, which was calculated by dividing the annual water produced and delivered (Table 2-6) by the baseline acreages (Table 2-8).

Table 3-2. Current Average Annual Water Use by Land Use Category (af/acre)

	Agency	Residential	Commercial	Other[1]	Average Production	Average Delivered
Ada	Boise	1.01	2.06	0.14	1.20	1.13
Ada	Eagle	0.41	3.59	0.00	0.54	0.49
Ada	Garden City	1.12	1.32	0.00	1.70	1.11
Ada	Kuna	1.22	1.18	0.32	1.93	1.13
Ada	Meridian	1.56	0.25	0.18	1.27	1.21
Ada	Star	2.48	0.00	0.00	2.62	2.22
Canyon	Caldwell	0.71	1.06	0.10	0.81	0.74
Canyon	Greenleaf	0.20	0.88	0.06	0.26	0.22
Canyon	Melba	0.38	0.07	0.03	0.36	0.30
Canyon	Middleton	0.45	1.60	0.10	0.56	0.48
Canyon	Nampa	0.71	0.43	0.10	0.70	0.59
Canyon	Notus	0.29	0.26	0.12	0.33	0.28
Canyon	Parma	0.47	0.17	0.04	0.38	0.32
Canyon	Wilder	0.82	0.67	0.06	0.77	0.66

1. Other includes recreation, municipal, and other water use

The calculated water demand estimates for the next 50 years in 10 years increments is shown in Table 3-3a. The average production water use rate presented in Table 3-2 for each city was multiplied by the corresponding projected acreage in Table 3-1 to estimate urban water demand for that city. Table 3-1 does not include domestic irrigation from water provided by irrigation districts.

Table 3-3a. Projected Urban Water Demand Based on Projected Land Use with Current Delivery Losses (af/year)

	Agency	2010	2020	2030	2040	2050	2060
Ada	Boise	47,595	54,354	61,113	67,313	74,980	81,972
Ada	Eagle	2,963	3,936	4,908	6,084	7,572	9,023
Ada	Garden City	3,828	4,075	4,323	4,534	4,775	4,993
Ada	Kuna	2,208	10,636	19,063	24,329	26,517	28,678
Ada	Meridian	9,329	17,833	26,337	35,616	45,740	55,841
Ada	Star	1,110	4,596	8,082	10,928	13,134	15,341
Ada	**Urban Total**	**67,034**	**95,430**	**123,826**	**148,804**	**172,719**	**195,849**
Canyon	Caldwell	5,529	7,315	9,102	11,874	15,947	19,915
Canyon	Greenleaf	108	108	108	903	2,590	4,245
Canyon	Melba	59	59	59	244	615	985
Canyon	Middleton	584	813	1,042	2,833	6,441	9,964
Canyon	Nampa	8,301	11,207	14,112	18,861	25,626	32,333

	Notus	75	75	75	632	1,760	2,883
	Parma	221	221	221	1,422	3,850	6,269
	Wilder	186	186	186	1,519	4,237	6,938
	Urban Total	**15,062**	**19,983**	**24,905**	**38,289**	**61,065**	**83,532**
Treasure Valley Urban		**82,096**	**115,413**	**148,731**	**187,093**	**233,784**	**279,380**

Table 3-3b presents urban water demand estimates for the next 50 years in 10 years increments using the land use based model assuming that all water purveyors decrease their system water delivery losses by 30 percent or fix it at 12 percent (national average) if the 30 percent decrease put the losses under 12 percent. Water delivery rates for the baseline conditions were increased by the new, lower water losses for each category, multiplied by the corresponding acreage from the projected land use acreages table, and summed to estimate the Treasure Valley urban water demand with conservation measures. Like Table 3-3a, this table does not include domestic irrigation from water provided by irrigation districts.

Table 3-3b. Projected Urban Water Demand Based on Projected Land Use with Conservation Measures (af/year)

	2010	2020	2030	2040	2050	2060
Treasure Valley Urban	**81,230**	**113,364**	**145,499**	**182,820**	**228,584**	**273,263**

Population Based Method Results

This section presents the results of the population based method. The urban and rural water demands were estimated over the next 50 years using water use rates per capita. Water use rates can be calculated using the baseline water production and use table and baseline population estimates table presented in Section 2.

Tables 3-4 and 3-5 show the annual population projections for Ada and Canyon counties respectively from 2010 to 2060. Baseline population estimates from U.S. Census Bureau population projections were used as a basis for these projections. The average population growth rate from COMPASS projections (2.1 percent) for Treasure Valley was used to project the population of each individual city year by year except Boise. A smaller rate of growth (2.0 percent) was used for Boise after examining the UWI population projections for its service area and Ada County. UWI projects larger growth rates for Ada County than for its service area.

Table 3-4. Ada County Population Projection

ADA COUNTY								
Year	**Boise**	**Garden City**	**Kuna**	**Eagle**	**Meridian**	**Star**	**Rural**	**Total**
2010	209,821	12,141	14,834	14,643	69,955	2,371	68,999	392,734
2011	214,018	12,396	15,175	14,950	71,424	2,421	70,658	400,981
2012	218,298	12,656	15,524	15,264	72,924	2,472	72,355	409,402

2013	222,664	12,922	15,881	15,585	74,455	2,523	74,093	417,999
2014	227,117	13,193	16,246	15,912	76,019	2,576	75,872	426,777
2015	231,659	13,470	16,620	16,246	77,615	2,631	77,692	435,740
2016	236,293	13,753	17,002	16,588	79,245	2,686	79,555	444,890
2017	241,019	14,042	17,393	16,936	80,909	2,742	81,462	454,233
2018	245,839	14,337	17,793	17,292	82,608	2,800	83,414	463,772
2019	250,756	14,638	18,202	17,655	84,343	2,859	85,412	473,511
2020	255,771	14,945	18,621	18,025	86,114	2,919	87,456	483,455
2021	260,886	15,259	19,049	18,404	87,923	2,980	89,548	493,607
2022	266,104	15,579	19,487	18,790	89,769	3,042	91,690	503,973
2023	271,426	15,907	19,935	19,185	91,654	3,106	93,881	514,556
2024	276,855	16,241	20,394	19,588	93,579	3,172	96,124	525,362
2025	282,392	16,582	20,863	19,999	95,544	3,238	98,420	536,395
2026	288,039	16,930	21,343	20,419	97,551	3,306	100,769	547,659
2027	293,800	17,285	21,834	20,848	99,599	3,376	103,173	559,160
2028	299,676	17,648	22,336	21,286	101,691	3,446	105,634	570,902
2029	305,670	18,019	22,850	21,733	103,826	3,519	108,152	582,891
2030	311,783	18,398	23,375	22,189	106,007	3,593	110,728	595,132
2031	318,019	18,784	23,913	22,655	108,233	3,668	113,366	607,629
2032	324,379	19,178	24,463	23,131	110,506	3,745	116,064	620,390
2033	330,867	19,581	25,026	23,617	112,826	3,824	118,826	633,418
2034	337,484	19,992	25,601	24,113	115,196	3,904	121,652	646,720
2035	344,234	20,412	26,190	24,619	117,615	3,986	124,544	660,301
2036	351,118	20,841	26,792	25,136	120,085	4,070	127,504	674,167
2037	358,141	21,278	27,409	25,664	122,606	4,155	130,533	688,325
2038	365,304	21,725	28,039	26,203	125,181	4,243	133,632	702,779
2039	372,610	22,181	28,684	26,753	127,810	4,332	136,804	717,538
2040	380,062	22,647	29,344	27,315	130,494	4,423	140,049	732,606
2041	387,663	23,123	30,018	27,888	133,234	4,516	143,370	747,991
2042	395,416	23,608	30,709	28,474	136,032	4,610	146,769	763,699
2043	403,325	24,104	31,415	29,072	138,889	4,707	150,246	779,736
2044	411,391	24,610	32,138	29,683	141,805	4,806	153,805	796,111
2045	419,619	25,127	32,877	30,306	144,783	4,907	157,446	812,829
2046	428,011	25,655	33,633	30,942	147,824	5,010	161,172	829,898
2047	436,572	26,194	34,407	31,592	150,928	5,115	164,985	847,326
2048	445,303	26,744	35,198	32,256	154,098	5,223	168,886	865,120
2049	454,209	27,305	36,008	32,933	157,334	5,332	172,878	883,288
2050	463,293	27,879	36,836	33,625	160,638	5,444	176,962	901,837
2051	472,559	28,464	37,683	34,331	164,011	5,559	181,142	920,775
2052	482,010	29,062	38,550	35,052	167,455	5,675	185,418	940,112

2053	491,651	29,672	39,436	35,788	170,972	5,795	189,794	959,854
2054	501,484	30,295	40,343	36,539	174,562	5,916	194,272	980,011
2055	511,513	30,932	41,271	37,307	178,228	6,041	198,853	1,000,591
2056	521,744	31,581	42,220	38,090	181,971	6,167	203,540	1,021,604
2057	532,178	32,244	43,192	38,890	185,792	6,297	208,336	1,043,057
2058	542,822	32,922	44,185	39,707	189,694	6,429	213,243	1,064,961
2059	553,678	33,613	45,201	40,540	193,677	6,564	218,264	1,087,326
2060	564,752	34,319	46,241	41,392	197,745	6,702	223,402	1,110,159

Table 3-5. Canyon County Population Projection

CANYON County										
Year	**Caldwell**	**Nampa**	**Parma**	**Wilder**	**Middleton**	**Greenleaf**	**Melba**	**Notus**	**Rural**	**Total**
2010	44,190	82,947	1,921	1,517	5,902	964	581	637	51,875	190,534
2011	45,118	84,689	1,961	1,549	6,026	984	593	650	52,964	194,535
2012	46,065	86,467	2,002	1,582	6,153	1,005	606	664	54,077	198,620
2013	47,033	88,283	2,044	1,615	6,282	1,026	618	678	55,212	202,791
2014	48,020	90,137	2,087	1,649	6,414	1,047	631	692	56,372	207,050
2015	49,029	92,030	2,131	1,683	6,549	1,069	645	707	57,555	211,398
2016	50,058	93,963	2,176	1,719	6,686	1,092	658	722	58,764	215,837
2017	51,110	95,936	2,221	1,755	6,827	1,115	672	737	59,998	220,370
2018	52,183	97,951	2,268	1,792	6,970	1,138	686	752	61,258	224,998
2019	53,279	100,008	2,316	1,829	7,116	1,162	700	768	62,545	229,723
2020	54,398	102,108	2,364	1,868	7,266	1,186	715	784	63,858	234,547
2021	55,540	104,252	2,414	1,907	7,418	1,211	730	801	65,199	239,472
2022	56,706	106,441	2,464	1,947	7,574	1,237	745	818	66,568	244,501
2023	57,897	108,677	2,516	1,988	7,733	1,263	761	835	67,966	249,636
2024	59,113	110,959	2,569	2,030	7,896	1,289	777	852	69,393	254,878
2025	60,354	113,289	2,623	2,072	8,061	1,316	793	870	70,851	260,231
2026	61,622	115,668	2,678	2,116	8,231	1,344	810	888	72,339	265,695
2027	62,916	118,097	2,734	2,160	8,404	1,372	827	907	73,858	271,275
2028	64,237	120,577	2,792	2,206	8,580	1,401	845	926	75,409	276,972
2029	65,586	123,109	2,850	2,252	8,760	1,430	862	946	76,992	282,788
2030	66,963	125,694	2,910	2,299	8,944	1,461	880	965	78,609	288,727
2031	68,370	128,334	2,971	2,347	9,132	1,491	899	986	80,260	294,790
2032	69,805	131,029	3,034	2,397	9,324	1,523	918	1,006	81,945	300,981
2033	71,271	133,781	3,097	2,447	9,520	1,554	937	1,028	83,666	307,301
2034	72,768	136,590	3,163	2,498	9,720	1,587	957	1,049	85,423	313,755
2035	74,296	139,458	3,229	2,551	9,924	1,620	977	1,071	87,217	320,343
2036	75,856	142,387	3,297	2,604	10,132	1,655	997	1,094	89,049	327,071

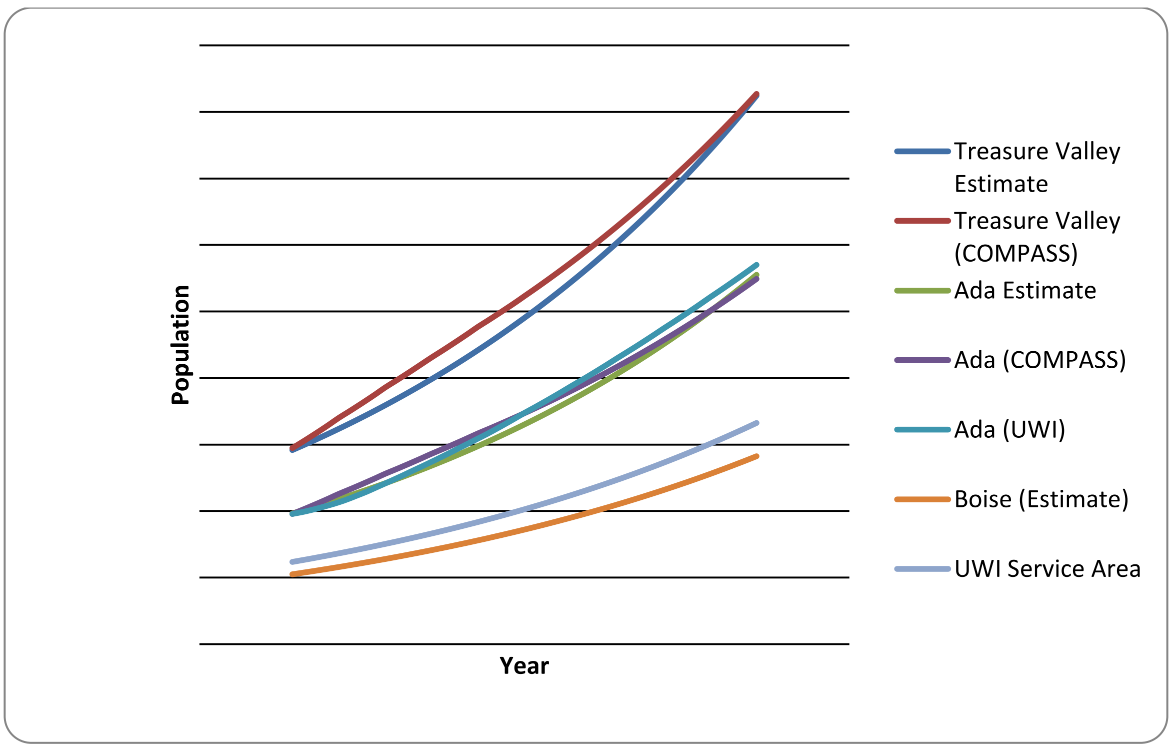
2037	77,449	145,377	3,366	2,659	10,345	1,689	1,018	1,117	90,919	333,939
2038	79,076	148,430	3,437	2,715	10,562	1,725	1,040	1,140	92,828	340,952
2039	80,736	151,547	3,509	2,772	10,784	1,761	1,061	1,164	94,777	348,112
2040	82,432	154,730	3,583	2,830	11,010	1,798	1,084	1,188	96,768	355,422
2041	84,163	157,979	3,658	2,890	11,242	1,836	1,106	1,213	98,800	362,886
2042	85,930	161,296	3,735	2,950	11,478	1,874	1,130	1,239	100,875	370,507
2043	87,735	164,684	3,813	3,012	11,719	1,914	1,153	1,265	102,993	378,287
2044	89,577	168,142	3,893	3,076	11,965	1,954	1,178	1,291	105,156	386,231
2045	91,458	171,673	3,975	3,140	12,216	1,995	1,202	1,319	107,364	394,342
2046	93,379	175,278	4,058	3,206	12,473	2,037	1,228	1,346	109,619	402,623
2047	95,340	178,959	4,143	3,273	12,734	2,079	1,253	1,375	111,921	411,078
2048	97,342	182,717	4,231	3,342	13,002	2,123	1,280	1,403	114,271	419,711
2049	99,386	186,554	4,319	3,412	13,275	2,168	1,307	1,433	116,671	428,525
2050	101,474	190,472	4,410	3,484	13,554	2,213	1,334	1,463	119,121	437,524
2051	103,604	194,472	4,503	3,557	13,838	2,260	1,362	1,494	121,622	446,712
2052	105,780	198,556	4,597	3,632	14,129	2,307	1,391	1,525	124,176	456,093
2053	108,002	202,725	4,694	3,708	14,426	2,356	1,420	1,557	126,784	465,671
2054	110,270	206,983	4,792	3,786	14,729	2,405	1,450	1,590	129,447	475,450
2055	112,585	211,329	4,893	3,865	15,038	2,456	1,480	1,623	132,165	485,435
2056	114,950	215,767	4,996	3,947	15,354	2,507	1,511	1,657	134,940	495,629
2057	117,363	220,298	5,101	4,030	15,676	2,560	1,543	1,692	137,774	506,037
2058	119,828	224,924	5,208	4,114	16,005	2,614	1,575	1,728	140,667	516,664
2059	122,344	229,648	5,317	4,201	16,341	2,668	1,608	1,764	143,621	527,514
2060	124,914	234,470	5,429	4,289	16,685	2,724	1,642	1,801	146,637	538,591

Table 3-6 and Figure 3-2 show the comparison of the Study population projections with COMPASS and UWI population projections. Table 3-6 and Figure 3-2 indicate that the Treasure Valley population estimates from the Study are slightly higher than the population estimates from COMPASS. The Study population projections for 2020 and 2030 are approximately 7 percent less than the COMPASS population projections for Treasure Valley. However, the other years are within 5 percent, and the 2060 population projections almost the same. Ada County population projections from COMPASS and the current Study follow the same trends as the Treasure Valley projections. UWI projections for Ada County are slightly less than the Study projections in the early years. Later, UWI population projections reach the Study population projections and finish slightly higher (3 percent). Boise population projections from the Study are approximately 15 percent lower than the UWI population projections for its service area. However, 15 percent of the UWI service area is out of Boise and subtracting this difference brings the Study's population projections for Boise relatively close UWI's projection.

