# DROUGHT CONTINGENCY PLAN

# for

# BELLA VISTA WATER DISTRICT

**2021**

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# Appendices

Appendix A – Communication and Outreach Plan

Appendix B - Frequently Asked Questions regarding Droughts and Water Restrictions

Appendix C – Water Shortage Contingency Plan

# List of Acronyms and Abbreviations

| | |
|---|---|
| ACID | Anderson-Cottonwood Irrigation District |
| AF | acre-feet |
| AFY | acre-feet/year |
| AMI | advanced metering infrastructure |
| BVWD | Bella Vista Water District |
| CDEC | California Data Exchange Center |
| CI | commercial and industrial |
| CVP | Central Valley Project |
| CY | calendar year |
| DCP | Drought Contingency Plan |
| DWR | Department of Water Resources |
| EDDI | Evaporative Demand Drought Index |
| FAQ | frequently asked questions |
| gpm | gallons per minute |
| M&I | municipal and industrial |
| MAF | million acre-feet |
| MG | million gallons |
| MSL | mean sea level |
| NIDIS | National Integrated Drought Information System |
| NOAA | National Oceanic and Atmospheric Administration |
| PHS | public health and safety |
| SCADA | supervisory control and data acquisition |
| SVI | Sacramento Valley Index |
| SWE | snow water equivalent |
| SWP | State Water Project |
| SWRCB | State Water Resources Control Board |
| TAF | thousand acre-feet |
| USBR or Reclamation | United States Bureau of Reclamation |
| USDM | US Drought Monitor |
| WC | water code |
| WSCP | Water Shortage Contingency Plan |
| WSP | Water Shortage Policy |
| WTP | water treatment plant |

# 1 Introduction

This chapter includes an overview of this Drought Contingency Plan, a description of the study area, background information on Bella Vista Water District, and a description of the different topics covered in this plan.

## 1.1 Report Overview

The Bella Vista Water District (BVWD) has significant water supply issues during droughts, primarily related to uncertainty in their Central Valley Project surface water supply. The District also lacks sufficient diversity in their water supplies. A recent multi-year drought resulted in unprecedented surface water cutbacks requiring extreme water conservation measures. These conditions have mobilized District staff to develop this long-term Drought Contingency Plan (DCP).

This plan includes an assessment of water supply shortages and vulnerabilities to the District, and discussions on policies and projects that can help reduce the impacts of drought. **Figure 1-1** illustrates a general process followed in this plan.


**Figure 1-1 – Drought Contingency Plan Flow Method**

As shown above, drought can be defined as a temporary, recurring, or emergency water shortage. This can be addressed with one or more strategies. Possible solutions include short-term or long-term actions, as well as demand management measures to conserve water supplies.

## 1.2 Study Area

The plan covers the entire service area of Bella Vista Water District. The District is located in western Shasta County (County). Approximately one-fifth of the District is located within the northeastern portion of the City of Redding and over half of the District's customer accounts are within the city limits of the City of Redding. The District encompasses approximately 34,360 acres (54 square miles). Refer to **Figure 1-2** for a vicinity map of the District.

