Treasure Valley

Comprehensive Aquifer Management Plan

The vision of the Treasure Valley CAMP is to promote and protect Treasure Valley water resources through:

- *Respect for Idaho water law and water rights*
- *A sustainable framework of collaboration, cooperation, and stewardship*
- *A commitment to ongoing research, data collection and analysis*

IDAHO WATER RESOURCE BOARD

TV CAMP 6/28 Draft Outline

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    - Water Supply Bank
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2. INTRODUCTION

In 2008, the Idaho Legislature passed House Bills 428 and 644, establishing the statewide comprehensive aquifer planning and management effort and creating a fund to support the effort. The Idaho Water Resource Board (IWRB) and the Idaho Department of Water Resources (IDWR) initiated work in the Treasure Valley to establish a framework and path forward which will lead to sustainable water supplies, optimum use of the aquifer, and develop strategies to avoid future conflicts. This effort was conducted under the leadership of the IWRB. The IWRB is the constitutionally established agency responsible for formulating and implementing the state water plan for optimum development of the water resources in the public interest. This plan is a component of the state water plan, which guides the development, use, conservation and management of water resources in Idaho. The specific goals of the statewide CAMP program are to:

- Provide reliable sources of water, projecting 50 years into the future
- Develop strategies to avoid conflicts over water resources
- Prioritize future investments in water

The IWRB recognizes that the long-term management of the water resources of the Treasure Valley must be acceptable to the local community and take into account the social and economic interests of the residents and public interest. The long-range plan must also be consistent with the legal constraints and laws of Idaho. The Idaho Water Resource Board appointed an Advisory Committee to consider these interests and develop recommendations for this plan. For a list of Advisory Committee members, see Appendix 1.

As the Advisory Committee progressed in their work, the members built on the CAMP goals and developed a unanimously-supported vision for the TV CAMP.

The vision of the Treasure Valley CAMP is to promote and protect Treasure Valley water resources through:

- ***Respect for Idaho water law and water rights***
- ***A sustainable framework of collaboration, cooperation, and stewardship, and***
- ***A commitment to ongoing research, data collection, and analysis***

This Plan and the recommended actions described are guided by this vision.

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3. BACKGROUND AND CURRENT CONDITIONS

The Treasure Valley water system is a complex system of dynamic interconnection. However, the connection between these waters is a critical element in the location and availability of water for the needs of the Treasure Valley. Water used in one location will likely be the supply for a different water need elsewhere in the basin. Although comprehensive studies have been undertaken, and continue today, the full extent of when, how, and where the ground and surface waters interact is not fully understood. The contribution of surface water to recharge of the aquifer system and the importance of aquifer discharge to drains and the rivers does, however, require that any discussion of the Treasure Valley Aquifer System will inevitably be a discussion about both ground and surface water.

Hydrology

Most of the surface water used in the Treasure Valley originates as snow in the higher elevations of the Upper Boise basin where precipitation can be as high as 50 inches annually. This upper basin supplies an estimated 90 percent of the water for the Treasure Valley. The upper basin is approximately 2,650 square miles and consists of four major tributaries including the North, Middle and South Forks of the Boise River, and Mores Creek. From Lucky Peak Dam, the lower Boise River flows about 64 (river) miles northwestward through the Treasure Valley to its confluence with the Snake River.

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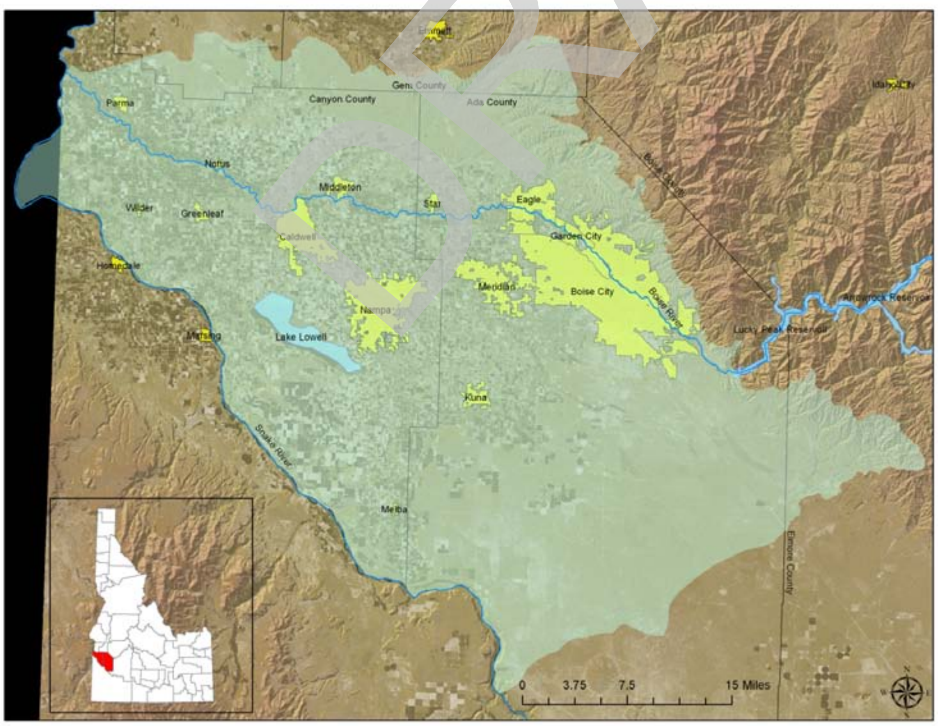

Figure 1. Map of the Treasure Valley study area (green-shaded area).

Hydrogeology

The Treasure Valley Aquifer System (TVAS) underlies the lower Boise River basin in southwestern Idaho (Figure 1). The TVAS extends downstream from Lucky Peak Dam to the confluence with the Snake River and serves as the primary source of drinking water for the communities and residents within the Treasure Valley. Approximately 95% of the valley's drinking water is pumped from the TVAS.

The TVAS can be conceptualized as a complex system of shallow, intermediate, and deep aquifers (Figure 2). The depths and thicknesses of the aquifers vary spatially and are controlled by geologic faulting, topography, and local land use characteristics (e.g. flood irrigation). The hydraulic communication between the various aquifers varies throughout the Treasure Valley, adding to the complexity. Hydraulic connections to aquifers underlying areas to the north (Boise foothills to the Payette River) and to the east (Mountain Home Plateau) are currently not fully understood.

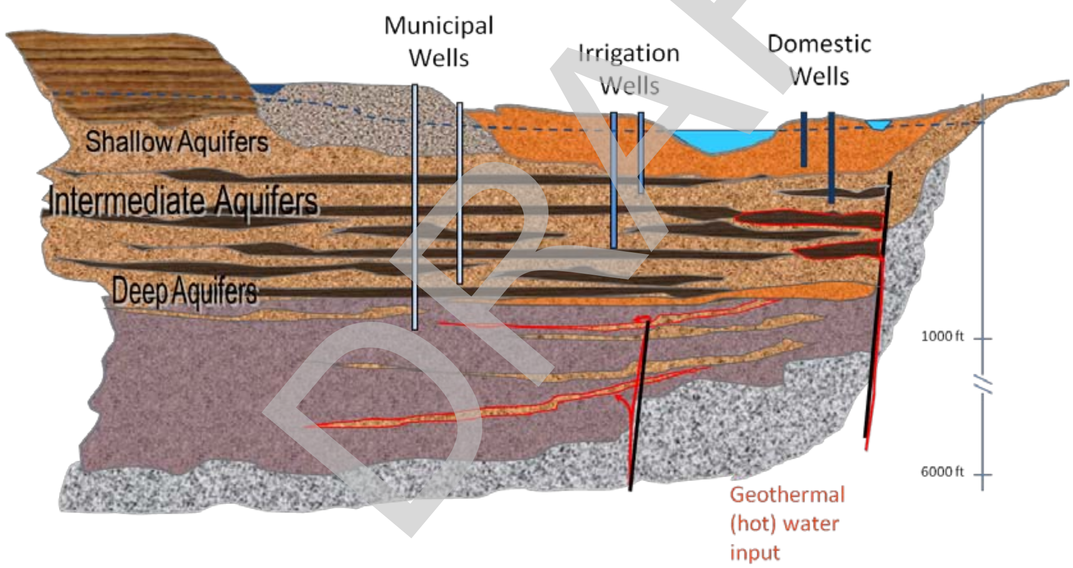

Figure 2. Conceptual schematic of the Treasure Valley hydrogeology.