Table 3-6. Population Projection Comparison

	Study Population Projections				Projection Comparison			
Year	**Boise**	**Ada County**	**Canyon County**	**Treasure Valley**	**Ada** COMPASS	**UWI Service Area**	**Ada** UWI	**Treasure Valley** COMPASS
2010	209,821	392,734	190,534	583,268	391,352	247,000	391,352	589,251
2020	255,771	483,455	234,547	718,001	512,062	301,092	482,896	771,442
2030	311,783	595,132	288,727	883,859	633,438	367,029	618,005	953,949
2040	380,062	732,606	355,422	1,088,028	760,877	447,406	774,800	1,146,400
2050	463,293	901,837	437,524	1,339,361	913,954	545,386	949,100	1,377,039
2060	564,752	1,110,159	538,591	1,648,751	1,097,830	664,822	1,140,100	1,654,081

Figure 3-2. Population Projection Comparison



The current average annual water use per capita is summarized in Table3-7. This table was calculated by dividing the annual water produced and delivered (summarized in Table 2-6) by the baseline populations presented in Tables 2-4 and 2-5.

Table 3-7. Current Average Annual Water Use Rates per Capita (af/capita)

	City	Production	DCMI Delivered	Residential	Comm/Ind	Other
Ada	Boise	0.23	0.21	0.14	0.07	0.00
	Eagle	0.20	0.19	0.14	0.05	-
	Garden City	0.36	0.23	0.15	0.08	-
	Kuna	0.18	0.11	0.09	0.01	0.01
	Meridian	0.13	0.13	0.12	0.01	0.00
	Star	0.48	0.41	0.34	0.07	0.01
	Subtotal	**0.21**	**0.19**	**0.14**	**0.05**	**0.00**
Canyon	Caldwell	0.13	0.12	0.08	0.04	0.00
	Greenleaf	0.11	0.10	0.08	0.02	0.00
	Melba	0.12	0.10	0.08	0.02	0.00
	Middleton	0.10	0.09	0.07	0.01	0.00
	Nampa	0.10	0.09	0.07	0.01	0.00
	Notus	0.12	0.10	0.08	0.02	0.00
	Parma	0.12	0.10	0.08	0.02	0.00
	Wilder	0.13	0.11	0.09	0.02	0.00
	Subtotal	**0.11**	**0.10**	**0.07**	**0.02**	**0.00**
Treasure Valley		**0.18**	**0.13**	**0.08**	**0.02**	**0.00**

Table 3-8a shows the water demand estimates for the next 50 years in 10 years increment using the population projections. Projected populations for each city were multiplied by the production water rates to calculate water demand. This table does not include domestic irrigation and industrial private water pumping. In Table 3-8a rural water demand is based on the average of water use rates for all of the cities. The equivalent gallons per capita daily (gpcd) use is approximately 160 gpcd for the Treasure Valley. This is consistent with USGS 2005 water use estimates for Ada County (200 gpcd) and Canyon County (160 gpcd).

Table 3-8a. Projected Urban Water Demand Based on Projected Population with Current Delivery Losses (af/year)

	City	2010	2020	2030	2040	2050	2060
Ada	Boise	47,746	58,202	70,948	86,485	105,425	128,512
	Eagle	2,989	3,679	4,529	5,575	6,863	8,448
	Garden City	4,342	5,345	6,580	8,100	9,971	12,275
	Kuna	2,668	3,284	4,042	4,976	6,126	7,541
	Meridian	9,350	11,510	14,169	17,442	21,470	26,430
	Star	1,135	1,398	1,721	2,118	2,607	3,210
	Urban Total	**68,230**	**83,418**	**101,988**	**124,696**	**152,462**	**186,415**

Canyon	**Caldwell**	5,565	6,851	8,433	10,381	12,779	15,731
	Greenleaf	110	136	167	205	253	311
	Melba	69	85	105	129	159	195
	Middleton	597	735	905	1,114	1,371	1,688
	Nampa	8,500	10,463	12,881	15,856	19,519	24,027
	Notus	77	95	116	143	176	217
	Parma	226	278	342	421	518	638
	Wilder	190	234	288	354	436	537
	Urban Total	**15,334**	**18,876**	**23,236**	**28,604**	**35,211**	**43,345**
Treasure Valley Urban		**83,564**	**102,293**	**125,224**	**153,299**	**187,673**	**229,760**
Treasure Valley Rural		**13,905**	**17,407**	**21,781**	**27,242**	**34,060**	**42,568**
Treasure Valley Total		**97,468**	**119,700**	**147,005**	**180,542**	**221,733**	**272,327**

Table 3-8b presents the urban water demand estimates for the next 50 years in 10 years increments using the population based model assuming that all water purveyors decrease their system water delivery losses by 30 percent or fix losses at 12 percent (national average) if the 30 percent decrease puts the losses under 12 percent. Water delivery rates per capita for the baseline conditions were increased by the new, lower water losses for each category, multiplied by the corresponding population from the projected population table, and summed to estimate the Treasure Valley urban water demand with conservation measures.

Table 3-8b. Projected Urban Water Demand Based on Projected Population with Conservation Measures (af/year)

	2010	2020	2030	2040	2050	2060
Treasure Valley Urban	**81,240**	**99,435**	**121,708**	**148,974**	**182,351**	**223,213**
Treasure Valley Rural	**13,905**	**17,407**	**21,781**	**27,242**	**34,060**	**42,568**
Treasure Valley Total	**95,145**	**116,842**	**143,489**	**176,216**	**216,411**	**265,781**

Domestic Irrigation Water Demand Estimates

This section summarizes the results of the domestic irrigation water demand as described in Section 2.

The baseline domestic irrigation water demand estimations are presented in Table 3-9. Domestic irrigated acreages and domestic irrigation water use data were collected from water districts within Treasure Valley and estimates from the previous studies. ”Rural Water Use in an Urbanizing Environment” (Fereday, 2007) estimates a total of 30,000 acres that receive domestic irrigation water in Treasure Valley..

Table 3-9. Current Domestic Irrigation Estimates

	Water Demand (af)	Domestic Irrigated Area (acres)	Water Rate (af/acre)
Boise	**9,125**	**3,755**	**2.43**
Kuna	**3,218**	**992**	**3.24**
Meridian	**3,379**	**1,126**	**3.00**
Nampa[1]	**21,427**	***8,571***	**2.50**
Boise Project	**9,876**	**4,395**	**2.25**
Subtotal	**47,025**	**18,839**	**2.50**
Additional Estimated Domestic Irrigated acreage[2]	**33,948**	**13,600**	**2.50**
Total	**80,973**	**32,439**	**2.50**

1. Nampa provided estimated data for water delivered. The acreage was estimated at 2.5 af/acre.
2. New residential development from 1994 to 2010 is approximately 13,600 acres using domestic irrigation at 2.5 af/acre.
3. All entities estimates are based on water use per acre that includes all impermeable surfaces such as roads, pavements, etc.

The land use based projection for the increase in domestic irrigated acres includes changes in new residential development from 2010 to 2060. The projected changes in new residential development and the assumed water demand based on 2.5 af/acre projected in 10 years increments is presented in Table 3-10.

Table 3-10. Domestic Irrigation Water Demand Projection (af/year)

	2010	2020	2030	2040	2050	2060
New Residential (acres)	32,439	48,624	73,844	113,299	167,000	220,702
Water Demand	80,973	121,560	184,610	283,247	417,500	551,755

Parks and Recreational Water Demand Estimates

This section summarizes the results of the parks and recreation water demand as described in Section 2.

Table 3-11 summarizes the water use by some of the schools, parks, golf courses, and estates within Meridian, Nampa, and Boise Water Districts. Using the water demand and area provide in Table 3-11, an average water use rate of 4.6 AF/Acre was estimated for the recreational water demand projections.

Table 3-11. Parks and Golf Course Water Usage Information (2009)

	Water Demand (AF)	Acres	Water Use Rate (AF/Acre)
Meridian			
Chateau Park	97		14.4
Mountain View High School	251	55	4.6
Meridian's Golf Course	265	61	4.4
Nampa			
Ridgecrest Golf Course	1,322	440	3.0
Boise			
Borah High School	387	25	15.6
Redwood Park	129	7	18.4
Hollandale Estates	387	72	5.4
Countryman Estates	710	113	6.3
Average Water Use			**4.6**

The land use based projection for the recreational acres from 2010 to 2060 are provided in Table 3-12. These area projections were multiplied by the average recreational water use rate to estimate the recreational water demand for the next 50 years in 10 years increments.

Table 3-12. Projected Water Demand for Recreational Area (AF/year)

	2010	2020	2030	2040	2050	2060
Acres	2,795	2,878	3,216	3,454	3,719	3,984
Water Demand (af)	12,730	13,108	14,647	15,731	16,938	18,145

Self-Supplied Industrial/Commercial Water Demand Estimates

This section summarizes the results for self-supplied industrial and commercial water demand estimates.

A limited amount of data is available for private water users within the Treasure Valley. As a result, this study adopted the methodology used in the TVHP report for self-supplied industrial/commercial water demand estimations. As a result, all the assumptions provided in the TVHP report are accepted in this study.

Table 3-13 shows the self-supplied commercial and industrial water demand for 2008. The industry categories are the same as in the TVHP report. 2008 employee census data for each industry was obtained from Idaho Department of Labor for all industries except Micron Technology; a Micron Technology employee count was obtained from Micron Technology's web page. The same water use coefficients from the TVHP report were used. These coefficients were based on data from USGS website: http://h20.er.usgs.gov/public/wateruse. According to the TVHP report, Micron Technology supplied specific water use estimates for 1995 and this estimate is used in this study also.

Table 3-13. Estimates for Commercial and Industrial Water Use by Private Pumpers

Industry	Number of Employees (2009)		Water Use Coefficient[2] (gpd/person)	Water Demand (af/year)		Total Water Demand (af/year)
	Ada	Canyon		Ada	Canyon	
Agriculture[1]	795	2,892	15	13	49	62
Construction[1]	10,316	3,113	390	4,507	1,360	5,867
Food Processing[1]	15,644		1,287	22,553		22,553
Manufacturing[1]	11,097		204	2,536		2,536
Micron[3]	15,000	0	215	3,612	0	3,612
Wood Products[1]	4,584		240	1,232		1,232
					Total	**35,862**

1. Number of employees from http://www.lmi.idaho.gov/
2. Water use coefficients From TVHP Water Budget 1996-2000
3. Micron employee numbers from http://www.micron.com/about/profile.html

Idaho Department of Labor also provided the industry employee census data for 2008 and the employee number projections by industry for 2011 and 2018. The employee census data for these years were multiplied with the water use coefficients presented in Table 3-13 for each industry to estimate the self-supplied industry water use. The results are shown in Table 3-14. Because there is not enough information on employee number projections to have a trend for the next 50 years, the average water demand (37,195 af/year) presented in table 3-14 is used for future self-supplied industrial water demand estimations.

Table 3-14. Comparison of Commercial and Industrial Water Use by Private Pumpers for Various Years (af/year)

	2008	2009	2011	2018	Average
Water Demand	39,183	35,862	34,688	39,049	37,195

Livestock Water Demand Estimates

This section summarizes the results for livestock water demand estimates. Table 3-15 presents the livestock water demand estimate for 2007. USDA National Agricultural Statistics Department provided animal inventories for 2007 for Ada and Canyon counties. This data for each category was multiplied by the daily water consumption values provided by IDWR to estimate livestock water demand for Treasure Valley for 2007.

Table 3-15. Estimates for Livestock Water Demand

Animal	2007 Count		Daily Water Consumption (gallons)	Total Consumption	
	Ada	Canyon		(gallons/day)	(AF/yr)
Cattle/Calves	48,091	88,083	12	1,634,088	1,830
Dairy	18,385	41,478	35	2,095,205	2,347
Hogs/Pigs	1,837	1,534	4	13,484	15
Sheep/Lamb	1,806	19,627	2	42,866	48
Broilers/Chicken	570	1,170	0	174	0
				Total	**4,241**

There is always fluctuation of livestock populations depending on the market. Without reasonable estimate for 50 year projection, the water demand value calculated in table above will be used for future livestock water demand estimations.

DCMI Water Demand Estimates

Table 3-16 summarizes the results of the DCMI water demand estimates from 2010 to 2060 in 10 years increments. The total DCMI water demand includes six components: 1) urban water use supplied by municipalities or private water companies; 2) domestic irrigation water supplied by irrigation districts or municipalities; 3) rural residential water use; 4) self-supplied industrial water use; 5) water needs for parks and recreation; and 6) livestock water use requirements.

In Table 3-16, non- conservation results refers to the water demand estimates with existing water losses from water delivery systems. Conservation results refer to water demand estimates based on the assumption that all water purveyors decrease their system water delivery losses by 30 percent or fix it at 12 percent (national average) if the 30 percent decrease from current level puts the losses under 12 percent. The land use based method and the population based method use the same estimates for all components of DCMI except for urban water demand estimates.

Table 3-16. Summary of DCMI Estimates in Treasure Valley (af/year)

Year	Non-Conservation		Conservation	
	Land Use Based Method	Population Based Method	Land Use Based Method	Population Based Method
2010	232,959	234,427	232,093	232,103
2020	311,182	298,062	309,132	295,204
2030	414,006	390,500	410,774	386,983
2040	558,225	524,432	553,953	520,106
2050	748,030	701,919	742,831	696,598
2060	938,633	889,012	932,515	882,465

When the DCMI demand estimated from Table 3-16 is examined, it can be seen that conservation measures decrease the urban water demand estimates by only 3 percent for both the land use method and the population based method. Because the difference is very small, and assuming that the cities will eventually improve their systems, only the conservation water demand estimates in Table 3-16 will be used in the discussion of results and conclusion sections.