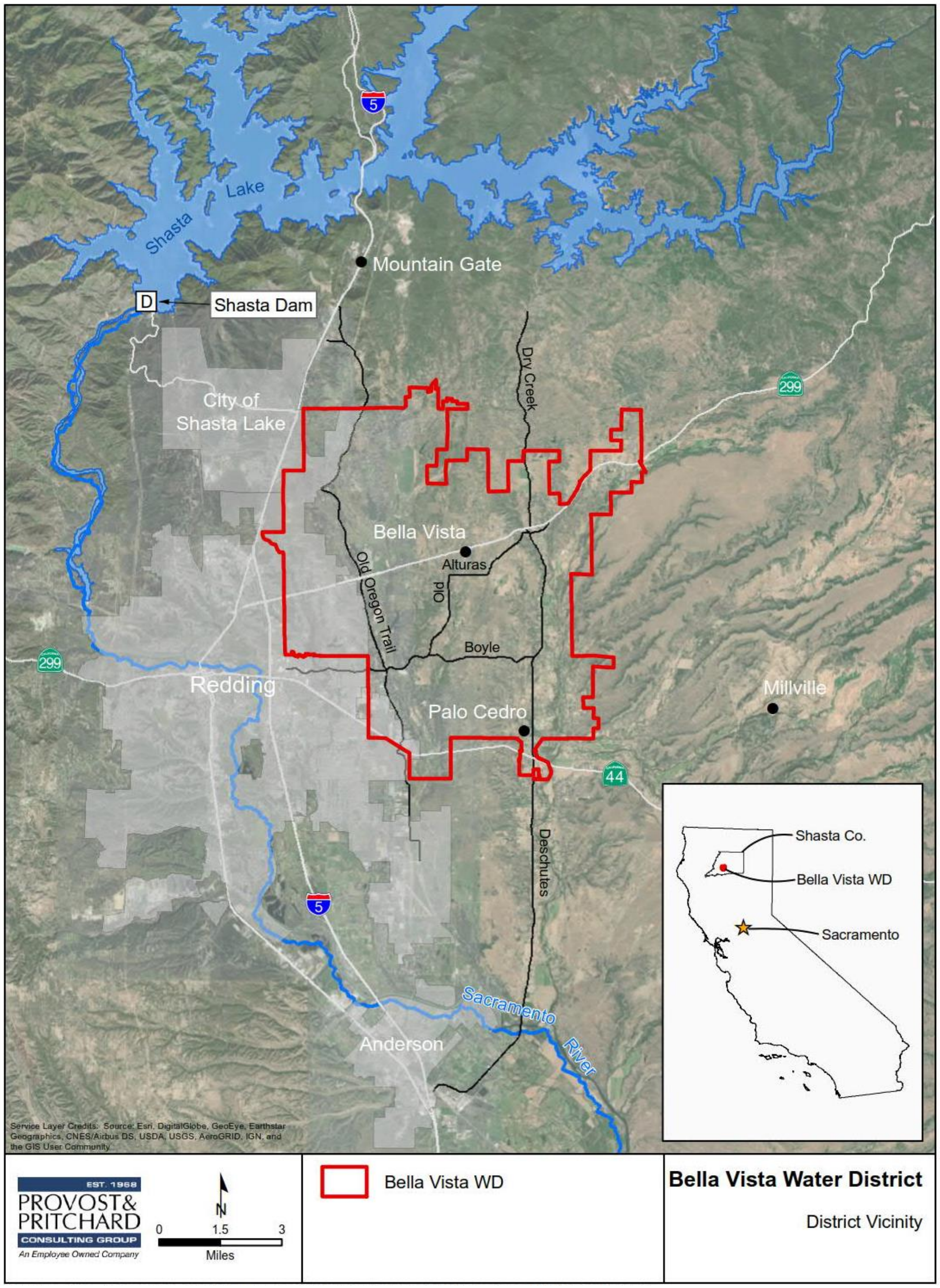



**Figure 1-2 – Bella Vista Water District**

## 1.3 Background Information on Bella Vista Water District

Bella Vista Water District (District or BVWD) was formed on June 4, 1957 to provide agricultural and domestic water to the area northeast of the City of Redding. BVWD is a California Water District pursuant to the California Water Code, operating under the governance of an elected Board of Directors. The District supplies agricultural, municipal, commercial, and public/institutional water, and operates the water treatment, storage, and a vast distribution system.

The District depends mostly on surface water from the Sacramento River. The Shasta Dam, on the Sacramento River near Redding, California, serves to control floodwaters and store surplus winter runoff for irrigation in the Sacramento and San Joaquin Valleys as well as for providing water for municipalities, the environment, and meeting water quality objectives. In 2005, the District entered into a long-term (25-year) renewal contract with the Reclamation (Contract No. 14-06-200-851A-LTR1) that authorizes the District to divert up to 24,578 AF from the Sacramento River supply via the Central Valley Project (CVP).

Bella Vista Water District is a retail agency, providing water directly to customers. In 2018 they served about 6,300 active residential, rural, commercial, institutional/public, and agricultural customers. The District serves water to agricultural customers used for growing irrigated pasture, hay, strawberries, grapes, fruit and nut trees, and vegetables.

The District's CVP supply is subject to shortages due to climate and environmental regulations. In addition, annual rainfall varies considerably from year to year and averages about 34 inches, of which approximately 80% occurs from November through April. This results in a prolonged dry season and heavy reliance on irrigation to meet demands.