The Aquifer system in the Treasure Valley consists of:

- Shallow aquifers - these shallow aquifers supply water to rural domestic and some irrigation wells. Shallow aquifers are generally in direct hydraulic communication with surface water features, and form localized flow systems with the nearest surface water body. The shallow aquifers are generally unconfined (the water level represents the top of the saturated zone), and water levels are typically controlled by topography (i.e., the elevations of canals or drains).
- Intermediate aquifers – the intermediate aquifers supply water for domestic, irrigation, and municipal uses. The hydraulic communication between the intermediate aquifers and the surface water features of the valley is unknown.
- Deep Aquifers - municipal, industrial, and some irrigation wells typically draw water from deeper aquifers. The hydraulic communication between the deeper aquifers and the surface water features of the valley is limited due to the depths below land surface where the deeper aquifers are found. The deeper aquifers are generally confined (water levels rising above the depth of the water bearing zone), and flowing artesian wells exist within the Treasure Valley.

Surface Water flows

The Boise River basin inflow volumes have varied from a low of 676,000 acre-feet annually to a high of 3.6 million acre-feet annually. The average runoff (1929 – 2010) is 1.9 million acre-feet annually. The inflow volumes were calculated at Lucky Peak and are published by the U.S. Bureau of Reclamation.
Of this 1.9 million acre-feet, on average1.6 million acre-feet annually is diverted for irrigation and serves as the primary source of recharge to the TVAS (BOR, 2007).

The average annual basin outflow (1972 – 2010) is 1.1 million acre-feet, with outflow volumes varying from 334,000 acre-feet annually to 2.8 million acre-feet annually. The basin outflow is measured at the Boise River near Parma gage, operated by the U.S. Geological Survey in cooperation with IDWR.

The remaining storage water left in the reservoirs (Arrowrock, Anderson, and Lucky Peak) at the end of an irrigation season is highly dependent on the water supply for that season. The average reservoir storage on November 1st is 390,000 acre-feet and has varied from a low of 65,000 acre-feet to a high of 665,000 acre-feet. The availability of this "carry over" water reduces the risk of a shortage of irrigation water in the succeeding year.

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Table XX: Summary of historical Boise River runoff and outflow.

	Boise River Runoff (at Lucky Peak)		Boise River Outflow (near Parma)		November 1 Storage	
	Acre-Feet	Year(s)	Acre-Feet	Year(s)	Acre-Feet	Year(s)
Long-term Average	1,929,000	1929 - 2010	1,120,000	1972 - 2010	390,000	1956 - 2010
Maximum	3,673,000	1965	2,820,000	1983	665,000	1965
Minimum	676,000	1977	334,000	1992	65,000	1992

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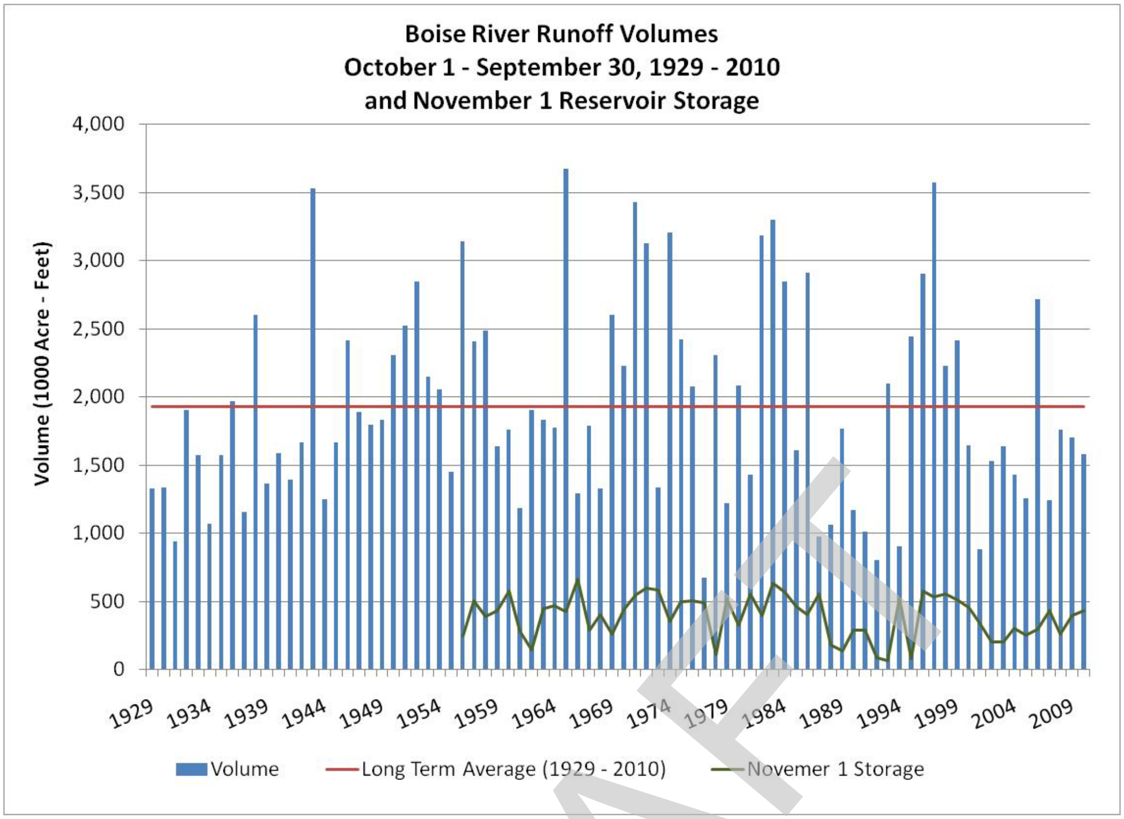

Figure XX: Boise River runoff volumes 1929 – 2010 and November 1 reservoir storage volumes.

The hydrograph below summarizes the historical data from the Boise River at Glenwood Bridge for the period of record (1982 – 2010). The Boise River at Glenwood Bridge gage is utilized by the Army Corps of Engineers for evaluating flooding on the river. Flood stage is reached at 7,000 cfs. The maximum discharge since the completion of the reservoir system was 9,840 cfs on June 13, 1983 (USGS, 2011). Typical winter flow out of Lucky Peak (November – March) is approximately 250 cfs. Typical flow at Glenwood after the spring runoff and during the irrigation season (July– September) is approximately 1,000 cfs.

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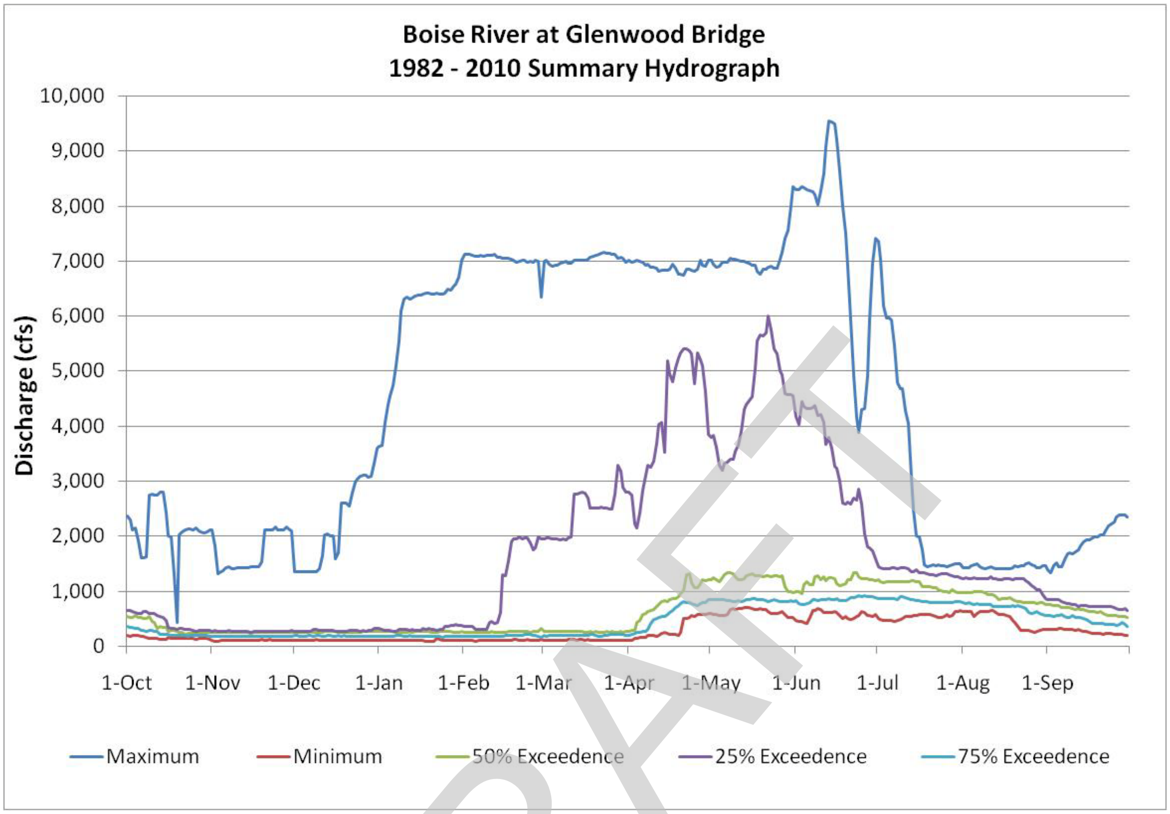

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Figure XX: 25% exceedence means that for the specified day of the year the flow was greater than this value for 25% of the same day from 1982 through 2010. 50% exceedence is the median and means that for the specified day of the year the flow was greater than this value for 25% of the same day from 1982 through 2010. 75% exceedence means that for the specified day of the year the flow was greater than this value for 75% of the same day from 1982 through 2010.