The primary method for estimating the total water demand for DCMI and agriculture is a land use based model which calculated the water requirement for crop and water use for DCMI. For DCMI, the land-use based water demand projection integrates planned land use development by the cities with the current water rates by land use category. This method is consistent with future changes in land use mix as found in the cities' comprehensive plans. The constraints of the land use method for estimating DCMI is that land and water use data for domestic and industrial areas outside of the city limits are generally not available. To fill this data gap, the population (and demographic) based water demand is used to estimate the water use per capita. Consequently, the land use method DCMI estimates will be used for further discussions later in this report.

3.3 Agricultural Water Demand Estimates

Purpose and Introduction

This section presents the results of the analysis to estimate agricultural water demand in Treasure Valley. This analysis estimates agricultural water demand over the next 50 years (in 10-year increments) using a consumptive use model with GIS analysis of current land uses and projected future land use patterns, current and projected precipitation, and evapotranspiration. Estimation of the agricultural water demand is a part of a series of other studies that include evaluation of alternative water supplies, data collection and analysis, groundwater studies in North Ada and Eastern Ada, and update of the Treasure Valley groundwater model. These would all lead to the Treasure Valley CAMP developed by IDWR. The historical hydrologic period selected for the model is from 1980 to 2008 due to the availability of the crop distribution.

The relevant water demand data for the 1980–2008 hydrologic period was collected from local, regional, and state agencies, and is presented in this section. Specifically, the following data were collected and analyzed:

- Historical land use data
- Historical crop acreage data
- Irrigation efficiency
- Agricultural water demand
- Urban water demand

Land Use Data

Because land use development and projections are already discussed in previous sections, they are not discussed here again. Historical, existing conditions, and planned land use data are summarized in Table 3-17 and Figure 3-3.

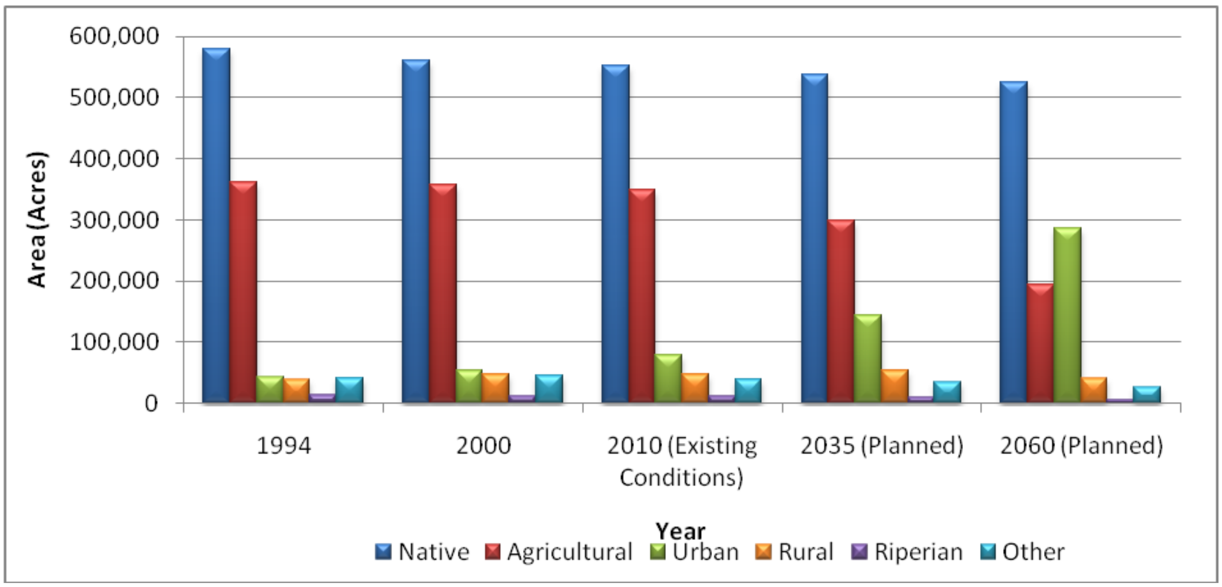
Table 3-17. Acreages for Land Use for Years 1994, 2000, 2010 (Existing Conditions) 2035 (Planned) and 2060 (Planned) (Acres)

	Native	Agricultural	Urban[1]	Rural[2]	Riparian	Other	Total
1994	580,136	361,155	42,724	38,633	14,171	41,743	1,078,562
2000	561,085	358,045	52,914	48,079	12,932	45,506	1,078,562
2010 (Existing Conditions)	551,822	348,025	78,904	48,078	11,929	39,805	1,078,562
2035 (Planned)	537,078	297,935	144,799	53,410	10,702	34,639	1,078,562
2060 (Planned)	525,337	193,307	286,095	40,561	6,446	26,816	1,078,562

1. Includes residential, commercial, recreational, and municipal areas within the existing city limits in Treasure Valley

2. Includes all the rural residential areas within and outside of the existing city limits in Treasure Valley

Figure 3-3. Land Use Data for Years 1994, 2000, 2010 (Existing Conditions), 2035 (Planned) and 2060 (Planned)



Data

This section describes the data collection and inventory efforts as well as how the available data sets were processed. The data collection and inventory efforts were directed to obtain available data from local, state, and federal sources and to identify data gaps. A summary of the data needs and collected data is provided in Table 3-18.

The project database includes an extensive collection of GIS coverage. This coverage, along with their descriptions and sources, are presented in Table 3-19.

Table 3-18. State, Federal, and Local Data Summary

Data Type	Data Needed	Description	Data Source
Irrigation Practices/ Efficiency Studies	Water demand analysis; calculate crop requirements	Methods of irrigation and efficiency	IDWR, University of Idaho College of Agriculture
Land use	Water demand and needs analysis	Land use surveys maps (GIS)	IDWR GIS Database, COMPASS, Ada County Assessor's Office Canyon County Assessor's Office, Common Land Use coverage from USDA
Crop Distribution	Agricultural land use	Yearly crop acreages	IDWR, Idaho Agricultural Statistics Service
Weather/Climate	Water demand analysis; calculate crop requirements	Evapotranspiration and precipitation (rain gage station)	University of Idaho Kimberly Research and Extension Center, USBR Pacific Northwest Region (AgriMet)
Soil	Water demand analysis; estimate the soil parameters		NRCS Soil Data Mart (Ada County Area and Canyon County Area)

The geographic coordinate system of these GIS map coverage is all NAD 1983.The land use analysis was based on land area retrieved from the GIS files. In some instances, there were discrepancies on the total area calculated from the GIS map and previous data reported by an agency. This study used the GIS calculated land area as the most current and accurate data available.

Table 3-19. GIS and CAD Data

Coverage Type	Description	Data Source
Land Use	GIS layer for land use	IDWR GIS Database, COMPASS, Ada County Assessor's Office Canyon County Assessor's Office
Soil	GIS layer for soil layers	NRCS Soil Data Mart (Ada County Area and Canyon County Area)
Water Districts	Federal, state, and private water districts	IDWR GIS Database
Public Land Survey System Grid	Grid showing township and range sections	IDWR GIS Database
Land Surface Elevation	30-meter digital elevation models (DEMs)	USGS Geographic Data Download
Counties' Boundaries	Jurisdictional boundary reference layer	IDWR GIS Database

Surface Hydrology	Detailed layer, generalized layer, and one polygon layer (reservoirs).	USGS
Roads	Both major and local roads	IDWR GIS Database

During interviews and follow-up meetings with local stakeholders, available data was obtained in digital and/or hard copy formats. However, it should be noted that often the requested data could not be made available to the project team typically because of limited staff time availability, lack of record maintenance protocols, or remote storage of unmarked boxes, which limited access to data-at-hand only. The data collected and the sources of the data are summarized on Tables 3-18 and 3-19.

A brief discussion on the categories of data mentioned above is provided below.

Precipitation and Evapotranspiration

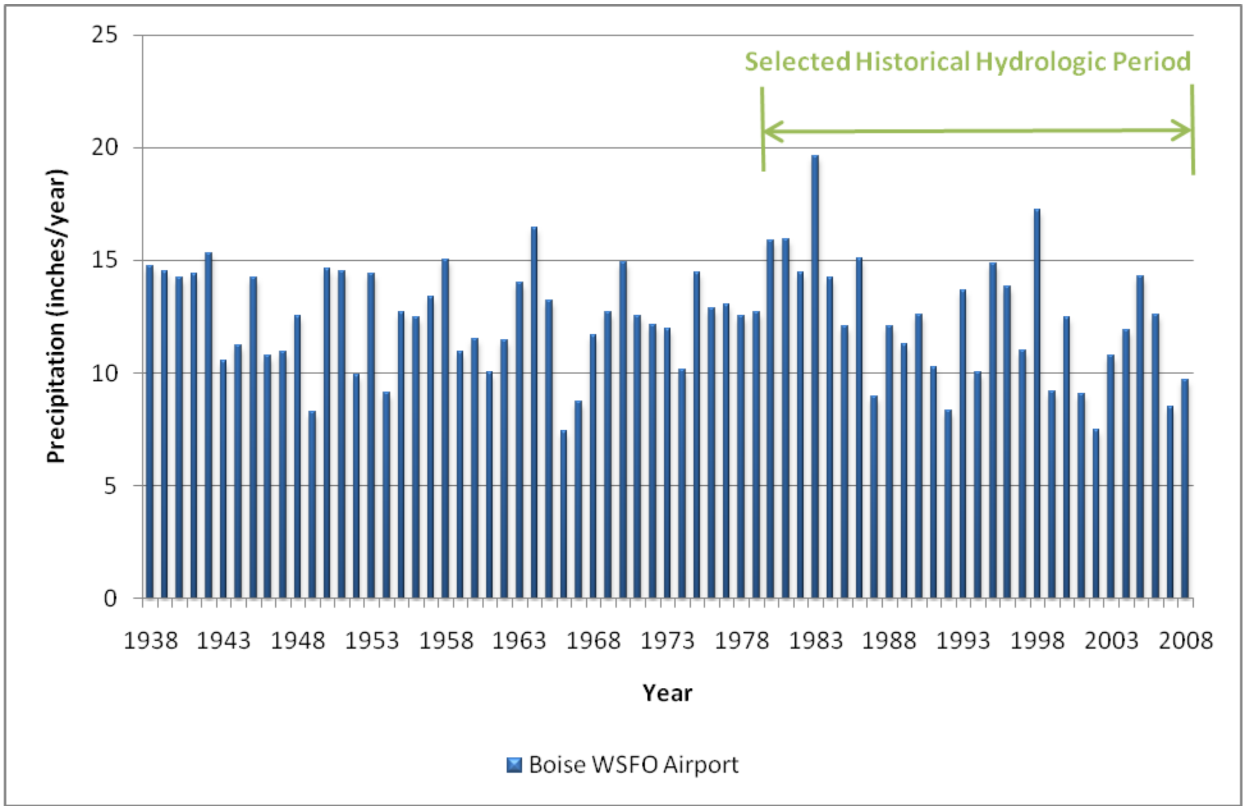
Six counties are within the boundaries of Treasure Valley: Ada, Canyon, Payette, Gem, Boise, and Elmore. Table 3-20 presents the rainfall stations available for these counties from the University of Idaho Kimberly Research and Extension Center’s database. Based on the locations, elevations, and length of the period of records, Boise WSFO Airport, Deer Flat Dam, Emmett 2E, Boise 7N, and Mountain Home 1 W were selected to represent Ada, Canyon, Payette, Gem, Boise, and Elmore counties respectively.

Table 3-20. Rainfall Stations within Treasure Valley

County	Station Name	Lat (Degrees)	Long (Degrees)	Period Of Record	Elevation
Ada	Boise 7 N	43.72	-116.2	May 1973to Dec 2004	3890' above s/l
	Boise WSFO Airport	43.57	-116.22	Jun 1937 to Dec 2004	2860' above s/l
	Kuna	43.48	-116.42	Nov 1907to Dec 1996	2680' above s/l
Canyon	Caldwell	43.65	-116.68	Oct 1904to Jun 1997	2370' above s/l
	Deer Flat Dam	43.58	-116.75	Mar 1916 to Dec 2004	2510' above s/l
	Parma	43.8	-116.93	Jan 1990 to Dec 2004	2305' above s/l
	Nampa	43.44	-116.64	Jan 1997 to Dec 2004	2634' above s/l
	Parma Exp Station	43.78	-116.95	Nov 1922 to Dec 2004	2220' above s/l
Payette	Payette	44.07	-116.93	Jan 1893 to Dec 2004	2160' above s/l
Gem	Emmett 2 E	43.87	-116.47	Oct 1906to Dec 2004	2390' above s/l
	Ola	44.17	-116.28	Aug 1948 to Dec 2004	3080' above s/l
Boise	Arrowrock Dam	43.6	-115.92	Nov 1911 to Dec 2004	3240' above s/l
	Garden Valley RS	44.07	-115.92	Aug 1948 to Dec 2004	3150' above s/l
	Idaho City	43.83	-115.83	Feb 1894 to Dec 2004	3940' above s/l
	Lowman	44.08	-115.6	Aug 1916to Dec 2004	3870' above s/l
Elmore	Anderson Dam	43.35	-115.47	Aug 1948 to Dec 2004	3880' above s/l
	Glenns Ferry	42.95	-115.3	Apr 1905 to Dec 2004	2570' above s/l
	Mountain Home 1 W	43.13	-115.72	Feb 1906 to Dec 2004	3150' above s/l
	Glenns Ferry	42.87	-115.36	Jan 1994 to Dec 2004	3025 above s/l

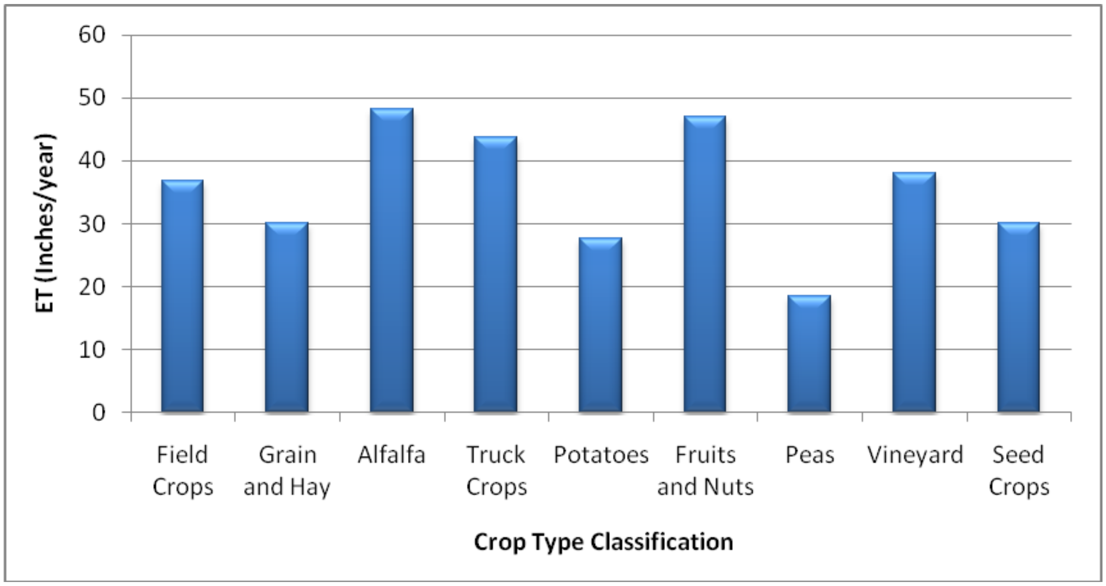
Rainfall records for all the selected stations were examined to determine the historical hydrologic period for the model. Figure 3-4 shows yearly rainfall records for Boise WSFO Airport station from 1938 to 2008. The period from 1980 to 2008 has three dry and wet periods, and the pattern of the data for this time interval is very similar to the whole period from 1938 to 2008. The annual rainfalls averages are 12.31 and 12.39 inches/year for the period from 1938 to 2008 and for the period from 1980 to 2008 respectively. Examinations of the other rainfall stations showed the same conclusions. As a result, the period from 1980 to 2008 was selected as a good representation of rainfall data for modeling purposes.