California faced a severe drought from 2013 to 2016, during which the District's CVP allocations were reduced to as low as 0% for agriculture and 25% of Historical Use for urban uses. This created significant challenges for the District and its water users and was a strong impetus for developing this Drought Contingency Plan.

## 1.4 Elements of Drought Contingency Plan

This Drought Contingency Plan includes six different elements, or topics, which are shown in the figure below.


**Figure 1-3 - Drought Contingency Plan Elements**

Following is a description of each element found in this plan.

<u>Drought Monitoring Plan</u>
Drought information sources, indicators and indices were identified, catalogued and prioritized for future use. Drought triggers were also identified. Lastly, water shortage stages were revised and discussed.

<u>Vulnerability Assessment</u>
The vulnerability of the District's water supplies was discussed. Various resources (such as District finances, private property, etc.,) which are vulnerable to droughts were identified and prioritized. Existing studies on CVP water supply vulnerability and climate change were reviewed. The level of risk at different stages of drought were identified. Lastly, the economic impacts to the vulnerable resources were quantified.

<u>Mitigation Actions</u>
Existing mitigation actions were assessed, including their current capacity for mitigating drought. A mitigation goal in acre-feet/year of new water yield was established, based on past and estimated future water shortages. A variety of new mitigation actions were identified, prioritized, and evaluated at a conceptual level.

<u>Response Actions</u>
The District's existing Water Shortage Contingency Plan was reviewed and updated based on its effectiveness in past droughts, as well as comments from the Drought Task Force. A detailed

process for implementing response actions was documented.

Operational and Administrative Framework
The organizational structure used to respond to a drought was documented, reviewed, and updated. This included identifying roles and responsibilities, procedures for initiating, announcing, and implementing response actions, and listing drought response resources.

Plan Update Process
A process was developed for updating the DCP. This includes identifying triggers for updates (i.e. large drought, change in policies), as well as criteria for monitoring the effectiveness of the DCP's six elements.

# 2 Public Outreach

This section discusses public outreach performed as part of this Drought Contingency Plan. Topics discussed include the purpose of the outreach, the content of a Communication and Outreach Plan, formation and involvement of a special Drought Task Force, and public outreach methods.

## 2.1 Purpose

Public outreach was performed to inform the general public and important stakeholders on the content of the Drought Contingency Plan and solicit their input. Another important component was to educate stakeholders on the water supply and potential drought conditions within BVWD. Most stakeholders are unaware of either the complexity of BVWD's water supply issues, or the severity of water supply reductions during droughts.

The key messages of the outreach efforts included:

- What is the Drought Contingency Plan?
- What is the Role of BVWD and the Drought Task Force?
- Purpose of the Drought Contingency Plan within BVWD
- How is the BVWD impacted by droughts

## 2.2 Communication and Outreach Plan

A Communication and Outreach Plan (Outreach Plan) was developed prior to the development of this DCP (see **Appendix A**). The Outreach Plan summarizes the strategy for engaging, educating, and soliciting input from stakeholders. Topics covered in the Outreach Plan include:

- Overview of District and Drought Contingency Plan
- Communication goals
- Stakeholder identification
- Messages and talking points
- Outreach materials

## 2.3 Drought Task Force

A Drought Task Force (Task Force) was developed to include a diverse group of stakeholders within the BVWD boundary. The purpose of the Task Force was to educate stakeholders, identify District issues, provide new ideas, and critique existing policies. Task Force members were initially contacted by BVWD staff to identify those who were interested in becoming a part of the effort, as this group was an integral part of developing the DCP.

Task Force members who were contacted by staff and expressed interest in participating are listed in the Outreach Plan (**Appendix A**). These members represent a comprehensive spectrum of agriculture, rural and residential stakeholders.

The Task Force members attended two workshops: one in the beginning to educate them on the scope of work and water supply issues in the District, and one towards the end of the project to provide comments on the Draft DCP. The Task Force members also provided comments on each individual draft chapter as they were prepared.

## 2.4 Public Outreach Methods

The outreach methods used with the general public included the following:

- Discussion of DCP at Board of Directors meetings
- Development of a List of Frequently Asked Questions (FAQs) regarding Droughts and Water Restrictions (**Appendix B**)
- District newsletter articles
- Website postings
- Press release

More information on these can be found in the Outreach Plan (**Appendix A**).