During the irrigation season, the Boise River from Lucky Peak to Middleton does not have enough natural flow to meet irrigation demands. Irrigators rely on storage water to supplement the limited natural flow supplies. Below Middleton there are often enough gains, from the drains and groundwater seepage in the river to satisfy the existing irrigation demands. On average, there is approximately 310,000 acre-feet per year of gain in flow between Middleton and Parma gages.

TVAS Ground Water Budget

The annual ground water budget for the Treasure Valley Aquifer System (TVAS) varies from year to year. For illustration purposes, estimates for the year 2000 are used to show the components of the annual water budget for the TVAS because total precipitation during the 2000 water year was near normal precipitation and temperature.

The Boise River and associated irrigation delivery system provides the primary source of recharge water to the TVAS. Of the approximately 1.6 million acre-feet annually that is diverted for irrigation, about 900,000 acre-feet annually infiltrates the ground and recharges the TVAS (BOR, 2007).

Table 1. Summary of TVAS ground water budget (modified from Urban, 2004).

Sources of Recharge and Discharge	Estimated Recharge and Discharge for 2000	
	(af)	(% of total)
Recharge		
Canal Seepage	521,500	50
Flood Irrigation	404,400	35
Other Sources	172,800	15
Total Recharge	**1,098,700**	
Discharge		
Discharge to Rivers and Drains	881,600	83
Pumping from wells	175,000	17
Total Discharge	**1,056,600**	

The shallow aquifers of TVAS are generally in direct hydraulic communication with the Boise and to a lesser extent the Snake River throughout most of the Treasure Valley. The aquifer discharges directly to the rivers and the ground water drainage network constructed in the Treasure Valley to drain shallow ground water from low-lying areas. It is estimated that over 80% of the TVAS total discharge enters the rivers and the drain network. Some of the drain water is also re-diverted and used for irrigation by downstream users. The amount of water leaving the TVAS through discharge to the drains, tributaries, or the rivers in 2000 was over 881,000 acre-feet (Urban).

Ground water Flow Direction and Water Levels

The ground water flow direction in the TVAS is generally east to west and follows the course of the Boise River. In the southern portion of the TVAS, ground water flows to the south, and discharges into the Snake River. Locally, ground water flow directions are dependent on the location (spatially and with depth) within the valley.

Water level trends are a good indication of a stable storage of water in an aquifer system. Rising water levels indicate an increase in water stored, and declining water levels indicate a reduction in water stored. Stable water levels generally indicate an aquifer storage that is in equilibrium. In the early to mid 1900's, water levels in the shallow aquifer rose significantly

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because of the development of the valley's irrigation network and continued to rise until the aquifer system eventually reached equilibrium with the drains and river, as indicated by stable water levels. In general, water levels in the shallow aquifer system have remained stable and are controlled by the operation and elevation of the surface water features. Water levels in the intermediate and deep aquifers also appear relatively stable, but some areas of water level decline have been identified in the valley, particularly in the Southeast Boise and Lake Lowell vicinities (Petrich and Urban, 2004).

Ground water withdrawals by pumping lower the water level in wells as water is taken out of storage in the aquifer. The change in water level reduces the amount of water that the aquifer discharges to the drains and rivers,. In an aquifer that is well-connected to flowing drains and rivers, flow to the drain can change soon after the pumping starts or stops. If pumping continues and the water table drops further, the flow direction may reverse and the drains dry up. River water may flow into the aquifer toward the pumping wells.

There are existing mathematical models of the Treasure Valley aquifer, of various ages and scopes, however they are not adequate to address aquifer management needs.

Climate Variability

Climate variability adds another element of uncertainty to planning for future water needs. The IWRB contracted with Boise State University to evaluate potential changes to water supply and demand which might result from climate variability on a watershed scale. There is a large range of uncertainty to climate model predications; however, general trends are indicated.

Increased temperatures are indicated by multiple studies of climate change in the Pacific Northwest and northern Rockies, although the range of change is uncertain. For example, climate change forecast models predict 21st century warming of annual mean temperatures about 1 to 4 degrees Celsius above the means in the 1990's at the Snake River near Brownlee Dam (BOR, 2011). Reclamation (2008) used three climate models to estimate increases in mean monthly temperatures of 0.48 to 3.05 during the irrigation months of 2040, compared to the present, for the Boise River Basin.

Regional studies for the northwest United States indicate severe climate conditions (floods and droughts) will be higher and deeper, and change the flow regime on which current system operating procedures are based. For example, temperature increases may alter the timing of snowmelt, resulting in earlier snow melt and more winter precipitation may fall as rain instead of snow. On average, peak flows in the Boise River basin may be higher in the future than current historic high flows. Spring runoff has been shown by analysis of streamflow measurements to already begin earlier by a few weeks, as predicted by the climate change models. Snowpack may be fully melted earlier in the summer, annual evapotranspiration

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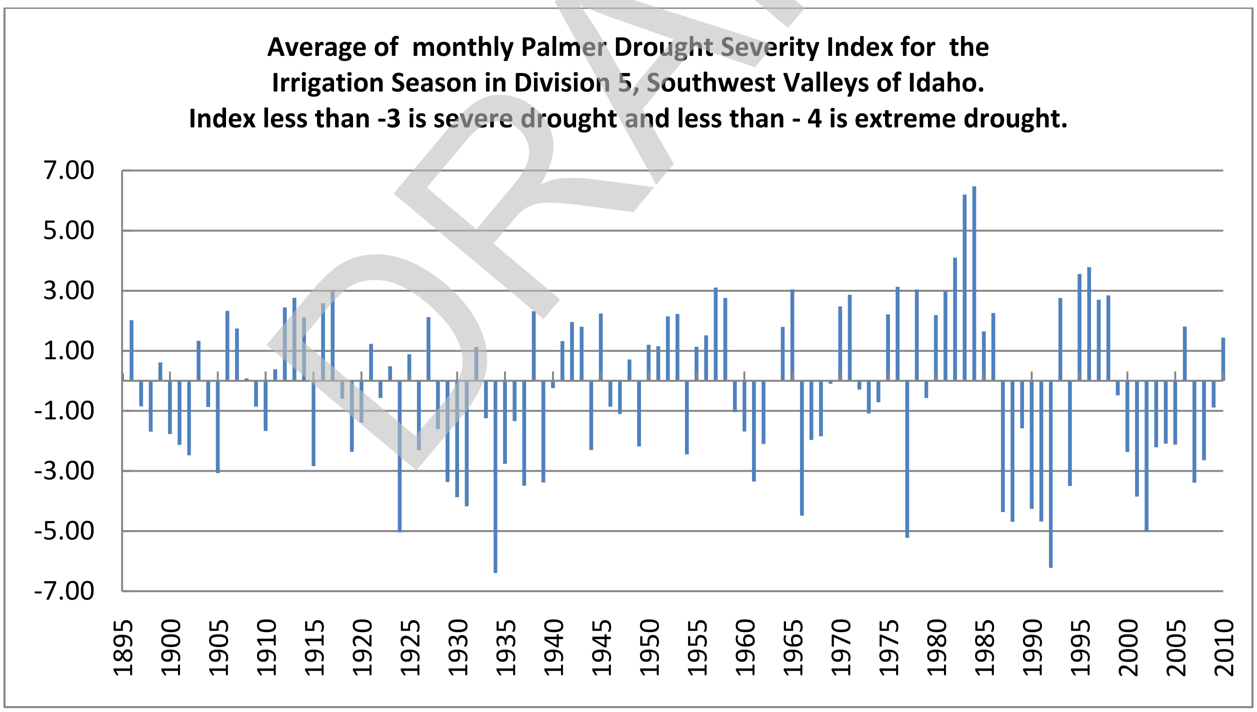
would increase, and low flows are expected to be lower than historic low flows. Fall precipitation also could be more frequently rain and less frequently snow.