Figure 3-4. Average Annual Precipitation for Boise WSFO Airport Station



The University of Idaho Kimberly Research and Extension Center's database also has evapotranspiration rates for a variety of crops grown in Idaho. Figure 3-5 shows the average yearly evapotranspiration rates for the historical hydrologic period for the crop type classifications used in the IDC model.

Figure 3-5. Average of Annual ET Rates from 1980 to 2008



There is a limited amount of information on evapotranspiration rates of seed crops. University of Idaho Kimberly Research and Extension Center's database has evapotranspiration rates for only alfalfa and snap and dry bean seeds. Additionally, USBR Pacific Northwest Region (AgriMet) provides annul averages for corn and pea seeds. As a result, an average evapotranspiration rate of the available data is used to represent the ET rate of the seed crops.

Crop Distribution

The land use maps from IDWR GIS database for years 1994, 2000, and 2010 do not classify the agricultural land according to crop type. As a result, there is no data available to specify the spatial distribution of different crop types.

IDWR provided the crop acreages for Ada, Canyon, Gem, Payette, and Boise counties for 2007, 2008, and 2009 excluding the seed crops. Also, Idaho Agricultural Statistics Service (IASS) provides countywide annual crop acreages in Idaho up to 2008. Table 3-21 shows the comparison of the percent crop distributions for 2007 and 2008, and their averages from different data sources for each crop type classification, again excluding seed crops. The values are not exactly the same for the two sources, but they are considerably close and their averages are even closer. As a result, IASS data is used for the percent crop distributions from 1980 to 2006 and IDWR data is used for 2007 and 2008. For future demand estimations over the next 50 years (in 10 year increments) the historical crop distributions are repeated two times from 2009 to 2067. Acreages for each crop type was calculated using these assigned percentages and projected agricultural land acreages from 2010, 2035 (build-out) and 2060 (planned) land use data sets.

Unfortunately there is a limited amount of information available for the distribution of the seed crops spatially and historically. After interviews and follow-up meetings with local stakeholders and IDWR, it was decided on an average acreage for crop seeds (58,725 acres), predominantly alfalfa, dry and garden beans, corn, onions, carrots, and cereal grains). Due to lack of historical information, the seed crops acreage was assumed to be constant during calibration analysis and future water demand analysis. Figures 3-6a and 3-6b show the historical and future crop acreages and percentages respectively for Treasure Valley including seed crops.

Table 3-21. Comparison of Percent Crop Distribution Data from IASS and IDWR Excluding Seed Crops

	Year	Grain & Hay	Filed Crops	Alfalfa	Truck & Nursery	Peas	Potatoes	Fruits & Nuts	Vineyard
IASS Data	2007	15.6	46.0	22.6	8.9	1.6	3.3	1.9	0.1
	2008	23.5	39.6	22.1	8.9	1.6	2.3	1.9	0.1
	Average	**19.5**	**42.8**	**22.4**	**8.9**	**1.6**	**2.8**	**1.9**	**0.1**
IDWR Data	2007	17.5	44.7	22.0	8.5	1.3	4.0	2.0	0.1
	2008	27.0	38.4	20.4	8.2	1.5	2.5	1.9	0.1
	Average	**22.2**	**41.6**	**21.2**	**8.3**	**1.4**	**3.2**	**1.9**	**0.1**

Figure 3-6a. Crop Type Acreages for Treasure Valley

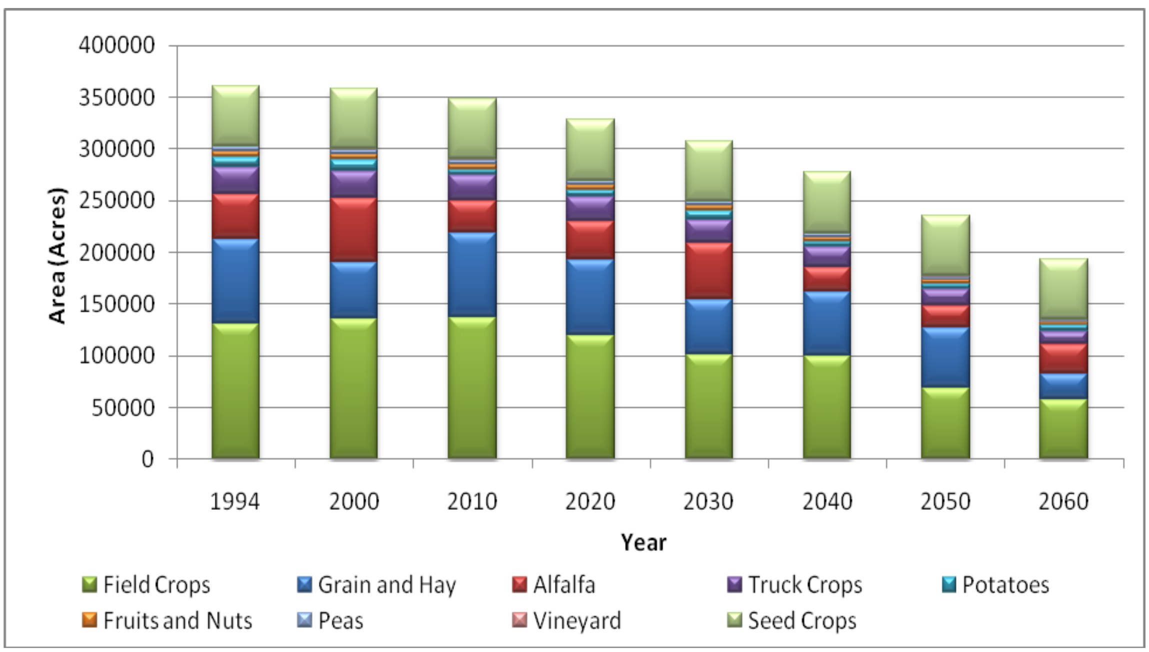
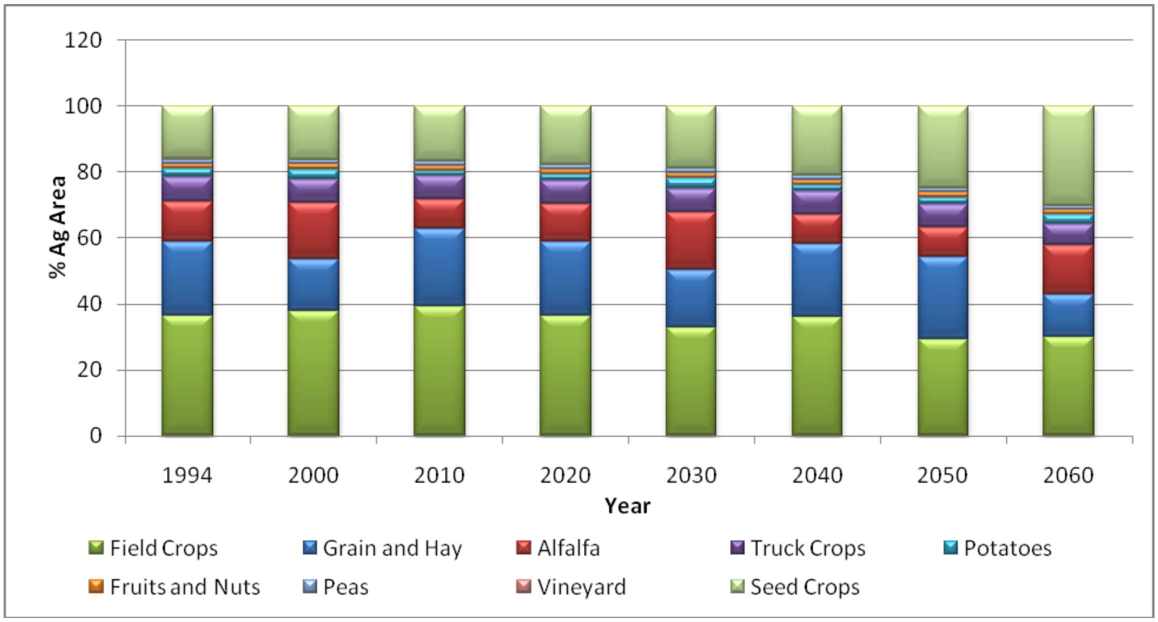


Figure 3-6b. Percent Crop Type Distribution for Treasure Valley



Historical Irrigation Practices and Irrigation Efficiency

The irrigation practices of individual farmers are not recorded by the counties or the irrigation districts. Historically, the predominant practice for irrigating crops has been by flood or furrow irrigation, which has very low irrigation efficiencies. Neibling (1997) reported that nearly all agricultural land is irrigated by either sprinklers (59 percent) or surface irrigation systems (40 percent), with only a very small amount (less than 1 percent) in micro-irrigation systems (trickle or drip). Neibling (1997) also provided application efficiencies for typical surface and sprinkler systems; these efficiencies are presented in Table 3-22.

Table 3-22. Typical Irrigation System Application Efficiencies for Surface and Sprinkler Systems

Irrigation System	Method	Application Eff (%)
Surface Systems	Furrow	35-60
	Corrugate	30-55
	Border, level	60-75
	Border, graded	55-75
	Flood, wild	15-35
	Surge	50-55
	Cablegation	50-55
Sprinkler Systems	Stationary lateral	60-75
	Solid-set lateral	60-85
	Traveling big gun	55-67
	Stationary big gun	50-60
	Center-pivot lateral	70-85
	Moving lateral	80-87

Micro-irrigation systems	Surface drip	90-95
	Subsurface drip	90-95
	Micro-spray or mist	85-90

(Source: Sterling, R., and W. H. Neibling, 1994. Final Report of the Water Conservation Task Force. IDWR Report. Idaho Department of Water Resources, Boise)

Model Results

Historic Calibration Analysis

The previous studies presented in Section 2 provided a good starting point for comparison of historical results. To evaluate the range of values estimated for agricultural water demand using the IDC, the IDC results were compared to the estimates presented in the TVHP report (IDWR, 2004) and the DP report (IDWR, 2008). Both of these reports provide estimates for agricultural water demand only for gravity irrigated land which is presented in Table 2-2. These reports do not provide the demand for sprinkler irrigated land.

The agricultural land is not classified as sprinkler irrigated and gravity irrigated due to lack of data for IDC model runs. To compare the results, four different irrigation efficiencies were used. After examining Table 3-22, 80 percent and 40 percent irrigation efficiencies were chosen to represent high efficiency and low efficiency respectively. Also, the model was run with irrigation efficiencies of 60 percent and 50 percent in addition to 40 percent and 80 percent irrigation efficiencies. The results are summarized in Table 3-23.

Table 3-23. Comparison of Water Demand Estimates from TVHP and DP Reports and IDC Model Results

Project		Year	Water Demand (af/year)	Ag Area (acres)	Applied Water (af/acre/year)
IDC	Crop Irrigation Eff = 80%	1994	1,083,463	361,155	3.00
	Crop Irrigation Eff = 60%		1,438,029	361,155	3.98
	Crop Irrigation Eff = 50%		1,668,479	361,155	4.62
	Crop Irrigation Eff = 40%		2,085,599	361,155	5.78
IDC	Crop Irrigation Eff = 80%	2000	1,038,293	358,045	2.90
	Crop Irrigation Eff = 60%		1,384,390	358,045	3.86
	Crop Irrigation Eff = 50%		1,604,196	358,045	4.48
	Crop Irrigation Eff = 40%		2,005,244	358,045	5.60
TVHP (gravity irrigated land only)		1996	1,155,500	252,000	4.59
		2000	1,209,700	269,000	4.50
DP (gravity irrigated land only)		Average 1967-1997	1,154,760	269,000	4.29

The TVHP report provided results for 1996 and 2000. The DP report provided an average value from 1967 to 1997. Because land use data is available for 1994 and 2000, the IDC results for those years are presented in Table 3-23. The TVHP report estimated applied water rates of 4.59 and 4.50 af/acre/year for 1996 and 2000 respectively. The DP report suggested a value of 4.29 af/acre/year as the average value from 1967 to 1997. The results from the IDC model were 4.62 and 4.48 af/acre/year for 1994 and 2000 respectively for an irrigation efficiency of 50 percent and 5.78 and 5.60 af/acre/year for 1994 and 2000 respectively for an irrigation efficiency of 40 percent. The IDC model results are consistent with the results from the TVHP and DP reports for low irrigation efficiencies (approximately 50). This was expected because the results for TVHP and DP reports presented values for gravity irrigated land. Table 3-23 shows that the applied water estimates go lower as irrigation efficiency increases; it becomes 3.00 and 2.90 af/acres/year for 1994 and 2000 respectively.

Scenarios for Future Water Demand Analysis

To estimate agricultural water demand over the next 50 years (in 10 year increments), the IDC model was set to run from 2009 to 2067 under six different scenarios. Since historic crop distribution is for 28 years, it was decided to repeat the crop distribution two times in the future to get a time interval to cover from 2010 to 2060. Hydrology and crop irrigation efficiency are the two most important factors that would affect the agricultural water demand estimates. A 50 percent crop irrigation efficiency was chosen for this Study after comparing of the results of the calibration analysis with the previous reports; in addition, it is the average of crop irrigation efficiencies mentioned in Neibling (1997). To see the effects of hydrology (precipitation) on the estimates, three different combinations of hydrology (wet, average, and dry) were used to define the scenarios. The scenarios are summarized in Table 3-24. After examining Figure 3-4, 1983 was accepted as a wet year and 2002 as a dry year. For an average hydrology the precipitation and ET rates from 1980 to 2008 were averaged.

Table 3-24. Scenarios Defined to Run IDC Model for Future Water Demand Analysis

Scenario #	Hydrology	Crop Irrigation Efficiency
1	Wet	50%
3	Ave	50%
5	Dry	50%

Future Water Demand Analysis

The annual agricultural water demands and applied water amounts were calculated based on land use acreage, precipitation, evapotranspiration for each crop type, and crop irrigation efficiency data over the next 50 years (in 10 year increments) for the scenarios defined above. The agricultural water demand ranges from 780,937 to 1,555,491 AF/year and the applied water rate ranges from 3.87 to 4.68 af/acre/year for a crop irrigation efficiency of 50 percent depending on the rainfall/evapotranspiration rates and crop distribution for that year. The results of the analysis for future demand for Treasure Valley under the scenarios described are presented in Tables 3-25 and 3-26 as well as Figures 3-7 and 3-8. It can clearly be seen from these tables and figures that the water demand decreases as hydrology changes from dry to wet. Also, for a chosen hydrology, the applied water rate changes show the effect of change in crop distribution. Detailed monthly or yearly water demands for each crop type for each county within Treasure Valley can be provided if requested.