Drought

Drought imposes hardships on the Treasure Valley community, particularly because it is an agriculturally based community in which DCMI and other water uses including tourism play an important part of the economy. Providing adequate supplies of domestic (culinary) water for public health, safety, and welfare are the first priority of the State Drought Plan which also identifies the importance of providing supplies for other uses during a drought to secure the state's economy, environment, and social well-being. Sufficient supply of inexpensive hydropower is also an important part of community resiliency during drought.

One major drought of the 20th century that affected the Treasure Valley extended from 1987-1992. During those six years, the Palmer Drought Severity Index classified conditions as extreme drought for 28 of the 36 months that comprised the irrigation seasons in the Treasure Valley. The series of dry, hot summers made response more difficult than the drought of 1977 because, although 1977 set the record low flow for the upper Boise River, 1976 and 1978 had wet irrigation seasons, reducing the stress on water supply.



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The Idaho Drought Plan encourages local communities to plan for and mitigate for future droughts. The Plan describes the authority counties and cities have to restrict use and raise funds through ordinances, rules, regulations, proclamations, and short-term levies. It also authorizes the IDWR to take actions to provide for full use of the available water supply, in accordance with valid rights for its use, during shortages by increasing supervision of water distribution from adjudicated sources, increasing water-right enforcement for non-adjudicated sources, and defining procedures to expedite processing of applications for replacement water supplies.

Available records indicate that during drought years surface water irrigation is supplemented with groundwater by up to as much as 300,000 acre-feet.

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CHALLENGES:

Increased annual variability of surface water supply increases uncertainty for meeting existing and future needs

Wetter years that yield water that exceeds available ground water and surface water storage space does not provide supply for future demand. Dry years are increasing in frequency and severity. Increased flows during wet years cannot be captured in our fixed storage capacity. Consequently wet years do not offset dry years.

Predicted intra-year variability is expected to reduce natural flow in the summer and fall
Reduced natural flows will result in less water available to fill natural flow water rights. This phenomenon results in increased use of stored water from the reservoirs leading to less reservoir carryover. Warmer temperatures during the growing season would increase water demand for all uses.

Predicted future demand cannot be met solely by readily available ground water supplies in some areas

Ground water supplies are not infinite. There is potential for additional groundwater development, however, the Treasure Valley is not homogeneous. Characteristics vary locally and regionally (and by depth). This variation results in limited availability of ground water supplies in some areas to meet existing and future needs. Ground water supplies are especially limited in southeast Ada County, and the Lake Lowell area. There are also concerns about ground water levels in the north foothills. (Reference for these gw limitations; IDWR data was used.)

Currently there is no Treasure Valley drought plan.

Lack of a comprehensive regional response before the next drought will delay demand reduction actions needed to reduce the negative impacts of drought and increase the likelihood of conflict between water-right holders

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Distribution

Reservoir System

The water supply of the Treasure Valley relies upon a reservoir system capable of storing approximately 1,000,000 acre-feet of water, which equals about one-half of the average annual inflow of the Boise River. Four reservoirs make up the reservoir system. Three of those reservoirs—Arrowrock, Anderson Ranch, and Lake Lowell—were constructed in the early to mid-1900's by the Bureau of Reclamation as part of the development of the Boise Project. A fourth reservoir, Lucky Peak, was constructed in 1957 by the Army Corps of Engineers for flood control, irrigation, and other congressionally authorized purposes. Combined these reservoirs provide water supplies for irrigation, hydropower, winter flows, and associated recreational, wildlife, and aesthetic interests, together with flood control benefits.

To meet irrigation demand, flows past Lucky Peak Dam average approximately 3,900 cfs during the irrigation season, which spans April through October. During periods of peak irrigation demand flows past the dam are kept at about 4,500 cfs. Reservoir space is allocated to storage users according to terms set out in spaceholder contracts entered into between the various users and the Secretary of Interior, through the Bureau of Reclamation. While the majority of the contracted reservoir space is used for irrigation storage, approximately 5,000 acre-feet in Anderson Ranch Reservoir is used to store water for municipal and industrial purposes.

Arrowrock, Anderson Ranch, and Lucky Peak are operated as a unified system for flood control and refill purposes. Flood control operations are governed by flood control rule curves developed by the U.S. Army Corps of Engineers. Taking into account various hydrological data, the rule curves attempt to fix the amount of empty reservoir space needed to intercept and capture peak spring runoff flows in order to minimize the effects of flooding downstream. Presently, the flood control objective is to limit flood flows at the Glenwood Bridge to 6,500 cfs.

Capacities of Federal Reservoirs in the Boise Basin

Reservoir	Elevation at Full Pool	Capacity (Acre-Feet)			
		Active	Inactive	Dead	Total
Lake Lowell	2531.2	159,400	--	--	159,400
Arrowrock	3216.0	272,200	--	--	272,200
Anderson Ranch	4196.0	413,100	37,000	24,900	475,000
Lucky Peak	3055.0	264,370	28,730	--	293,100

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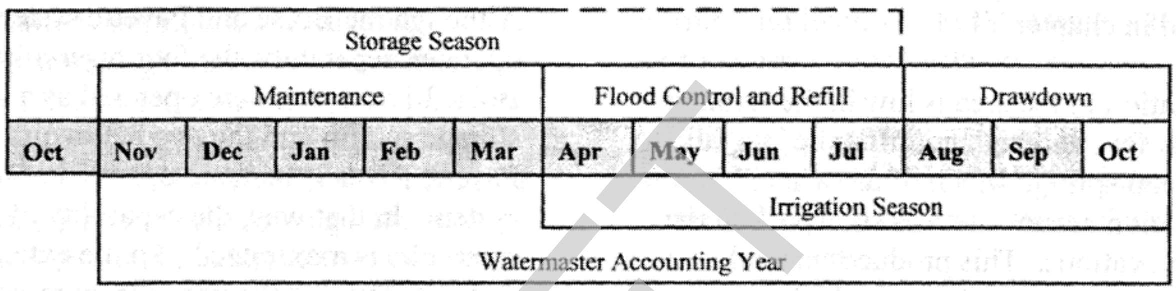
Operation of the reservoir system, with the exception of Lake Lowell, is coordinated between Reclamation, which operates Arrowrock and Anderson Ranch, and the Corps which operates Lucky Peak. By agreement between the two federal agencies, the storage system is operated as a unified system in order to maximize the capabilities of the reservoirs. Reservoir operations are defined by generally three operating periods which are based on climatological patterns, runoff and irrigation demand as shown below:

Figure 5.—Operating Periods and Seasons (Water year shown by shaded blocks)



During the maintenance period, the system is operated primarily for carry over and storage as allowed by flood control requirements; however, storage releases continue for municipal and industrial and streamflow maintenance uses. During the flood control and refill period, operation is adjusted continually based on runoff forecasts to provide space for flood control and to assure storage refill for water users, while releasing water necessary to satisfy irrigation demand. The drawdown period is operated for release of irrigation storage water. To the extent possible water is typically stored as high in the system as possible, although storage accrues to accounts in order of priority. During the summer Lucky Peak is held near full pool for recreation purposes and water is released from Arrowrock and Anderson Ranch reservoirs to meet irrigation demand.

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Lake Lowell is operated by the Boise Project Board of Control. It is used to store water and regulate water supplies for the lower end of the Boise Project. Lake Lowell is drafted during the summer when irrigation demands exceed the capacity of the New York Canal.

Canals

An extensive distribution system carries water to 70 points of diversion and provides irrigation to 350,000 acres of land below Diversion Dam. These diversions range from the New York Canal with a capacity of 2400 cubic feet per second to the pumps used for irrigation of individual city lots. Most large canals branch into sub-canals and laterals to distribute water throughout the valley. Irrigation districts and canal companies maintain their individual systems of delivery for their patrons. There are approximately 1,170 miles of major irrigation canals.

[Map of Canals]

Drains

Eleven principle drain systems discharge into the Boise River. Approximately 195 miles of drains channel water out of low-lying areas. They were constructed to drain groundwater from shallow aquifers and reduce the incidence of water logged soils. Some drains also serve as canals, providing additional irrigation water through re-diversion. Some drains flow year around because of groundwater discharge. Groundwater discharge to the drains will fluctuate in response to groundwater withdrawals, as well as recharge and other changes in the water budget. Studies are currently underway to better understand the drainage system and quantify seasonal and annual flows.

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CHALLENGES:

Ability of water infrastructure to meet existing and future needs

Maintaining aging infrastructure of wells, canals, ditches, and collection systems that have existed for decades is needed to retain the regional benefits expected of it now, and into the future. An additional challenge is the need to modernize existing infrastructure to optimize the beneficial use of water.

Management of Interconnected Sources

Surface water and ground water are hydraulically connected. This means ground water can become surface water in the Boise River, including tributary creeks and drains. Likewise, surface water can become ground water. This interconnection presents a challenge for future management of surface and ground water rights, which historically have been managed separately. Further complicating this challenge is the recognition that while we understand that a connection exists our understanding of the timing, extent and location of the interconnected sources is limited and needs further study in order to provide effective management.

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Use/Needs

Ninety-five percent of the Treasure Valley water use falls into one of two major categories: domestic, commercial, municipal, and industrial use (DCMI), and irrigation. While not always included in water-use estimations, water is used to recharge the aquifer, support the river and tributary biological systems, and convey irrigation water. Water leaving the Valley passes through downstream hydropower plants that generate electricity used in the valley.

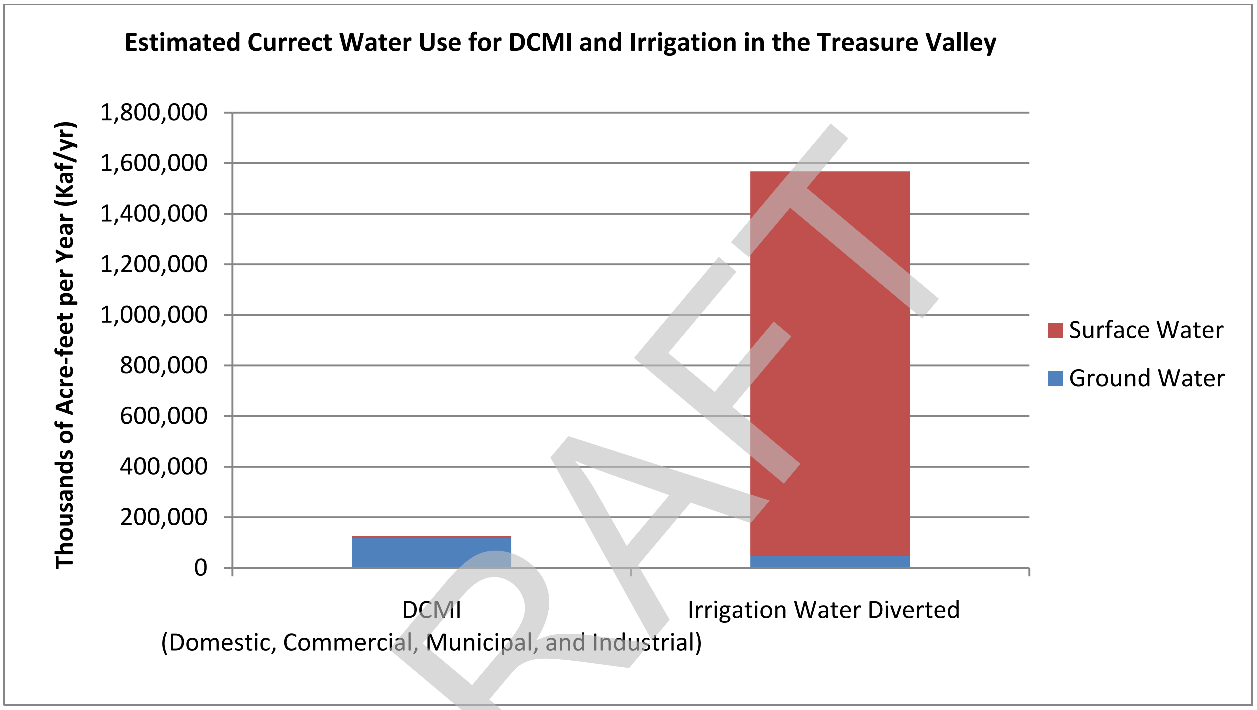

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Figure XX: For DCMI, portion of ground water is 94% and portion of surface water is 6%. For Irrigation water, portion of ground water is 3% and portion of surface water is 97%. Source of Data: IDWR.

In the Treasure Valley, the principal source of water for DCMI is groundwater. The single largest supplier of groundwater is United Water Idaho, whose service area includes the City of Boise and part of Ada County. United Water also delivers surface water for DCMI uses. United Water Idaho produces about 45,000 acre-feet/year and regularly updates its water demand projections based on records on customer usage and modeling future growth.

While surface water is the primary source of water for irrigation ground water is also a source for irrigation. The annual demand varies because some irrigators rely on groundwater every year and some use it to supplement surface water. Weather conditions strongly influence irrigation demand and therefore the necessity of using groundwater in a particular year.

Seepage of over 800,000 acre-feet/year of water from canals and flood irrigation recharge the Treasure Valley aquifer.

Fisheries/Biological flows

Man caused impacts over a long period of time have altered most fish and riparian habitats in the Treasure Valley creating limitations on fish productivity. Human development has significantly altered habitats of native fish species and much of the angling opportunity is provided by introduced sport fishes.

Native coldwater species including trout, charr, and whitefish inhabit the middle and upper reaches of the Boise River between Star and Lucky Peak Dam. Winter stream flows in the Boise River below Lucky Peak Dam are the largest constraint on fish populations and riparian habitat.

Reclamation also holds 152,300 acre-feet of un-contracted storage space, which it uses in consultation with the Idaho Department of Fish and Game to provide for winter flows for stream maintenance in the Boise River below Lucky Peak Dam. During drought periods these flows have been reduced to avoid exhausting the winter storage supply. Winter flows provide needed habitat for local fisheries and provide aesthetic benefits to the municipalities located along the river.

Since the 1990's allocation of uncontracted storage space towards winter “stream channel maintenance” flows has increased typical winter flows to 240 cfs, which requires approximately 86,000 AF of storage for about 180 days. Flows of 240 cfs or higher provide young fish with access to shoreline woody cover and cobble substrates which improves survival. Since the mid-1990s wild trout populations have increased 17-fold, with an estimated 2,000 fish per mile in some reaches. Recent (2007-2008) creel surveys indicate that annual fishing effort is nearly 5,000 hours per mile, uniquely large for an urban river trout fishery.

From Star to its confluence with the Snake River the Boise River is generally a gaining reach with good stream flows, although water quality condition supports cold-water fishery only seasonally. This section of river supports a fair fishery for largemouth bass, smallmouth bass and channel catfish. The Lake Lowell fishery consists primarily of largemouth bass, smallmouth bass, yellow perch, black crappie, bullhead, bluegill, and channel catfish.

Upstream from Lucky Peak and Arrowrock reservoirs, the river and its tributaries contain excellent populations of wild rainbow trout, mountain whitefish, and bull trout.

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Dry Creek, the largest stream on the north side of the Boise River has a low-functional channel and is seasonally disconnected from the River, generally sinking into the ground in the foothills north of Boise. This stream provides recharge into the Treasure Valley Aquifer system.

Riparian woodland habitats and wetlands adjacent to the Boise River and tributaries provide habitat for aquatic, semi-aquatic, and terrestrial wildlife and serve as movement corridors, facilitating movement of wildlife through the landscape. Nesting and wintering bald eagles, as well as great blue heron communal nesting areas known as rookeries can be found along the Boise River.

Recreation and Aesthetic Values

The Boise River contributes greatly to the quality of life in the Treasure Valley and is partly responsible for the growth in the area. Cultural attractions include a string of city parks and greenbelt trails, undeveloped areas within an urban setting, and sportsman's access areas. Natural attractions along the river range from basalt cliffs to gallery cottonwood forests.

There are water recreation opportunities available from the upper reaches of the Boise basin, on each of the reservoirs and on the Boise River below Lucky Peak.

Boaters and fisherman access the lower Boise River from Lucky Peak dam to the confluence with the Snake River. Floating the five mile reach from Barber Dam to the center of Boise is especially popular in the hot summer months. Likewise, water skiing is popular on Lucky Peak Reservoir.

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Water Quality

Water quality is an important characteristic in meeting future water needs in the Treasure Valley. Ground water in the Treasure Valley Aquifer System is generally of good quality for drinking and other uses. Surface water quality is variable and has been impacted by both natural and anthropogenic sources. Overall, the water quality throughout the system could constrain the availability of water supplies to meet current and future water needs if the water quality is degraded.

Degraded water quality can impact both supply as well as significantly increase costs for groundwater providers.

Hydropower

Hydropower is generated below the reservoirs at both federal and non-federal hydroelectric power plants. Federal Reclamation power plants were constructed at Anderson Ranch Dam (40,000 kW) and Boise Diversion Dam (1,500 kW) as part of the development of the Boise Project in order to provide power to operate project facilities and to help reduce power costs to project farmers who depend upon pumping water for irrigation. In 1988, four of the five irrigation districts who make up the Boise Project Board of Control completed construction of a power plant at Lucky Peak Dam (101,250kW). Power generated at the facility is under contract with the Seattle Light Company. More recently, in 2010, the Board of Control completed construction of a second hydropower facility on the Boise River at Arrowrock Dam (18,000 kW). Ada County owns a 3,700 kW powerplant located at Barber Dam which is located just upstream of Boise. Upstream of the reservoir system the Atlanta Power Company owns a 187 kW hydro power plant at Kirby Dam to supply electricity to the town of Atlanta.