Table 3-25. Estimated Agricultural Applied Water (af/acre/year)

Year	Crop Irrigation Efficiency = 50%		
	Dry	Ave	Wet
2010	4.469	4.274	3.992
2020	4.517	4.311	4.025
2030	4.679	4.466	4.169
2040	4.460	4.231	3.958
2050	4.420	4.156	3.866
2060	4.592	4.329	4.040

Table 3-26. Estimated Agricultural Water Demand (af/year)

Year	Crop Irrigation Efficiency = 50%		
	Dry	Ave	Wet
2010	1,555,491	1,487,412	1,389,298
2020	1,481,409	1,413,773	1,320,102
2030	1,440,712	1,375,116	1,283,653
2040	1,235,332	1,171,831	1,096,323
2050	1,039,392	977,256	908,925
2060	887,717	836,760	780,937

Figure 3-7. Estimated Agricultural Applied Water (af/acre/year)

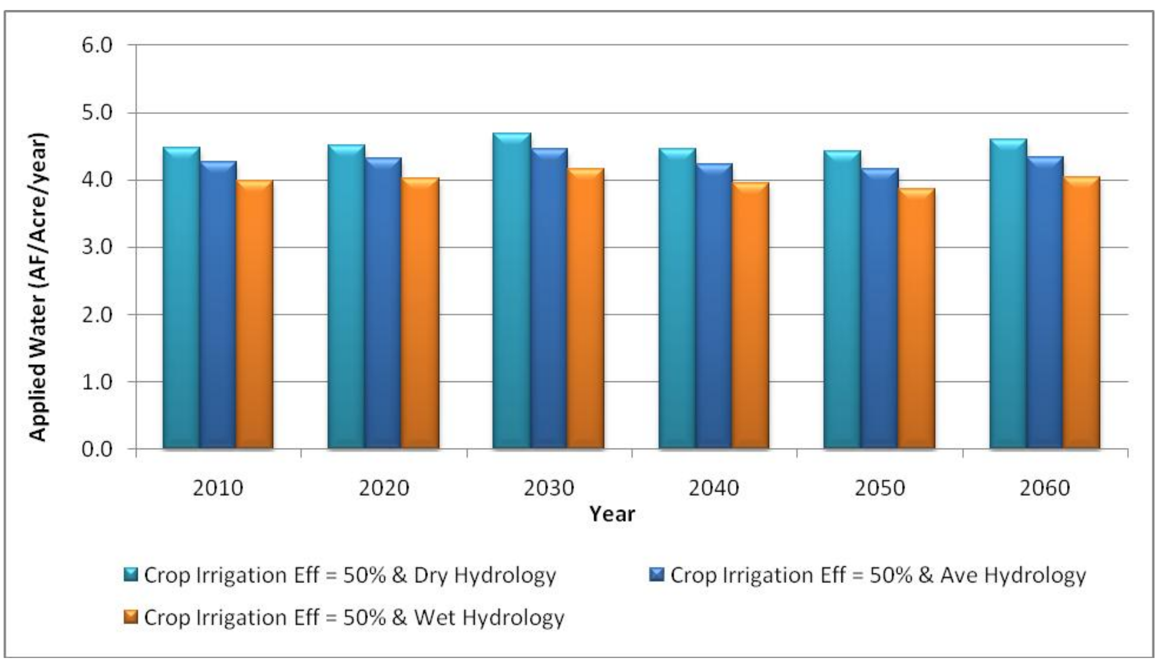
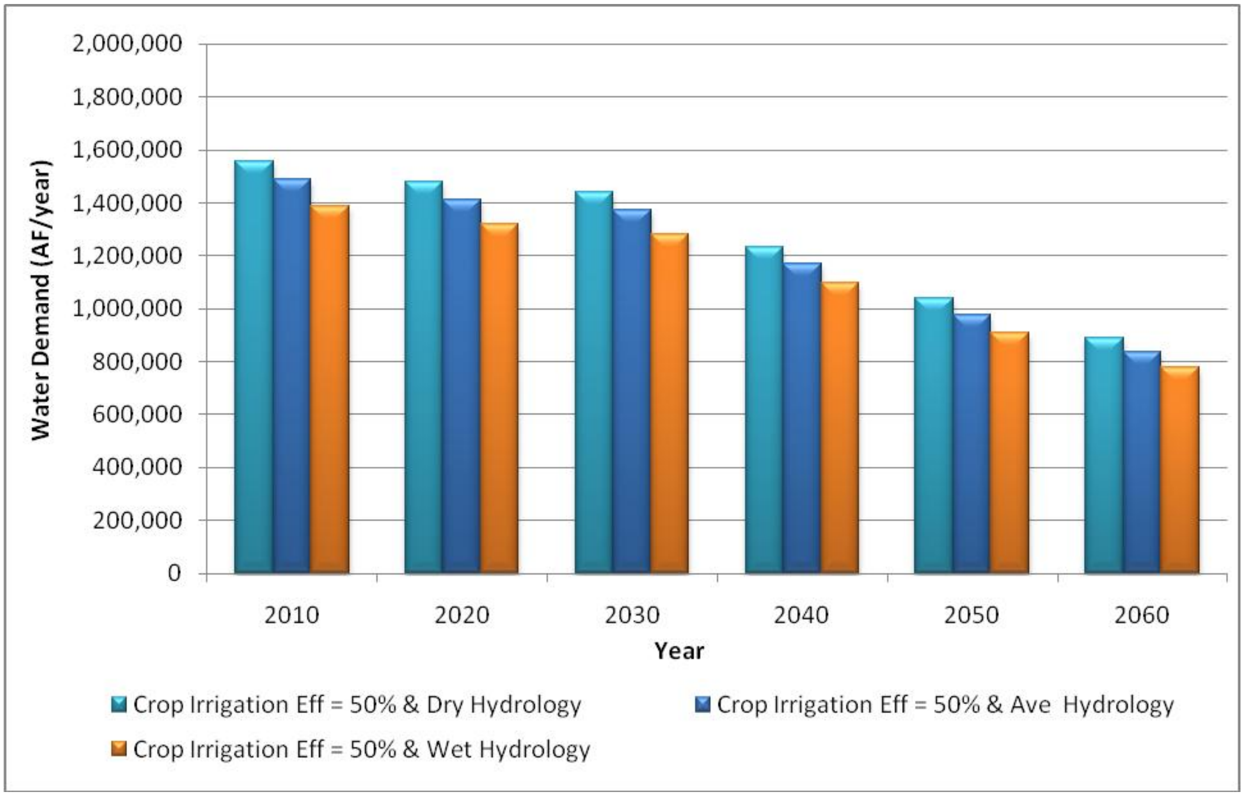


Figure 3-8. Estimated Agricultural Water Demand (af/year)



Summary of Results and Conclusion

The IDC model results are consistent with the TVHP and DP reports' results when compared for an irrigation efficiency of 50 percent, which should represent irrigation efficiency for a gravity irrigated land.

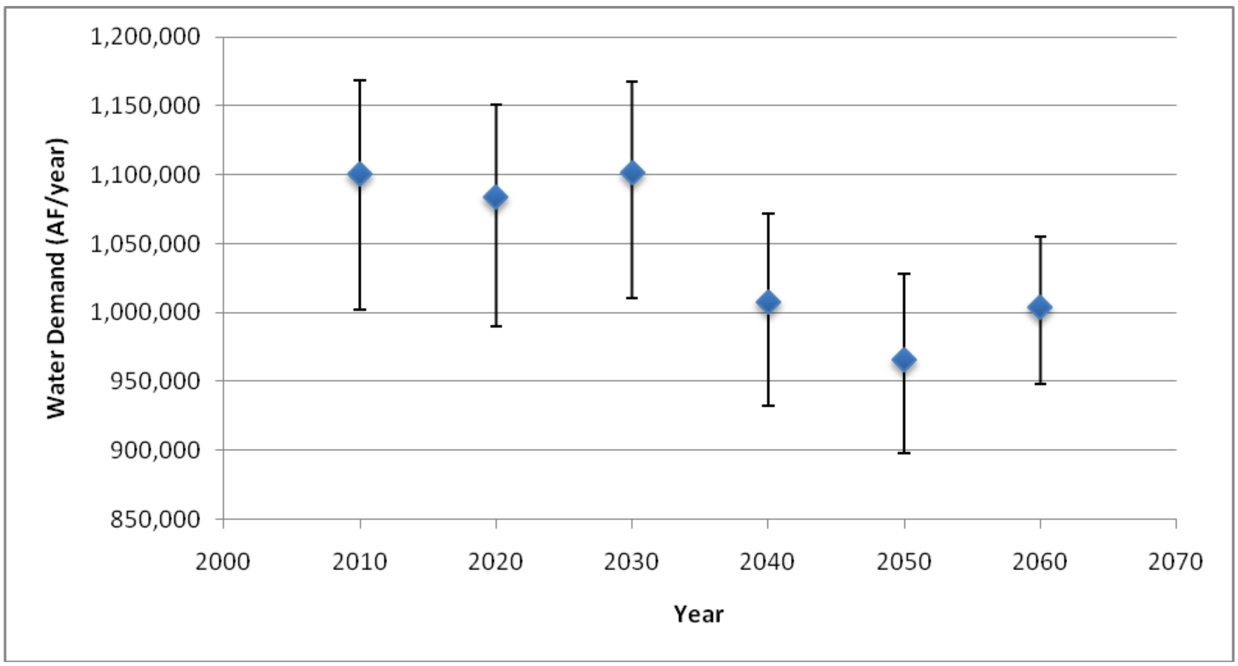
Agricultural water demand analysis in the Treasure Valley region indicates that hydrology (the year being a dry, average or wet year) has a significant effect on the water demand estimations. Figure 3-9 shows water demand ranges for crop irrigation efficiencies of 50 percent. Possible maximum, average, and minimum values for water demand for a given year can be seen in these figures. As expected the applied water demand increases from a wet year to a dry year. For this Study, the water demand increases by an average of 5.3 percent from an average to a dry hydrology and decreases by an average of 6.7 percent from an average to wet hydrology. These percentages could go higher if a drier or wetter hydrology were used.

Crop irrigation efficiency is another important factor that would affect the future agricultural water demand analysis. Additional agricultural water demand analyses were done to determine the effect of crop irrigation efficiency on water demand. Decreasing the crop irrigation efficiency from 50 percent to 40 percent increases the agricultural water demand by 25 percent from the water demand calculated by

50percent efficiency. On the other hand, increasing the crop irrigation efficiency from 50 percent to 60 percent decreases the agricultural water demand by 13 percent from the water demand calculated by 50percent efficiency.

Finally, effect of crop distribution should be considered for future demand estimates. Field crops, grain and hay, alfalfa, and seed crops cover most of the agricultural land in Treasure valley (they cover around 85percent of the agricultural land on average). As a result, their rotation within the crop distribution dominates the water demand and as the percentage of crops that have higher water duty increases the water demand increases, too. Years 2030 and 2060 have a higher percentage of alfalfa, which has a higher applied water rate, compared to the other years. As a result, the applied water rates for these years are higher compared to the other years for a chosen hydrology.

Figure 3-9. Water Demand Range for Crop Irrigation Efficiency = 50 percent



3.4 Total Water Demand

Table 3-27 below summarizes the total water demand estimates for Treasure Valley for the next 50 years in 10 years increments. The total water demand is the sum of the DCMI water demand and the agricultural water demand. The DCMI water demand estimates are based on the land use method with conservation measures. The water demand estimated for the United Water service area, including the City of Boise, was replaced by the demand projections provided by United Water in Table 2-2. Agricultural water demand estimates are based on average hydrology.

Table 3-27. Estimated Total Water Demand in Treasure Valley (AF/year)

Year	DCMI (Land Use Method & Conservation)	IDC (Average Hydrology)	Total
2010	228,535	1,487,412	1,715,947
2020	307,210	1,413,773	1,720,983
2030	416,050	1,375,116	1,791,166
2040	564,491	1,171,831	1,736,322
2050	759,797	977,256	1,737,053
2060	962,077	836,760	1,798,837

The DCMI water demand increases by approximately 733,000 af/year and the agricultural water demand decreases by approximately 650,000 af/year from 2010 to 2060. As a result, the total water demand increase by approximately 83,000 af/year from 2010 to 2060. The agricultural water demand decreases due to the conversion of agricultural land to urban land and DCMI water demand increase due to the increase in population and increase in urban land use. The projections in Table 3-1 show that the Treasure Valley urban area grows from 78,904 acres to 286,095 acres in the next 50 years; this is an increase of 207,191 acres. Out of 207,191 acres, 154,718 acres are converted from agricultural areas and the rest from the undeveloped land within Treasure Valley.

4 Environmental and Water Quality Constraints

This section presents the results of the compilation and qualitative assessment of existing information on project environmental and water quality needs, including Federal requirements that may limit management options and quantify those needs when possible. This section is organized as follows:

Section 4.1 Current and Expected Future Environmental Uses for Water. Presents the assessment of the environmental water needs

Section 4.2 Water Quality Constraints on Future Water Demand Presents the assessment of the water quality needs in relation to the future water demand.

4.1 Current and Expected Future Environmental Uses for Water

The available data was gathered to support estimating future water needs for environmental purposes in the Treasure Valley of Idaho. The section summarizes compiled data and offers a qualitative assessment.

Description of Data

Data gathered for this task includes Snake River Basin Adjudication water rights, claims and recommendations from IDWR; documentation of the Nez Perce Settlement agreement; and telephone interviews with USBR personnel in the Idaho Area Office in Boise.

The following is a summary of the above data items.

<u>Snake River Basin Adjudication Data.</u> The Snake River Basin Adjudication commenced in Idaho in 1987 and is nearing completion. It constitutes review, summarization, determination, and decree of all water rights tributary to the Snake River. One of its provisions is that any right not claimed and confirmed through adjudication will cease to exist after completion of the adjudication. Therefore, the adjudication and its data constitute a complete and exhaustive listing of water rights, water use, and claims upon water in the basin. For the current project, data were gathered for Administrative Basin 63 (the Boise River system) and Administrative Basin 3 (the Lower Snake River system).

From the water-rights data library, a list of "Water-Right Uses" considered to be environmental is presented in Table 4-1.

Table 4-1 List of Water-Right Uses Considered to be Environmental Uses

100 Year Flood Flow	Minimum Stream Flow Storage
Aesthetic	Multiple Use
Aesthetic From Storage	Recreation
Aesthetic Storage	Recreation From Storage
Aquatic Habitat	Recreation Storage
Average Annual Flow	Riparian Maintenance
Base Flow	Streamflow Maintenance From Storage
Channel Maintenance	Streamflow Maintenance Storage

Federal Reserved Use	Water Quality Improvement
Fish Habitat	Water Quality Improvement From Storage
Fish Habitat From Storage	Water Quality Improvement Storage
Fish Habitat Storage	Wild And Scenic River
Lake Level Maintenance	Wildlife
Minimum Stream Flow	Wildlife From Storage
Minimum Stream Flow From Storage	Wildlife Storage

All Basin 3 rights below the confluence of the Snake and Boise rivers and all Basin 63 rights, with uses included in the above categories, were selected as the list of water rights for environmental purposes. Some of these uses, such as Federal Reserved Use, Recreation, or Aesthetic, may include uses associated with commercial or residential developments, or other uses that would not generally be considered to be environmental uses.

Five different data tables were considered for the purpose of this analysis:

- Claims. The claims data contain records of Snake River Basin Adjudication claims that have not yet received a recommendation or further processing. Surprisingly, past experience has shown that generally claims are reliable representations of water rights, despite the fact that they are owners' or water users' unverified statements of the nature and extent of their water rights. Only a small fraction of the environmental uses described below rely upon claims records.
- Recommendations. This data set includes records that have been investigated and recommended to the court by IDWR, but have not yet been decreed.[1]
- Water Rights. This data set contains water rights that have been decreed in the Snake River Basin Adjudication. It also includes licensed rights perfected after the commencement of adjudication.
- Permits. These water rights have received a permit in the statutory licensing process, but have not yet been licensed. While not perfected water rights, they authorize diversion and use of water. None of the uses in Table 1 were identified in the Permits data, and none of the environmental uses described below are derived from water-right permits.
- Michael Ciscell of IDWR provided a customized query from the IDWR database that included all Basin 3 or Basin 63 water rights with uses in Table 1. This data set was requested for two reasons: 1) Some environmental water rights may exist without a GIS Place of Use (POU) or Point of Diversion (POD) and therefore would not be represented in the data sets described above; and 2) If a water right has multiple water uses, it is possible that not all uses will be represented in the data sets described above.

Nez Perce Agreement Documentation. The collected data includes the following:

- Agreement. A copy of the Mediators Term Sheet, which details the components of full agreement, is contained in file complete-agreement.pdf, a 49-page document.

- Published Summaries. The following files are collected:
    - Settlement Fact Sheet

[1] Nearly all of these are expected to become decreed water rights, as the Adjudication processing continues.

- Agreement Summary
- Press Release (US Department of Interior)
- Snake River Currents. This is a web page published by the Nez Perce Tribe Department of Natural Resources, dated May 2004.
- Slide Presentation. This was downloaded via a link in the Idaho Water Resources Board web page, but it appears to be a product of the Western States Water Council. No authorship is given, but the name "Moore" appears in the URL. The title slide is dated September 2005.