Anticipated Changes in Water Use

Water demand in the Treasure Valley is expected to increase, although there is no consensus on the amount. The U.S. Bureau of Reclamation projected in a 2006 assessment level study that consumptive water demand in the Boise Basin could increase by as much as 124, 085 af/year by 2050. WRIME's detailed 2010 demand study determined that demands for water in the Treasure Valley would increase by 82,880 af/year by 2060. IDWR staff estimates that new water demands and shortfalls in water supply for existing demands could result in a need for new water supplies of approximately 170,000 af/year.

New water needs are difficult to quantify because there are areas of uncertainty, along with many variables which will determine actual water use and need. Changing land uses, social attitudes, as well as economic conditions are all factors which will affect water use in the Treasure Valley.

Increased population and economic growth will add to the future water demand, which may be partially met by water conservation and some decrease in agricultural production as lands are converted from irrigated agriculture to municipal and domestic water use, including domestic irrigation. However, these changes may not meet the potential water demand. Particularly difficult to anticipate is what proportion of growth will be on undeveloped land, rather than farm land, and what industrial or commercial uses might develop. Those changes are most likely to increase demand for water above current usage.

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CHALLENGES:

Facilitating the transition from agriculture water use to DCMI water use in a manner that minimizes conflicts while supporting agricultural and DCMI interests poses a significant challenge in the future

The Treasure Valley population and economy has grown over the past decade and is expected to do so in the future. A recent study projects up to 650 KAF (WRIME 2010) could transition in use from agricultural to DCMI although a wide range of possible scenarios could occur.

Maintaining Quality of Life

The challenge for the Valley will be to preserve the quality of life while being sensitive to the changing needs of the Valley into the future. Quality of life can include aesthetics, recreational needs, property values, socio-economic values and influences economic development. Issues of quality of life are often subjective and water management decisions can affect quality of life in the Treasure Valley. How these issues influence water management will remain a challenge.

Meeting Environmental Needs

The challenge over the next fifty years will be to conserve and protect the water resources in the Treasure Valley's streams and aquifers and the riparian habitat it supports, while providing the water supplies for the current and future use. An incomplete understanding of the effect of water diversions for both consumptive and non-consumptive uses on the surface and ground water leads to an inability to assess their impact on the natural environment. The Valley will be challenged to voluntarily and collaboratively provide functional habitats and mitigate the impacts of water diversions and discharges on the natural environment.

Meeting Water Supply Needs

The challenge for the Valley will be to meet new and on-going water demands over the next 50 years. The size and location of future water demands, as well as projections for shortfalls in meeting current demands, is uncertain. Water supply solutions involve resolving difficult social and economic issues depending upon form, size and location. Some solutions, such as ground and surface water storage proposals, require a long lead time to plan and construct, so must be commenced long before there is consensus regarding the size and scope of future water demands. The challenge will be to conduct wise, proactive planning, and marrying that with careful monitoring of demand increases and supply shortfalls, to develop appropriate, timely and economical water supply solutions.

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Management

IDWR

A long history of water development and legal decisions has led to a complex system of interaction among water managers in the Treasure Valley. Water administration is under the authority of the Director, Idaho Department of Water Resources. However, numerous organizations and agencies are involved in the practical management of water.

IWRB

The Idaho Water Resource Board (IWRB) is a constitutionally created body responsible for formulating, adopting and implementing a comprehensive state water plan for conservation, development, management and optimum use of all unappropriated water resources and waterways of this state in the public interest. The state water plan is a guiding document for all state actions and activities. The IWRB undertakes water projects for a variety of purposes throughout the state. The IWRB also provides financing for local water entities, such as canal companies, irrigation districts, cities, and others to undertake water projects, including improvement, expansion, and reconstruction of facilities.

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Water District #63

Water District #63 was created by the Director of the Idaho Department of Water Resources to administer surface water rights from the Boise River currently subject to administration. The administration is carried out under state water law and court decrees. Water rights to more than 330,000 irrigated acres are administered in the Treasure Valley from the Boise River. In addition to irrigation, water rights for other uses are also administered.

Throughout the water year, the Watermaster works closely with the NRCS Snow Survey, IDWR, U.S. Bureau of Reclamation and the U.S. Army Corp of Engineers. The information provided by these agencies help the water users understand predictions for the total amount of water available each year.

Water District #63 currently records 75 points of diversion weekly during the irrigation season. This information is used with the IDWR accounting program to track natural flow and storage use at each diversion.

Data from the water district, USGS, Bureau of Reclamation, and Idaho Power are compiled to run the water rights accounting model. IDWR operates the daily water rights accounting model and the water master uses the model output to administer the water rights and storage water in the basin.

Boise Project Board of Control

Boise Project Board of Control (BPBC) is the operating entity for the Arrowrock Division of the Bureau of Reclamation's Boise Project which operates the New York Canal. The BPBC was created by contracts between the five major irrigation districts and the Reclamation. The five districts are Big Bend, Boise-Kuna, Nampa & Meridian, New York and Wilder. Each district has representatives on the board, proportional to the acreage in the district.

Irrigation districts/canal companies/lateral associations

There are 47 Irrigation entities that operate within the Treasure Valley. These entities were created locally for the purpose of new irrigation development. Irrigation entities usually hold water rights and own diversion facilities and infrastructure. The majority of storage space in the reservoir system is used for irrigation by these entities that hold spaceholder contracts with the Bureau.

State law associated with requiring the continued use of irrigation water for landscaping

In 2005, the Idaho Legislature adopted Idaho Code 67-6537 which encourages the use of surface water for irrigation. The law amended the Local Land Use Planning Act and requires that if land has irrigation water appurtenant and is reasonably available, access and use of the surface water for irrigation will be used. The requirement is directed at applications for land use changes, such as from agricultural land to residential subdivisions.

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Flows regulated to Star

Average summer flows at Star vary, but 250 cfs is the target flow. Surface water in the Boise River or tributary to the Boise River upstream from Star is considered fully appropriated during the irrigation season and during much of the rest of the year. In 1995, the Director, IDWR, issued a moratorium order stating that new applications for water would be denied unless it included an acceptable plan to mitigate or avoid injury to existing water rights. The order also describes an area in which applications for ground water shallower than 200 feet below surface would not be processed unless certain conditions applied, such as if they include mitigation measures, and can show no adverse impacts to existing water rights.

Downstream from Star, surface water (as well as ground water) is available for new appropriation, but the actual amount will vary from year to year and season to season.

Salmon Flow Augmentation

The Bureau of Reclamation holds 40,932 acre-feet of storage space in Lucky Peak Reservoir to be used for downstream salmon flow augmentation. This is a component of the (up to) 427,000 acre-feet of storage water that Reclamation delivers down the Snake River every year for salmon flow augmentation, consistent with the Nez Perce term sheet and Idaho Code 42-1763B. If replacement water supplies could be found in another basin (consistent with the Nez Perce term sheet) and delivered for salmon flow augmentation, this 40,932 AF in Lucky Peak could potentially be made available to help meet future water needs in the Treasure Valley.

Water Supply Bank and Rental Pool

The Idaho Water Supply Bank was legislatively recognized in 1979 (Section 42-1761, *Idaho Code*) and is operated under the authority of the Idaho Water Resource Board (Board). The state program includes two distinct programs, **Rental Pools** and the **Water Supply Bank**, which are both essentially water exchange markets intended to assist in the marketing of natural flow and water stored in Idaho reservoirs. They also provide a mechanism by which water rights and stored water that is not being used can be made available for use by others through a lease and rental process.

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Water Supply Bank

The Water Supply Bank (Bank) includes water rights from surface water and ground water sources throughout Idaho. Water rights may be leased to the Bank (e.g. deposited), if not currently in use, and then rented from the Bank (e.g. withdrawn) by another water user for beneficial uses such as commercial, industrial, irrigation, or mining. In addition, water rights leased to the Bank are protected from forfeiture. Applications to lease and rent water from the Bank are currently received and processed by the IDWR.

The Boise River drainage had the most activity in the state in 2010 for leasing water rights into the Bank, but only 9% of these rights were rented back out for actual use (2010 Water Supply Bank Annual Report, IDWR).

Water District #63 Rental Pool

Water District #63 Rental Pool is a mechanism for reservoir spaceholders to make stored water available to other entities in short supply in a given year. The Rental Pool also provides a source of revenue for Water Districts #63 to make improvements in water distribution while encouraging the maximum beneficial use of stored water.

Water District #63 Rental Pool is under the jurisdiction of and operated by the local committee appointed by the IWRB. The Local Committee develops the rules of procedure, lease pricing and operation requirements for their rental pool which then must be approved by the Idaho Water Resource Board. Reclamation must also approve the rules and rates for Federal storage as a facility owner. A Watermaster administers the rental pool under the guidance of the committee.

The Water District #63 rental pool has rented an average of 6,236 AF over the past 8 years, excluding Reclamation-held uncontracted space. Use of the Boise Rental Pool appears to be low compared with the other rental pools despite the rapid growth of DCMI uses in the basin.

Ground water rights not currently administered

The administration of water rights generally refers to the curtailment of junior water rights to satisfy senior water right. Water rights are administered by a Watermaster appointed by the IDWR. In order to administer water rights, they must be legal quantified through adjudication

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or other administrative action, such as a license. In the Treasure Valley, only surface water rights are currently administered by the Watermaster because ground water rights have not been judicially quantified. Following the completion of the SRBA, it is expected that groundwater rights may be included in a water district and conjunctively administered in priority. Conjunctive administration is the term used to describe administration of both ground and surface water under a common system. Administration of ground water rights or the implementation of conjunctive administration in the Treasure Valley is not currently underway.

The legislature adopted the “Ground Water District Act” in 1995 to create a mechanism to allow groundwater users to organize to formulate and implement mitigation plans to provide protection for senior surface water rights that otherwise would be materially injured by groundwater pumping. The groundwater users in the Treasure Valley to date have not elected to form such a district.

Administrative Designations

Although water levels are generally stable throughout the valley, local areas of concern exist that have resulted in the formation of ground water management areas or moratorium areas. There are currently three of these areas within the Treasure Valley study area (Figure 3). The reasons for the designation of each area varies, based on fully appropriated water resources, declining water levels, or to further protect a limited water resource. The current areas include: the Star Bridge Moratorium, a moratorium on non-municipal water rights for ground water that is less than 200 feet deep in order to protect against depletions of the fully allocated Boise River upstream from Star; the Southeast Boise Ground Water Management Area, designated in response to significant water level declines; and the Boise Front Geothermal Management Area, designated to protect the geothermal aquifer system. To the southeast of the study area are the Mountain Home Ground Water Management Area and the Cinder Cone Butte Critical Ground Water Management Area; both were designated in response to declining water levels.

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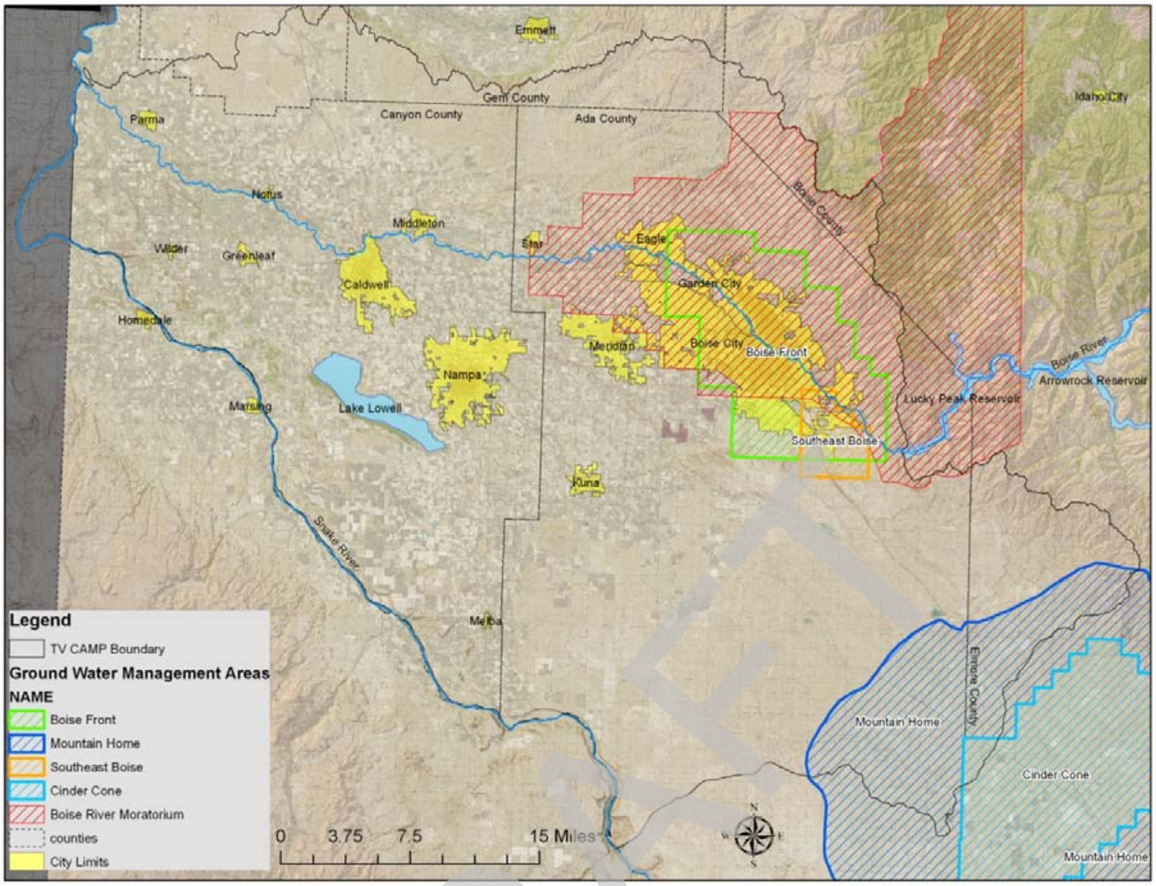

Figure 3. Map of Ground Water Management areas in the vicinity of the Treasure Valley study area.

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CHALLENGES:

The lack of organizational structure for ground water users to collectively plan for and respond to future challenges

Solutions to meeting long-term water needs and avoiding conflict may require action beyond single individuals. Long term successful solutions may require cooperative/collaborative efforts within and among ground water users who share a common interest.

Advanced technical capabilities are needed to meet increasingly complex water management challenges

Although we understand a great deal about the regional hydrology, our information does not provide a full understanding of the localized interaction between ground and surface water, and between the shallow aquifer and deep aquifer. Knowledge is not sufficient to fully characterize the hydrologic system which results in difficulty predicting system responses to management actions. Historical hydrological records may not be sufficient for forecasting future conditions. Existing ground-water models do not incorporate newer information or forecasts.

Existing water Management tools that appear to be under-utilized could help provide solutions to meeting water needs in the future

Several water management tools exist that could be utilized to help meet future water needs, but currently appear to be under-utilized. The Boise River (Water District 63) Rental Pool, which facilitates marketing of reservoir storage water, has a lower level of activity when compared with the Payette and Upper Snake Rental Pools, despite the Treasure Valley having rapidly growing DCMI water needs. The Water Supply Bank, which facilitates marketing of natural flow and ground water rights, shows that in the Treasure Valley there is considerable activity to lease water rights into the Bank, but little demand to rent water rights out of the Bank, again, with the Treasure Valley having rapidly growing DCMI water needs. Another tool is the Municipal Water Rights Act of 1996 which provides for growing municipalities to acquire water rights based on future growth projections. However due to lack of a defined process and defined criteria, both IDWR and municipal water users have been somewhat unsure with how to proceed, resulting in under-utilization of this statute.

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ACTIONS NEEDED

Guided by the CAMP goals and this vision, the Advisory Committee identified several recommended actions for addressing the challenges discussed in previous section of this plan (see section 3). Understandably, these actions will need to be more fully refined during the implementation phase, but the plan by adopting a mix of strategies represents a balanced approach to addressing the future water challenges in the Treasure Valley. These actions have not been ranked or placed in order of priority.

Enhance Water Planning and Management to maximize economic, environmental, monetary and non-monetary benefits to Idaho

Water planning and management tools, developed and updated using accurate data and current interpretations of the hydrology and estimates of water use of the Valley are needed to reduce uncertainty, effectively and efficiently use the water resources of the Idaho, and better manage the resource.

Successful water management protects the public health and safety, avoids conflicts, and promotes the economic and environmental health of Idaho.

The following should be accomplished:

- Improve ground water models and technical tools to meet administrative purpose and to facilitate decision making.
- Support water supply modeling and stream flow monitoring
- Measure water usage changes, reporting demand trends to IWRB
- Support drought planning to increase the resiliency of the water supply specific to the Boise drainage
- Create a mechanism for coordination within the ground water community (e.g. creation of ground water district, or a hybrid ground water district incorporating all users including self-supplied domestic)
- Continue to increase transparency of planning process
- Organize a periodic Water Forum ("Water Summit") to assess the state of the aquifer and discuss emerging issues and opportunities.