Interviews with Bureau of Reclamation Personnel. Phone interviews were conducted on December 18, 2009 with Brian Sauer in Operations at the Idaho Area Office and Lesa Stark, Program Manager in the Idaho Area Office.

Existing Uses within the Boise System

Rights in Snake River Basin Adjudication. Table 4-2 summarizes the environmental uses associated with 246 water rights in Basin 63. After adjusting for apparent overlap of some rights, Adjudication water rights for environmental uses on the Boise sum to approximately 730 cubic feet per second (cfs) instantaneous flow and 240,000 af annual volume.[2] This is probably a slight over-estimate; it includes some claims that may never be decreed, and there are still some overlaps that could not be addressed without individual evaluation of each right.

Table 4-2. Environmental Water Uses in Basin 63

Use Group[3]	Number of Rights	Diversion Rate (cfs)	Diversion Volume (af/year)
Aesthetic	92	248	24,772
Minimum Streamflow	5	283	-
Recreation	58	87	60,516
Wildlife	110	109	5,817
Water Quality Improvement	2	0.44	182
Streamflow Maintenance	1	-	152,300

Needs for Nez Perce Settlement. The Settlement impacts the Boise by requiring flows to support the Snake River Flow Component of the Settlement. These are discussed in the Snake River section below. The Settlement also established a number of minimum-flow water rights. Any that affect the Boise system are included in Table 4-2.

1. Needs for Bull Trout. Reclamation's Lesa Stark reports that current operations include allowances to protect Bull Trout in and above the reservoirs. Additional information is available from the 2005 Biological Opinion published by US Fish and Wildlife Service (Final_FWS_2005_BiOP.pdf).

2. Informal agreements for local needs. Stark also reports that current operations incorporate informal agreements to address local fisheries needs.

---

[2] Some of these water rights include non-environmental uses. This may result in a slight over-estimate, if an overall rate or volume was used where individual use values were not reported, and the overall also includes non-environmental uses.

[3] Use groups include diversion, storage, to storage, and from storage uses for the category named in Table 2.

- Informal agreements with Idaho Department of Fish and Game are used to protect fisheries with wintertime flows.
- A 1984 accord between irrigators, USBR, and the US Army Corps of Engineers calls for "operation of the system as a whole" to sustain "flows for fisheries and recreation." Stark did not have access to a copy of this accord.

These accommodations for local needs are reflected in current and recent historic reservoir operations, and appear to be applied within the framework of existing operations rules and water rights.

Existing Environmental Uses within the Snake System

Rights in the Snake River Basin Adjudication. Table 4-3 describes the environmental uses identified in the water rights data for the Snake River below its confluence with the Boise River.[4] Adjusting for overlapping rights, it appears that environmental uses from the lower Snake sum to approximately 100,000 cfs and 560,000 af. As with Table 20, this may be a slight over-estimate due to the presence of claims and due to the fact that some overlaps could not be addressed without hand review of all water rights.

Table 4-3 Environmental Water Uses in Basin 3

Use Group[5]	Number of Rights	Diversion Rate (cfs)	Diversion Volume (acre feet/year)
Minimum Streamflow	2	22,750	-
Recreation	1	1.05	378
Wildlife	14	1.17	-
Water Quality Improvement	1	5.3	-

The Boise system is tributary to the Snake and therefore use in the Boise is constrained by these rights, within prior appropriation administration.

The Snake River flow component of the Settlement includes use of water from the Boise system. Additional detail may be obtained from the 2008 Biological Opinion recently published by National Oceanic and Atmospheric Administration (NOAA) fisheries.

The Moore slide presentation suggests that all components of the Settlement have now been put in place. It appears that Table 4-2 and Table 4-3 include all water rights or recommendations required by the Settlement.

In the telephone interview, Sauer of USBR stated that in recent history, the Boise River contribution to Nez Perce Settlement flows has been approximately 41,000 to 42,000 af/year. Nearly all of this has been provided from uncontracted reservoir storage controlled by USBR.

[4] While Basin 3 actually starts upstream of the confluence with the Boise, all the identified environmental uses are described below the confluence.

[5] Use groups include diversion, storage, to storage, and from storage uses for the category named in Table 4-2.

Future Environmental Water Needs - Specifics from Documentation

Interviews. One outcome of the interviews with USBR personnel was the hope and expectation that the Nez Perce Settlement will "hold up," and that for the next 25 to 30 years, current allocations and delivery of water for environmental purposes will prevail. USBR also identified a potential future need for high springtime flows of water to encourage and facilitate natural regeneration of cottonwood groves. It is likely that this can be accomplished with adjustments to operations similar to recent practice in the South Fork of the Snake River, without allocation of new volumes of water.

Nez Perce Agreement. As part of the Settlement, the Nez Perce tribe agreed to not pursue acquisition of additional water rights based upon treaties.

Other Parties. The Nez Perce Settlement did not include all potential future water uses or claimants upon water from the Snake system. It specifically omitted the states of Montana, Oregon, and Washington, as well as Native American nations other than the Nez Perce.

Federal Reserved Claims. The Snake River Basin Adjudication is a general stream adjudication meeting the requirements of the McCarran Amendment, and therefore is binding upon Federal claims. When completed, the adjudication will be final and definitive for all Federal reserved rights for all reservations made prior to the commencement of the adjudication.

Snake River Adjudication Water Rights in Context of Annual Hydrograph. Figure 4-1 shows the hydrograph of the Snake River at China Gardens, below McDuff Rapids, from 2004 through 2009. This is the most-downstream Idaho gage station on the Snake.

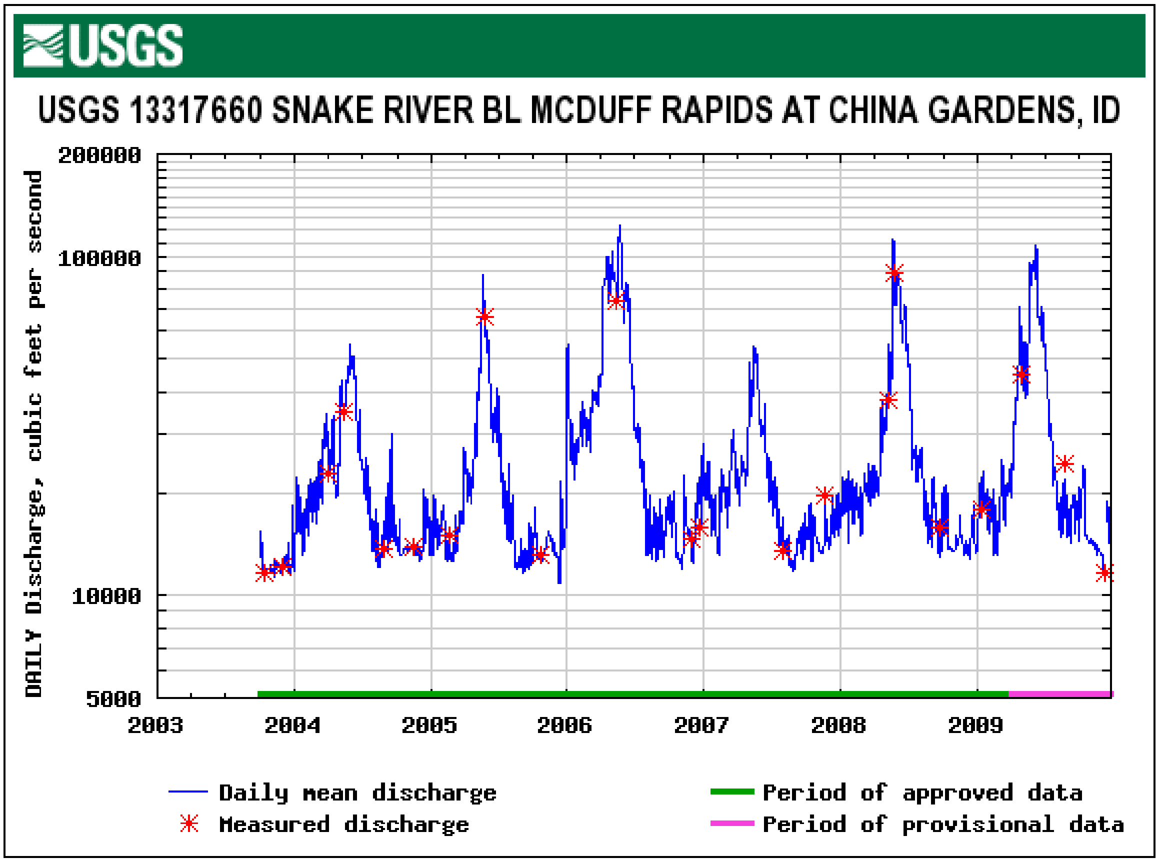


Figure 4-1. Hydrograph of the Snake River at China Gardens, 2004-2009.

Future Environmental Water Needs - Discussion and Interpretation

Anticipation of future environmental water needs for the Boise system depends on three important factors: implications of existing uses, rights, and agreements; conceptual foundations of environmental and other water-use needs; and future social attitudes toward water-allocation decisions.

<u>Implications of Existing Uses, Rights, and Agreements.</u> The status quo of water allocation in the Boise system includes a tension between factors that promote stability and certainty and factors that point to uncertainty for the future. The Nez Perce Tribe agreement under the settlement to not pursue additional water rights pursuant to existing treaties, as well as the quantification and decree of all existing Federal reserved rights in the adjudication, point to stability and certainty. The good-faith process of the settlement and the fact that parties adopted a pragmatic approach also point to stability and certainty.

On the other hand, there is still significant uncertainty: The settlement did not include all possible interested parties, nor address all issues. Specifically the Settlement avoided fundamental issues of principle; therefore, these issues may yet result in future challenges and negotiations. A large potential source of future uncertainty is the practical effect of Water Rights 3-10037 and 3-10098, which have very senior priority dates and large diversion rates.

Conceptual Foundations of Water-use Needs. The rationale for water for environmental needs can be defined by a narrow economic valuation of ecosystem services, recreation, and fisheries. It can also be as broad as a value judgment that any departure from the pre-human condition is less than optimal. In either case, conceptually any human use of water creates a change on the ecosystem. The implication of this is that any future allocation decision must be considered as a potential reduction in water for ecosystems and environmental needs.

The rationale for water for direct human use can be defined by the production value of water as an input to agricultural or industrial processes, or by its use value for personal activities such as landscape irrigation, cooking and cleaning. There are undeveloped lands in the Treasure Valley that could be suitable for irrigated agriculture, residential, commercial, or industrial uses. It is likely that water supply will always constrain these uses before land availability constrains them.

These two conceptual factors explain the current tension between water for ecosystem purposes and water for more traditional human uses. They also suggest that this tension will always exist.

Future Social Attitudes. Part of the current tension between environmental and other water uses arises from a change in social attitudes. Prior appropriation, which is used to allocate water to traditional human uses, was developed with a particular social attitude and perspective towards environmental needs. The Federal Endangered Species Act and other laws and policies were developed under different social attitudes and perspectives. Social attitudes define the current balance between environmental uses and direct human uses. This balance can be expected to change in the future as social attitudes change and develop.

Summary: Expectations for Future Environmental Water Needs in the Boise System

The precedent and the inertia of the Nez Perce Settlement will provide significant stability into the future. Future allocation negotiations in the Boise system will likely adopt a similar pragmatic approach.

It appears that the important implication for future water-use planning in the Boise basin is that any new infrastructure can only be accomplished with consideration of environmental and ecosystem needs. Any new allocation of water to traditional human uses will likely need to be balanced with additional allocations to environmental and ecosystem needs, or with additional assurances and guarantees for these uses.

4.2 Water Quality Constraints on Future Water Demand

4.2.1 Regulatory Framework

The Clean Water Act (CWA) establishes the structure for regulating discharges of pollutants into waters of the United States and regulating quality standards for surface waters. The CWA gives the U.S. Environmental Protection Agency (EPA) the authority to implement pollution control programs, including the establishment of water quality standards for all pollutants in surface waters (EPA, 2010-1). EPA's Region 10 is responsible within Idaho.

The Idaho water quality standards program is a joint effort between Idaho Department of Environmental Quality (DEQ) and EPA. DEQ is responsible for developing and enforcing water quality standards that protect beneficial uses such as drinking water, cold water fisheries, industrial water supply, recreation, and agricultural water supply. The EPA develops regulations, policies, and guidance to help Idaho implement the program and to ensure that Idaho's adopted standards are consistent with the requirements of the CWA. The EPA has authority to review and approve or disapprove state standards and, where necessary, to promulgate Federal water quality rules. Basin Advisory Groups (BAG) are established by State law. Watershed Advisory Groups (WAG) are organizations of stakeholders and interested parties in a particular watershed. A WAG applies to the BAG to become a state-designated WAG. The Lower Boise Watershed Council is the WAG associated with the general Treasure Valley CAMP study area.

Amendments to the CWA have made it unlawful to discharge any pollutant from a point source into navigable waters without a permit. EPA's National Pollution Discharge Elimination System (NPDES) permit program controls such discharges. Point sources are discrete conveyances such as pipes or man-made ditches, with some exceptions, including some related to agricultural practices. Industrial, municipal, and other major facilities must obtain permits if their point source discharges go directly to surface waters.

Amendments also recognized the need for planning to address problems posed by nonpoint source pollution. Nonpoint sources are more difficult to identify, and EPA allows the states to decide how nonpoint sources would be regulated. Nonpoint sources include urban storm water runoff, sediment and nutrient influx from agricultural lands, and sources such as commercial agricultural drains that are not tributaries to the river system. The NPDES permit process also provides a regulatory mechanism for control of nonpoint source pollution created by runoff from construction and industrial activities, and general and urban land uses such as runoff from streets.

Idaho adopts water quality standards (Idaho Administrative Procedures Act [IDAPA] 58.01.02) to protect public health and welfare, enhance the quality of water, and serve the purposes of the CWA. The combination of point and nonpoint pollution sources has resulted in failure to meet water quality standards. Section 303(d) of the CWA requires states to address both point and nonpoint sources by establishing total maximum daily loads (TMDLs) for waters that do not meet water quality goals. TMDL targets are based on water quality standards.

In October 1994, the lower Boise River and some of its tributaries were listed as water-quality limited in accordance with paragraph 303(d) of the CWA. The Boise River reaches within the Treasure Valley CAMP study area and its associated tributaries have agricultural water supply, cold water biota, domestic water supply, primary contact recreation, salmonid spawning, and a Special Resource Water as designated beneficial uses at various locations. Pollutants within the lower Boise River are identified as bacteria, dissolved oxygen, nutrients, oil and grease, sediment, and temperature. In the Treasure Valley, DEQ and the LBWC WAG develop and implement the plan to reach the goal of the lower Boise River watershed TMDL.

TMDL and implementation plan preparation and acceptance is a dynamic process. The most recent and comprehensive report regarding the current TMDL status of Treasure Valley CAMP area water bodies is provided in DEQ's 2008 Integrated (303[d]/305[b]) Report (DEQ, 2009) and on DEQ's website (DEQ, 2010-1). Because the tributaries are sources of pollutants to the Boise River, pollutant limits are provided in the tributaries' TMDLs. In 2008 after the first round five-year review of the lower Boise River TMDL, DEQ petitioned for removal of a portion of the lower Boise River from the 303(d) list, but this request was not honored.

Sediment, bacteria, and phosphorous are the current focus for pollutant reduction within the lower Boise River from the Snake River confluence to Lucky Peak Dam (DEQ, 2000 and 2003). The lower Boise River TMDL (DEQ, 2000) and the Snake River-Hells Canyon TMDL (DEQ, 2003) have somewhat different sediment requirements within their individual TMDLs. The goal of the Snake River-Hells Canyon nutrient TMDL is to lower the phosphorus concentration within the Snake River and Hells Canyon reservoir system. At this level, scientists feel that large algae blooms and anoxic conditions may be alleviated. Therefore, the goal had been to reduce the phosphorus levels in the tributaries that feed the Snake River, such as the Boise River, in order to meet the goal within Hells Canyon (Campbell, 2009).

The Safe Drinking Water Act (SDWA) is another of the seven major environmental statutes that EPA is responsible for implementing. The SDWA was established to protect the quality of drinking water in the United States. This law focuses on all waters actually or potentially designated for drinking use, whether from above or below ground sources. The SDWA authorizes the EPA to establish water quality standards, and requires all owners or operators of public water systems to comply with primary (health-related) standards. The attainment of secondary standards (nuisance-related) is encouraged. Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are regulated as primary and secondary MCLs. In Idaho MCLs have been proposed or established for 121 contaminants (DEQ, 2010-2). Water quality standards in Idaho that are the basis for TMDLs are mostly narrative (IDAPA 58.01.02), in contrast to primary and secondary MCLs, which are nearly all numeric.

August 1996 amendments to the SDWA directed EPA to support protection of all public drinking water sources. Building on previous wellhead protection programs, EPA is working to develop source water assessment and protection programs to address potential contamination of both surface and subsurface water sources. The DEQ is responsible for ensuring that source water assessments are conducted for all public water systems. The assessments include: delineating the source water assessment area, inventorying potential contaminants within the delineated area, conducting a susceptibility analysis of the potential contaminants, and informing the public of the results (DEQ, 1999). Multiple entities within the Treasure Valley have completed or are actively working on updates to their source water protection plans. The Treasure Valley CAMP study area is not designated as a sole source aquifer (EPA, 2010-2).

4.2.2 Waterborne Contaminants of Current Regional Concern in the Treasure Valley

Generally, current Treasure Valley surface and groundwater sources are of good quality. Regional impacts on both surface water and groundwater quality have been identified which could impact future water supplies at their sources. Regionally degraded water quality is currently impacting individual domestic well users and public water suppliers at existing sources and at regulated discharge points, i.e., into the Boise River. Isolated source areas have been identified that are impacted by naturally occurring and human caused pollutants.

Most current data on water quality may be collected from the USGS on-line inventory (http://waterdata.usgs.gov/nwis) and from the SDWIS database (http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/howtoaccessdata.cfm).

Surface Water

The water quality of the lower Boise River within the Treasure Valley CAMP study area has been adversely affected by the following factors (USGS, 2010):

- Agricultural land and water use
- Confined-animal feeding operations
- Reservoir operations
- River channelization
- Transportation infrastructure construction and operation
- Urban and residential development
- Urban runoff
- Wastewater treatment facility discharge

From 1994 to 2002, in cooperation with the LBWC and DEQ, the USGS Idaho Water Science Center undertook a comprehensive study of water quality and biotic integrity of the lower Boise River (MacCoy, 2004). Water quality parameters collected consisted of nutrients, suspended sediments, bacteria, discharge, temperature, dissolved oxygen, conductivity, and pH. Evaluation of the data collected by the USGS revealed increases in constituent concentrations in the lower Boise River in a downstream direction. Median suspended sediment and nutrient concentrations from Diversion Dam to Parma increased by about an order of magnitude each, and fecal coliform concentrations increased more than 400 times. Chlorophyll-a concentrations, used as an indicator of nutrient input and the potential for nuisance algal growth, also increased in a downstream direction; median concentrations were highest at the Middleton and Parma sites. Temporal trends in nutrients, sediment, or bacteria concentrations over the 8-year study were not detected (MacCoy, 2004).

The USGS developed regression equations and estimated loads total phosphorus (TP), dissolved orthophosphorus (OP), and suspended sediment (SS) from January 1994 through September 2002 at four sites on the lower Boise River: below Diversion Dam near Boise, at Glenwood Bridge, near Middleton, and near Parma (Donato and MacCoy, 2005). The objective was to help the DEQ develop and implement TMDLs by providing spatial and temporal resolution for phosphorus and sediment loads and enabling load estimates made by mass balance calculations to be refined and validated. Calculated annual flow-weighted concentrations highlighted the strong interaction between flow and particle-associated constituents such as TP and SS. Estimated average daily loads of SS at Parma from 1994 through 2002 exceeded the current lower Boise River TMDL load allocation of 101 tons per day except in 2001. The USGS' calculated average daily TP load estimates indicated that load reductions of 24-75 percent would have been necessary to meet the proposed goal of 565 pounds per day set forth in the Snake River-Hells Canyon TMDL.

Most recently, a study by Idaho State Department of Agriculture indicated that four tributaries to the lower Boise River and one tributary to the Snake River studied in 1998 and 2008 continue to be major contributors of sediment, phosphorus, and bacteria. The four Boise River tributaries still have a large percentage of agricultural lands mixed with urban development and sprawl. A large percentage of the agricultural land is still under erodible irrigation techniques such as furrow or flood surface irrigation. Best management practices are being recommended for land use areas dominated by agricultural practices (Campbell, 2009). Both traditional and unconventional means to reduce target pollutants are underway by municipalities which discharge wastewater and storm water to the Boise River.

Groundwater

Groundwater obtained via municipal and other public water supply wells and a growing number of domestic wells serves as the drinking water source for nearly all Treasure Valley domestic water users. Groundwater quality in the Treasure Valley Shallow (TVS) and Treasure Valley Deep (TVD) hydrogeologic subareas is regularly determined from data collected through the Statewide Ambient Ground Water Quality Monitoring Program (Statewide Program) (Neely and Crockett, 1998). The Statewide Program is administered by IDWR in cooperation with the USGS-Water Resources Division. The TVS and TVD subareas are located primarily in Ada and Canyon Counties and generally correspond to the Treasure Valley CAMP study area. USGS, in cooperation with DEQ, has also performed a comprehensive survey of existing wells in the TV CAMP study area from 1992 to 2000 (Boyle 1995, 1996, 2000, Parliman 1996 and 1998).

Groundwater quality data were collected from 144 Statewide Program monitoring sites (existing wells) in the TVS subarea and 137 sites in the TVD subarea from 1991 through 1994. Most of the sites sampled in 1991 through 1993 were re-sampled in 1995 through 1997, respectively (Neely and Crockett, 1998). Overall, groundwater of the TVS subarea were more mineralized than groundwater of the TVD subarea. The groundwater at most monitoring sites, both shallow and deep, was deemed suitable for human consumption and other beneficial uses. However, 23 percent of the TVS subarea and 12 percent of the TVD subarea had one or more constituents with concentrations exceeding the primary MCLs as established by the EPA for public drinking water supplies. Arsenic, bacteria, fluoride, gross alpha, gross beta, nitrate, and volatile organic compounds (VOCs) were the constituents detected above existing primary MCLs. Sulfate, total dissolved solids, and uranium had concentration levels above secondary MCLs or proposed primary MCLs.

Nitrate data analysis indicates that impacts to groundwater quality from human activities has occurred regionally in the Treasure Valley, particularly in the TVS subarea. Most recent available data (1997-2000) show that 35 percent of the Statewide Program wells in the TVS system had nitrate levels equal to or greater than 5 milligrams per liter (mg/L) (Neely, 2001). Ten percent of the Statewide Program sites in the TVS system had nitrate concentrations above the MCL of 10 mg/L, and most of these wells are located in Canyon County. In some parts of the two counties, clustering of sites with high nitrate levels is visible. According to the 1998 report, 69 percent of the TVS subarea sites had nitrate concentrations equal to or greater than 2.0 mg/L, the value used by the Statewide Program to distinguish between non-impacted and impacted nitrate levels. During this same reporting period 32 percent of sites exhibited nitrate concentrations equal to or greater than 2.0 mg/L for the TVD subarea. The full extent of impacts of nitrate on shallow domestic wells is not known (Neely, 2001).

In the USGS/DEQ study in Canyon County, concentrations of nitrate exceeded the MCL in 24 of the 314 wells sampled (Boyle, 2000). A smaller scale study was undertaken by DEQ (Cosgrove and Taylor, 2007) to quantify nutrient, arsenic, and radionuclide levels in Canyon County. Of the 27 wells sampled for nitrate as N, 7 percent were above the nitrate MCL, 26 percent were between 5 and 10 mg/L, and 67 percent were below 5 mg/L. Most samples obtained in a 1970 study conducted by the State contained nitrate in concentrations well above today's MCL (IDWA, 1970).

Pesticide impacts on groundwater are also documented to be regional in nature (Neely and Crockett, 1998, Neely, 2001 and 2004, Boyle, 2000). The 2001 IDWR report identifies that approximately 53 percent of the TVS sites had one or more pesticides detected in the groundwater; and approximately 31 percent of the TVD sites had pesticide detections. Reported detections were below any known levels for health concerns. Atrazine and its degradation products were detected at very low levels in 31 of the 37 wells sampled in the USGS/DEQ Canyon County study (Boyle, 2000).

Other groundwater constituents of concern in the Treasure Valley reported on by IDWR (Neely, 2001) are arsenic, fecal coliform, radioactivity as detected through gross alpha, gross beta, uranium, and radon tests, pesticides, and VOCs.

In Canyon County, there are wells with high arsenic levels (Neely, 2001, Hagan, 2003, Boyle, 2000). Samples obtained in a smaller scale DEQ study in Canyon County confirmed the presence of high arsenic concentrations in groundwater, ranging from 1.5 to 114 micrograms per liter (µg/L) (Cosgrove and Taylor, 2007). Out of the 27 samples, 19 percent exceeded the MCL of 10 µg/L and 22 percent were between 5-10 µg/L. Nearly half of the wells sampled in the USGS/DEQ Canyon County study exceeded the current MCL for arsenic (Boyle, 2000). Lithology is a good indicator of arsenic species (Hagan, 2003).

Approximately 9 percent of the Treasure Valley sites tested positive for fecal coliform bacteria, indicating that fecal material (human or animal) is in the water (Neely, 2001). Detections were along the same order of magnitude in the USGS/DEQ studies (Boyle 1995, 1996, 2000). State of Idaho water quality standards for E-coli are specific for primary and secondary contact waters (IDAPA 58.1.02). A single exceedance of primary or secondary levels does not constitute a violation. Exceedances do indicate the need for a further data collection for statistical evaluation for comparison to the geomean criteria. Referenced studies were not performed to determine compliance with MCLs, but they are indicative of the widespread persistence of bacteria in source waters.

Radioactivity, as detected through gross alpha, gross beta, uranium, and radon tests, is present in the groundwater of the Treasure Valley. Some sites in the Treasure Valley had concentrations over the existing or proposed MCLs (Neely, 2001). Although relatively few wells were sampled for the DEQ pilot study (27 wells), 26 percent exhibited uranium concentrations above the MCL (30 mg/L) for private drinking water wells (Cosgrove and Taylor, 2007). All high uranium concentrations were located in relatively shallow wells (less than 150 feet in depth). The authors stated that it is reasonable to conclude that there is a concern for uranium in the drinking water supply within the Canyon County study area. Possible sources of the uranium contamination include a potential linkage between phosphate fertilizer and uranium concentrations in the aquifer and/or the potential for uranium to leach out of the vadose zone through cycles of wetting and drying.

VOCs occur in groundwater in some areas of the Treasure Valley, usually concentrated near industrial or commercial areas or transportation links such as roadways and rail lines. Common VOCs are hydrocarbons found in petroleum products and solvents such as perchloroethylene (also known as tetrachloroethylene, or “perc”), a common dry cleaner solvent. VOCs are difficult to remove from groundwater and can degrade into even more deleterious compounds over time. Generally, existing occurrences are not regional in extent but may be fairly large nonetheless, particularly in groundwater. Material handling practices regulated under the Resource Conservation and Recovery Act have greatly reduced current and future impacts by VOCs. However, releases still occur. They are typically associated with a single human-induced point source. Current information for individual point sources of volatile pollutants is available through DEQ and EPA (EPA, 2010-3). Public and domestic water supplies impacted by groundwater contaminant plumes must be either operationally modified or treated to reduce contaminant levels below their respective MCLs.

Geothermal sources are also present in the Treasure Valley, such as those used for energy in the downtown Boise area. For some uses, particularly industrial, elevated temperature in groundwater may be considered a pollutant.

IDWR has also undertaken or reviewed aquifer testing studies throughout the Treasure Valley whose purposes were quantity driven (Baker, 1991 and 1993). Some of these studies have included geochemical data gathering and analysis but typically did not include measurement of regulated pollutants.

4.2.3 Potential Water Quality Constraints on Future Water Demand and Supply

Sources and geologic formations with naturally elevated concentrations of pollutants such as arsenic and possibly radionuclides can be avoided through well-researched placement of intakes, dedication of impacted sources to uses which are not subject to MCLs, or operational modifications or treatment at each impacted intake. Without current monitoring networks in operation, these options may not be practical. Zoning restrictions could be enacted in defined areas of known source areas to protect end users from potential repetitive sampling and individual residential end-of-pipe treatment burdens. These measures could constrain municipalities and developers, particularly in areas of Canyon County.

Nutrients have been documented to regionally impact Treasure Valley surface water bodies and groundwater in amounts considered to be both human in origin and above MCLs. Pollutants of human origin such as bacteria, pesticides, and VOCs are cause for continued concern. Bacterial contamination and VOC plumes are not regional in nature, but occurrences are frequent and widespread enough to deserve regional consideration. Pumping of groundwater can affect plume migration. Pesticide and VOC sources, use, transport, and disposal are comprehensively regulated compared to historic practices. The persistence of these manmade substances in the environment may be their primary constraint on water supply.

Continued urbanization and accompanying land use changes in the Treasure Valley are expected to impact nutrient levels in surface and groundwater. As agricultural land is converted to residential and commercial uses with greater impervious surface area, the agricultural contribution of applied and generated materials has been and will continue to decrease. However, urban areas generally result in a concentration of similar pollutants and add considerably to other pollutant loads such as heavy metals and oil and grease. These changes do not necessarily lead to constraints.

Comprehensive control of pollutants is physically and administratively complex, involving multi-jurisdictional zoning, permits, regulatory controls, and voluntary programs. Pollutant sources are located under and above ground. Underground sources such as lithology or septic systems directly impact shallow groundwater. Hydrocarbons, land applied waste water, surface applications of fertilizer for urban and agricultural use, decaying organic matter and airborne deposits, and nutrients found in animal waste make their way into urban and rural storm water runoff and irrigation return flows while also dispersing nutrients in groundwater through infiltration. Storm water from developed areas and irrigation return water flows are transported into surface water bodies for whose quality other jurisdictions are responsible. These instances, which are widespread across the Treasure Valley, create conflicts and raise concerns regarding liability.

Current regional plans with enforceable outcomes and regulatory limits are not comprehensive in dealing with human sources and transport of pollutants in the Treasure Valley CAMP study area. Current exceedances of MCLs and TMDL targets require treatment by individual domestic well owners and public water systems now and into the future, placing a financial burden on water users. TMDL assessments indicate the need for continued adjustments to meet targets using watershed-based implementation plans. The TMDLs create a watershed-based approach for reduction of some, but not all, pollutants of concern in the Treasure Valley CAMP study area. The timescale for TMDL planning, implementation, and response is long-term. Grant programs and other incentives have been made available to NPDES permittees and agricultural owners/operators to protect and improve water quality in several tributaries by providing financial incentives to implement best management practices; impacts of such programs are typically also long term. Public water supply source water protection plans are fragmented by areal extent and lack authority to effect regional change.

It has been suggested that poor well construction practices could be a possible source of pollutants in groundwater sources (Cosgrove and Taylor, 2007). Transfer of pollutants between aquifers or leakage around a poorly sealed well could be minimized by enforcing existing requirements for well construction and maintenance.