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Additional storage and supply

Additional storage or other sources of water supply may be needed in the future to offset the increased variability of water supply and additional water demand. Due to the complexity and extended lead time required for initiating storage and water supply projects, study of these projects should be continual to ensure the information is available when decisions need to be made.

- Continue the study of the feasibility of potential surface water storage projects in a manner that comprehensively addresses supply options and avoids conflict.
- Investigate the feasibility of utilizing managed recharge for meeting future water demands.
- Support the exchange of Reclamation's flow augmentation space in Lucky Peak (excluding stream flow maintenance) with replacement water supply consistent with the Nez Perce term sheet.
- Evaluate augmentation of existing cloud seeding programs as an option for increasing supply.

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Reducing Demand through Water Conservation

Reducing demand should be adopted as one of the strategies for meeting future water needs in the Treasure Valley. The capital costs of new supply may be reduced/delayed through the reduction of per capita demand. Addressing these issues is a multi-jurisdictional responsibility; therefore the Department should work in cooperation with water users and water providers to collaboratively develop incentives to reduce demand.

- Use education to encourage conservation
- Encourage conservation and efficient use of groundwater in all cases.
- Encourage conservation and efficient use of surface water, where a viable/sensible opportunity exists, taking into consideration the benefits of incidental recharge.
- Support efforts for retrofitting neighborhoods with pressurized irrigation
- Encourage and support wastewater/gray water reuse
- Encourage or support incentives for conservation
- Develop guidelines for conservation programs
- Consider conservation requirements for new water appropriations

Conversion of Water Use from Agriculture to DCMI

Urbanization has changed some water demand from agricultural irrigation to residential irrigation. This trend is expected to continue into the future as additional growth occurs. The intent is to ensure irrigation water is available for residential use and irrigation entities continue to have a financial basis/protection of infrastructure. This is also beneficial because it reduces the amount of water that municipal water systems need to provide if domestic irrigation is provided through the canal systems.

The following actions should be undertaken to ensure orderly transition of water use from agriculture to DCMI:

- Continue to support the use of surface water on those lands that convert from agriculture to DCMI utilizing the existing irrigation entities.
- Support voluntary cooperative arrangements between irrigation entities and municipal providers to deliver surface water recognizing the long-term challenges associated with maintaining HOA-owned systems.
- Encourage the use of Water Marketing to meet new DCMI needs including the use of rental pool and water supply bank

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Municipal Water Rights Act of 1996 (Two Choices)

The Municipal Water Rights Act of 1996 is a tool available to municipal water providers to secure water rights for growing municipal water demands based on anticipated future needs. The Act sets out a process through which municipal water providers can apply for and perfect water rights which may be needed over a longer time period than traditionally used for perfecting water rights.

The tool has been under-utilized by municipal water providers because of uncertainty in the implementation of the Act. We recommend that an assessment be undertaken to identify how the Municipal Water Rights Act of 1996 can be better utilized in the Treasure Valley.

Or

The Municipal Water Rights Act of 1996 is a tool available to municipal water providers to secure water rights for growing municipal water demands based on anticipated future needs. The Act sets out a process through which municipal water providers can apply for and perfect water rights which may be needed over a longer time period than traditionally used for perfecting water rights.

The Act is an essential tool to meeting the goals of the TV CAMP. It will enable better planning and create opportunities to avoid potential conflicts in advance. The challenge for the Treasure Valley municipal providers is that the Act as written provides vague guidance for implementation by the Department. The absence of specific guidance creates significant financial risk for municipal providers trying to utilize the tool. The TV CAMP recommends that IDWR or the legislature provide better guidance for implementation of the tool in order to reduce the risk to municipalities for the financial investment in data collection, planning and mitigation. For municipal providers, meeting this challenge is one of the most important priorities in meeting the goals of the TV CAMP.

Ensuring Viability of Water Delivery Infrastructure

The integrity of the delivery system is vital to the optimal use of water in the Treasure Valley. The following actions recognize specific components of the water delivery system which will ensure continued integrity into the future.

- Support voluntary arrangements between irrigation entities and municipalities to ensure long-term maintenance of new residential irrigation systems.
- Ensure easements/access to canals for maintenance in face of growth.
- Continue to support considerations of security, both in terms of infrastructure and on water quality.
- Support the rehabilitation and modernization of water delivery infrastructure.
- Explore opportunities to minimize fish entrainment in the canal systems.

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TV CAMP Implementation

Management of the Treasure Valley Aquifer affects numerous stakeholders. Effective implementation of the plan will require the participation and cooperation of stakeholders and governmental entities with jurisdictional authorities and responsibilities.

Board Staff will provide leadership and coordinate activities for the implementation of this plan.

The Board may continue to convene the Advisory Committee to guide and make recommendations concerning the implementation of management strategies and review of goals and objectives. The Advisory Committee could provide a forum for discussing implementation, establishing benchmarks for evaluating the effectiveness of actions, coordinating with water users and managers, evaluating and addressing environmental issues and identifying and pursuing funding opportunities.

The Advisory Committee will continue to include interest groups currently represented, and may expand or contract as appropriate to include other interested people, per the Board's direction. In addition, the Board will appoint at least one of its members to serve as a liaison between the Committee and the Board. The Advisory Committee will serve at the pleasure of the Board and provide a forum for public participation. Board staff will facilitate the work of the Advisory Committee and provide the technical information needed for its deliberations. The Board will make all final decisions concerning Plan project priorities, implementation, and funding.

As various programs are implemented, additional monitoring or modifications will likely be needed. Specific projects may require site specific measurement and analysis which are not currently available. Additional analysis will likely be required to assist the Board and the Advisory Committee.

Outreach and Education

During implementation of the Treasure Valley CAMP, the Advisory Committee will help develop a plan for broad water education and outreach, building on existing efforts and programs. Emphasis will be placed on education efforts that promote conservation and a reduction in consumptive use.

Funding

Implementation of the CAMP actions will be a partnership among the State, local and federal governments, stakeholders, water users and non-governmental organizations. The costs of implementation are anticipated to be shared among partners. As the implementation plan is

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developed, the funding needs for the plan components will be evaluated and potential funding sources, including federal grants will be identified.

The many existing activities for maintaining the health of the Treasure Valley Aquifer reflect the value and importance the aquifer and water resources have to the region. These existing activities are undertaken by a myriad of governments, agencies, and others. They activities are funded through various sources and through various programs. The Board supports existing program which protect and enhance the water resources of the area. Opportunities to combine resources and leverage existing programs with CAMP implementation will be encouraged and supported.

Adaptive Management

The goal of adaptive management is to support improved decision-making and performance of water management actions over time.

Key principles fundamental to this approach include:

1. Anticipating possible future uncertainties and contingencies during planning.
2. Employing science-based approached to build knowledge over time.
3. Designing projects that can be adapted to uncertain or changing future conditions.

Adaptive management involves taking actions, testing assumptions, and then monitoring and adapting/adjusting the management approach as necessary. It is a way of taking action in a complex system with many variables and constant change. Developing perfect knowledge concerning any system, including the Treasure Valley Aquifer, is impossible. Therefore, an adaptive management approach is critical to the successful attainment of the qualitative and quantitative goals set forth in the plan. Successful adaptive management requires patience and long term commitment, just as acquiring enough data to make decisions about program changes takes time.

The adaptive management strategy will allow the Board to:

- Develop protocols for revising management actions
- Compare costs and impacts of different actions on the Treasure Valley Aquifer.
- Adjust funding allocation between projects to get the most “bang for the buck.”
- Concentrate funding on management actions that produce results.
- Make adjustments and revisions to the plan as new information becomes available, or in response to changing water supply and demand needs.

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- Proceed with flexibility depending on results and analysis of monitoring and measurement data.

Coordination & Implementation

Management of the TVA affects numerous stakeholders within Idaho and requires coordination. The Advisory Committee will be charged with providing guidance and recommendations concerning the implementation of management strategies. The Advisory Committee will provide a forum for discussing implementation, establishing benchmarks for evaluating the effectiveness of actions, coordinating with water users and managers, evaluating and addressing environmental issues and identifying and pursuing funding opportunities.

Monitoring and Data Gathering

The Advisory Committee and Board staff will be able to assess the impacts of various management activities using data gathered through the monitoring process. In some cases, it may take a number of years to obtain sufficient data to achieve a comprehensive understanding of the effects of particular actions. Regardless, the success of the plan depends upon the development and maintenance of state-of-the-art monitoring and evaluation tools that provide the information necessary to make sound planning decisions for the future.

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Appendices

A. TV CAMP Advisory Committee Membership
B. Schematic Representation of TV Water Budget
C. References & Information Sources
D. Glossary or Acronyms & Key Terms
E. Others?

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