5 Current Water Conservation Plans and Measures

Several efforts that are being implemented to conserve water in the Treasure Valley. The Water Conservation Measures and Guidelines for Preparing Water Conservation Plans (IDWR, 2006) builds upon the EPA's Water Conservation Plan Guidelines and identifies conservation guidelines for those that do not have a conservation plan. Table 2-1 of the plan identifies the following conservation measures:

Table 2-1 Conservation Measures

Fixtures and Appliances
Install low flow or ultra-low flow toilets.
Install dual flush toilets.
Install waterless urinals.
Install low flow shower heads and faucets.
Install fingertip faucet valve – this allows the user to temporarily turn off the water (e.g., turn off while brushing teeth and on when rinsing).
Install electronically activated faucets for public areas.
Install high efficiency clothes washer and dishwasher.
Replace leaking bathtub plug or plug washer, tub diverter valve, or toilet flapper valve.
Landscaping – Residential, Golf Course, Cemetery, and Park
Reduce irrigated turf areas.
Replace irrigated turf areas with Xeriscaping and/or native plants. Growing plants that are suited to the area can save more than 50 percent of the water normally used to care for outdoor plants.
Install efficient irrigation equipment, and schedule and use properly.
Install rain and/or soil moisture sensors with the irrigation system.
Adjust the watering times (number of minutes) and the frequency of watering (daily, twice a week, etc.) based on weather conditions and seasonal differences.
Check the system regularly for leaks, broken heads, and other problems.
Adjust the sprinkler heads to avoid watering pavement and other non-landscape areas.
Water areas in the shade about 30 percent less than sunny areas.
Use drip irrigation to water trees and shrubs.
To eliminate runoff, set the irrigation timer to cycle 2-4 start times (no longer than 5 minutes each), 1 to 2 hours apart to allow water to soak into the soil. For example: water 3 times for 5 minutes, instead of 15 minutes all at once.
Develop a separate drip watering schedule for trees, shrubs, and flower beds.
Aerate in the spring and fall to loosen soil and reduce runoff.
Apply mulch around trees, shrubs, and flower beds.
Water landscaping early in the morning or late in the evening and on cooler days, when possible, to reduce evaporation. Allowing the grass to grow slightly taller will reduce water loss by providing more ground shade for the roots and by promoting water retention in the soil.
Behavioral
Use appliances (e.g., dishwasher, washing machine) only when full.
Turn off faucet while brushing teeth or shaving.

Shorten time spent in the shower.
Adjust water levels in the washing machine to match the size of the load.
If washing dishes by hand, do not leave the water running.
Turn off the hose between rinses when washing a car or use a commercial car wash facility.
Sweep sidewalks and driveways instead of hosing them down.
Only fill the bathtub as much as necessary. Bathing babies, small children, and pets requires much less water than an adult.
When using a hose, use a spray nozzle with a cutoff handle so water doesn't flow continuously.
Industrial and Commercial Facilities
Reuse and recycle water used in industrial process.
Analyze waste stream to determine areas of conservation and the possibility of reuse.
Assess feasibility of using reclaimed water if it is available.
Only provide water at restaurants when requested.
Install low flow toilets, faucet aerators, electronically controlled toilets and faucets for public restrooms.
For hotels and motels, encourage water conservation by developing educational materials and providing guests the opportunity to decline daily linen changes.
Distribution System Owners and Operators/Purveyors
Identify and repair leaks.
Reduce pressure.
Conduct a system audit to identify “unaccounted” water (e.g., fire hydrants, line flushing).
Remove vegetation from open canals.
Line or place open canals underground.
Install meters and maintain and calibrate existing meters.
Provide incentives and/or rebates for the replacement of high volume appliances and fixtures with efficient fixtures and appliances.
Use reclaimed water for large landscaped areas such as parks, golf courses, and cemeteries.
Audit large-volume water users and large landscaped areas to identify appropriate conservation measures.
Provide current and past water use information on bills. Send bills more frequently to provide more immediate feed-back on water use.
Develop and conduct educational activities targeting all categories of water users.
Implement tiered rates to encourage water conservation.
Construct and operate water supplier spill and tailwater recovery systems.
Automate canal structures.
Develop a water measurement and water use report to track conservation.
Pools and Spas
Use a pool cover. It will reduce water loss due to normal evaporation.
Repair any swimming pool leaks. An inch-a-day leak in a 15-by-30-foot pool can result in a loss of approximately 102,000 gallons per year.
If heated, reduce the pool and spa water temperature. Warmer water evaporates more quickly.
Shut off fountains and waterfalls. The effect of aeration loses a significant amount of water to evaporation.
Manually clean the filter. You will do a more thorough job and use less water. The average backwash uses between 250 to 1,000 gallons of water -- without completely cleaning your filter.

Maintain proper chemical levels and adequate circulation time. You will avoid the need to drain your pool or use excessive water to correct conditions of neglect.
Turn off the tile-spray device on the automatic pool cleaner.
Reevaluate the frequency of backwashing if the pool has no separation tank. Most people backwash more frequently than necessary. Some pool filters do not require backwashing; they can be taken apart and cleaned.

Water Conservation by the Water Purveyors

Water conservation programs are typically initiated at the local level, by either municipal water utilities or regional governments. Common strategies include public outreach campaigns, tiered water rates (charging progressively higher prices as water use increases), or restrictions on outdoor water use such as lawn watering and car washing. Cities can also require or encourage the installation of xeriscaping or natural landscaping in new homes to reduce outdoor water usage.

Installation of residential water meters can also encourage water conservation. The prevalence of residential water metering varies among cities in the Treasure Valley. The EPA publication *How to Conserve Water and Use It Effectively,* estimates that metering alone can reduce consumption by 20 to 40 percent. In addition to raising consumer awareness of their water use, metering is also an important way to identify and localize water leaks.

The guidelines for water conservation identify that water purveyors should “identify and repairs leaks” as the first step. During the data collection process, we noted some significant differences in the amount of water produced and sold (delivered). The percentage of unaccounted water ranged from 4 percent to 43 percent. This suggests that there may be some distribution systems losing an excessive amount of water through leaks or there may be excess deliveries that are not being recorded. The American Water Works Association recommends that the loss occurring after treatment be maintained at 10 percent or less. The national average for unaccounted water (loss) is 15 percent.

Water Conservation by Irrigation Districts

Water conservation poses a unique challenge for irrigation districts. Currently, surface water diversion are recorded at the headgate and return flow back into the river, but water deliveries to specific farms, including drainage water, are not tracked between districts. The operation of drains is a complicated system that may be difficult to map and trace water flows. Without this information it is difficult to determine the efficiency or effectiveness of surface water deliveries. Within each district there are several measures to improve operations and distribution system, such as:

- Installation of SCADA systems to monitor, measure, and record deliveries to farms will provide invaluable data on water use and canal seepage rates
- Providing domestic irrigation water to subdivision by on “on-demand” system instead of a “constant flow” may reduce the overall water diversion requirements
- Installation of soil moisture monitoring stations to improve the accuracy of crop water requirements
- Changing irrigation practices to a higher efficiency, such as sprinkler versus flood, may conserve water if the crop type can tolerate the irrigation method. However, applying such measure to

reduce the amount of water applied to irrigated lands may also have a negative effect by reducing the amount of recharge to the aquifer.

Improving crop irrigation efficiencies will minimize losses due to evaporation, runoff or subsurface drainage. Promoting application water quantity and timing to reduces over application and increased losses. Flood irrigation is the most common type and is often very uneven in distribution, as parts of a field may receive excess water in order to deliver sufficient quantities to other parts. Overhead irrigation, using center-pivot or lateral-moving sprinklers, gives a much more equal and controlled distribution pattern. Drip irrigation is the most expensive and least-used type, but offers the best results in delivering water to plant roots with minimal losses. Selecting the most efficient and cost effective irrigation method for the crop may be able to continue to the agricultural economy grow.

Residential Water Conservation

The reduction in residential water use per capita can suggest that residential water conservation programs have produced effective results. Some tactics in water conservation include campaigns to educate their customers on the importance of water conservation to control increased costs and preserve water supply reliability. UWI identifies practical measures that can make a difference in overall water consumption. In cooperation with the City of Boise and the University of Idaho Extension Service, the UWI offers free water efficient landscaping classes and tips on how to conserve water in and around homes.

- Check your plumbing for leaks, and fix any immediately
- Make sure your sprinkler system is operating correctly
- Don’t over water your lawn or landscaping
- Let Mother Nature work – don’t water your lawn when it rains
- Treated effluent is used to irrigate grass and trees at both wastewater treatment plant facilities

When divided into indoor uses and outdoor uses, the amount of indoor water used remains fairly constant throughout the year, with the breakdown of typical indoor water uses. By far the largest percentage of indoor water use occurs in the bathroom, with 41 percent used for toilet flushing and 33 percent for bathing (EPA, 1992).For indoor water saving technology, replacing toilets, showerheads, faucets, and appliance can reduce water use. Prior to the Federal Energy Policy Act of 1992 establishing maximum allowable water-flow rates for toilets, urinals, showerheads and faucets, some showerheads had flow rates of 5.5 gallons per minute (gpm). Today’s showerheads can be replaced by ones that have a flowrate of 2.5 gpm or less. Installation of dual flush toilets includes two buttons or handles to flush different levels of water. Dual flush toilets use up to 67 percent less water than conventional toilets. Changes in water fixtures and appliances can reduce indoor water use by half.

Outdoor residential water use varies greatly depending on geographic location and season. On an annual average basis, outdoor water use in the arid western states is much greater than that in the east. The national average for residential outdoor water use is 32 percent of the total water use, with landscape irrigation the primary application. Outdoor water use in the Treasure Valley accounts for nearly 70 percent of the total water use. This is likely associated with unmetered surface water deliveries for domestic irrigation. Reducing outdoor water use can be achieved by implementing an outdoor water schedule, installation of weather based irrigation controller, installation of soil moisture content irrigation controller, using drip irrigation for shrubs, trees, and flower beds, using garden hose nozzles that shut off water when it is not being used, and water reuse and recycling program for irrigation and installation of xeriscaping or natural landscaping. Reducing the application of outdoor irrigation water the national average can result in a savings of up to 55,000 AF per year.

6 Summary

Projected Water Demand

The projected DCMI demand in the Treasure Valley for 2010 to 2060 is shown in Table 6-1. These projected demands are based on the land use method and include savings from reduction in system losses. It can be seen that the DCMI demand in the study area increases from 228,535 af/year in 2010 to 962,077 af/year in 2060. This corresponds to a projected population growth from 583,000 to 1,649,000.

Table 6-1 DCMI Water Demand Projection (af/year)

2010	2020	2030	2040	2050	2060
228,535	307,210	416,050	564,491	759,797	962,077

The projected agricultural demand for 2010 to 2060 is shown in Table 6-2. The agricultural demand shown here are based on the IDC model; three hydrologic scenarios (wet, dry, average) were used to generate a range of values for the agricultural demand. The average water demand decreases from 1,487,412 AF per year in 2010 to 836,760 AF per year in 2060. This decrease is due to conversion of agricultural lands into urban lands. As presented in Section 3 of this report, there is a reduction of about 155,000 acres of agricultural land from 2010 to 2060.

Table 6-2 Agricultural Water Demand (af/year)

	2010	2020	2030	2040	2050	2060
Dry	1,555,491	1,481,409	1,440,712	1,235,332	1,039,392	887,717
Average	1,487,412	1,413,773	1,375,116	1,171,831	977,256	836,760
Wet	1,389,298	1,320,102	1,283,653	1,096,323	908,925	780,937

Two caveats should be mentioned in relation to agricultural demand. The agricultural demand as presented in Table 6-2 is based on the assumption of urbanization of agricultural lands for the growth areas identified in the City Impact Area maps for 2060. It was assumed on the basis of current land use maps that all the growth in Canyon County will take place in the currently farmed land. However, in reality, the urban area growth may not entirely occur in the farmed land; there may be urbanization over undeveloped land. It is estimated that for every acre of agricultural land conversion to urban land, there is a net water demand reduction of about 1.1 af/year because the average agricultural land water duty is 4.3 af/year per acre, while the average urban land water duty is 3.2 af/year per acre. If the development occurs over undeveloped land, than there would be a net increase in water demand of 3.2 af/year per acre as per the estimated average urban water duty. Therefore, there is a substantial range of uncertainty in the total water demand for the Treasure Valley depending on the extent of the agricultural to urban land use conversion.

Another important caveat to agricultural to urban conversion is related to the groundwater recharge. About 30 to 35 percent of applied irrigation water percolates into the underlying groundwater basin, a major source of supply for Treasure Valley. A substantial conversion of agricultural lands to urban lands will reduce this aquifer replenishment component and will substantially lower the groundwater elevation over a long time.

The total water demand for the Treasure Valley is presented in Table 6-3 assuming an average hydrologic year. From 2010 to 2060, the DCMI demand is increased by 733,542 af/year and the agricultural water demand is decreased by 650,653 af /year, resulting in a net increase 82,889 af/year.

Table 6-3 Total Water Demand for the Treasure Valley

	2010	2020	2030	2040	2050	2060
Average	1,715,948	1,720,983	1,791,166	1,736,322	1,737,053	1,798,837

Potential Environmental Constraints

Quantitatively, the existing allocation of water to environmental and ecosystem purposes can probably be considered at a minimum level for the future. The final decree and interpretation of water rights 3-10037 and 3-10098 will determine whether there is realistically any remaining water available for appropriation in the Boise system.

The precedent and the inertia of the Nez Perce Settlement will provide significant stability into the future. Future allocation negotiations in the Boise system will likely adopt a similar pragmatic approach.

It appears that the important implication for future water-use planning in the Boise basin is that any new infrastructure can only be accomplished with consideration of environmental and ecosystem needs. Any new allocation of water to traditional human uses will likely need to be balanced with additional allocations to environmental and ecosystem needs, or with additional assurances and guarantees for these uses.

Water Quality Constraints

Sources and geologic formations with naturally elevated concentrations of pollutants such as arsenic and possibly radionuclides can be avoided through well- researched placement of intakes, dedication of impacted sources to uses which are not subject to maximum contaminant levels (MCL), or operational modifications or treatment at each impacted intake. Without current monitoring networks in operation, these options may not be practical. Zoning restrictions could be enacted in defined areas of known source areas to protect end users from potential repetitive sampling and individual residential end-of-pipe treatment burdens. These measures could constrain municipalities and developers, particularly in areas of Canyon County.

Water Conservation Potential

Water conservation has played a significant role over the past few years. Water use per capita has decreased since 2000. This trend may be a result of changes in current economic conditions, changes in water rates, conservation awareness, use of low-flush toilets in public park restrooms, metering faucets to reduce water consumption (new plumbing code), and the use of native and drought-tolerant plants and efficient irrigation practices for park landscapes.

With continued employment of water conservation efforts and system operation improvements by the water purveyors, overall water use per capita can continue to see improvements. Implementation of measure to identify and repair leaks to improve water loss percentage to 4 percent, as in the case for UWI, can lead to water saving of 184,000 AF per year in 2060.

Conclusion and Recommendations

The net increase in total water demand over the 50-year period is about 83,000 af/year in the Treasure Valley. The increase in DCMI water demand is nearly balanced by the decrease in water demand from agriculture due to land use conversion. Changes to land use conversion assumptions can make a significant impact on the projected total water demand. If less agricultural land is removed from production then the overall demand will increase. Another factor that may affect the overall water demand is changes in water conservation strategies. A reduction in outdoor residential water use by 15 percent may reduce DCMI demand by about 82,000 af, balancing the net water demand increase in 2060.

The Treasure Valley Future Water Demand Study is a component of the overall Treasure Valley CAMP and will need to be updated on a periodic basis as more data becomes available and uncertainties about the future are reduced through pro-active and integrated planning. Several recommendations are in order to improve the accuracy of the future water demand study. The water demand study is very data intensive; therefore a sound data collection, compilation, and organization process will ascertain the accuracy of future studies. Installation of residential meters will improve water demand estimates. Currently, many water purveyors sell water on a flat rate basis, which does not provide incentives for water conservation. Metering can reduce the overall water use and help detect leaks in the system. Urban land use planning should be integrated with water supply planning, and agricultural land use surveys should be conducted more frequently and should include data on the seed crops. In addition, the development of an Integrated Groundwater Surface Water Model for the entire Treasure Valley will give the opportunity to analyze multiple land use and growth scenarios using a calibrated model.