# 3 Drought Monitoring Plan

## 3.1 Introduction

The section describes a Drought Monitoring Plan that includes a process for collecting, analyzing, and disseminating drought-related data. The data will be used to help predict the likelihood of an upcoming drought. The preliminary goal for developing a Drought Monitoring Plan is to initialize a process for researching and prioritizing data relevant to enhancing the District's ability to predict and prepare for periods of drought and water scarcity. In order to be proactive and sufficiently prepared for potential water shortages, the District will need to continually monitor for conditions that may cause reductions in water supply.

The District's primary water supply is its water service contract with the United States Bureau of Reclamation (Reclamation) or Federal Water Supply. The water made available by Reclamation's Central Valley Project (CVP) can vary greatly from year to year, due to limited water storage capacity, instream flow requirements, and recent increases in carryover storage goals to maximize the cold-water pool in Shasta Lake for the next year. Therefore, the District must stay abreast of numerous factors that can impact CVP deliveries and how this directly impacts shortage vulnerability. The District's water supplies are also subject to shortages due to regulatory actions, including the Trinity Record of Decision (requiring greater releases in wetter years), the Bay-Delta Water Quality Control Plan with the potential for required unimpaired flows, etc. These can cause a 'regulatory drought,' or in other words, a water shortage caused by regulatory policies and actions rather than hydrologic conditions. Current regulations have essentially created a perpetual water shortage for many agencies, with shortages occurring even in years with above normal precipitation. Chapter 4 – Vulnerability Assessment includes a more detailed discussion on the vulnerability of the District's water supplies due to drought and regulatory actions.

The following is discussed below:

1. Existing drought indicators and indices
2. Prioritization of the data sources
3. Drought triggers for Bella Vista Water District
4. Refined water shortage stages
5. Dissemination of drought monitoring information

## 3.2 Drought Indicators and Indices

Reclamation typically provides its initial water-allocation forecast in mid-February for the water year starting March 1. However, there are several indicators or indices that the District can monitor that will give them a general idea of the allocation that they can expect under its CVP water service contract. It should be noted that, in addition to the typical hydrological factors that affect water supplies, other factors, such as fishery and Delta salinity conditions, limit the water supplies available to CVP contractors.

Many sources of indicator data and indices are readily available and useful for determining water supply conditions and evaluating the District's vulnerability to shortages. These include various data sets from the National Oceanic and Atmospheric Administration (NOAA), the California Department of Water Resources (DWR), and Reclamation, as well as groundwater level data from District wells. The various indicators are categorized as high priority indicators and low priority indicators in **Table 3-1.** Each indicator maintains an associated trigger that identifies when specific parameters have been met. These sources of data and indices are described in greater detail in the following sections.

**Table 3-1 – High and Medium Priority Indicators**

| High Priority Indicators/Indices | Low Priority Indicators/Indices |
|---|---|
| Lake Shasta Reservoir Storage | US Drought Monitor (USDM) |
| Northern Sierra Precipitation and Snowpack | Evaporative Demand Drought Index (EDDI) |
| Sacramento Valley Index | National Integrated Drought Information System (NIDIS) |
| Unimpaired Inflow into Lake Shasta | |

### 3.2.1 Lake Shasta Reservoir Storage

Under its water service contract with Reclamation, the District diverts surface water from the Sacramento River at its Wintu Pump Station into the Bella Vista service area. The primary source of this water is Shasta Dam, which is just northwest of Highway 151 and the town of Shasta Lake. Additional surface water supply is diverted from Trinity Lake via Whiskeytown Lake and the Spring Creek Powerhouse which flows into the Sacramento River above Keswick Dam approximately five river miles above the District's intake. The water stored behind Shasta Dam represents about 41% of the stored water throughout the entire CVP. This stored CVP water is used for irrigation, municipal and industrial (M&I) needs, and salinity control for the Sacramento-San Joaquin River Delta, as well as to meet various environmental needs.

The average water storage in Shasta Lake at the beginning of the water year (October 1) has been approximately 2,750,000 acre-feet (**Figure 3-1**). Typically, a decline in storage can be seen until sometime in late November to early December when runoff from fall and winter rains start reaching the reservoir, and such runoff eventually exceeds releases from the dam. Reservoir storage continues to increase until early May or June when releases to meet irrigation, M&I, and environmental demands exceed inflows into the lake. On average, storage in Lake Shasta tops out at just under 4 million-acre feet.

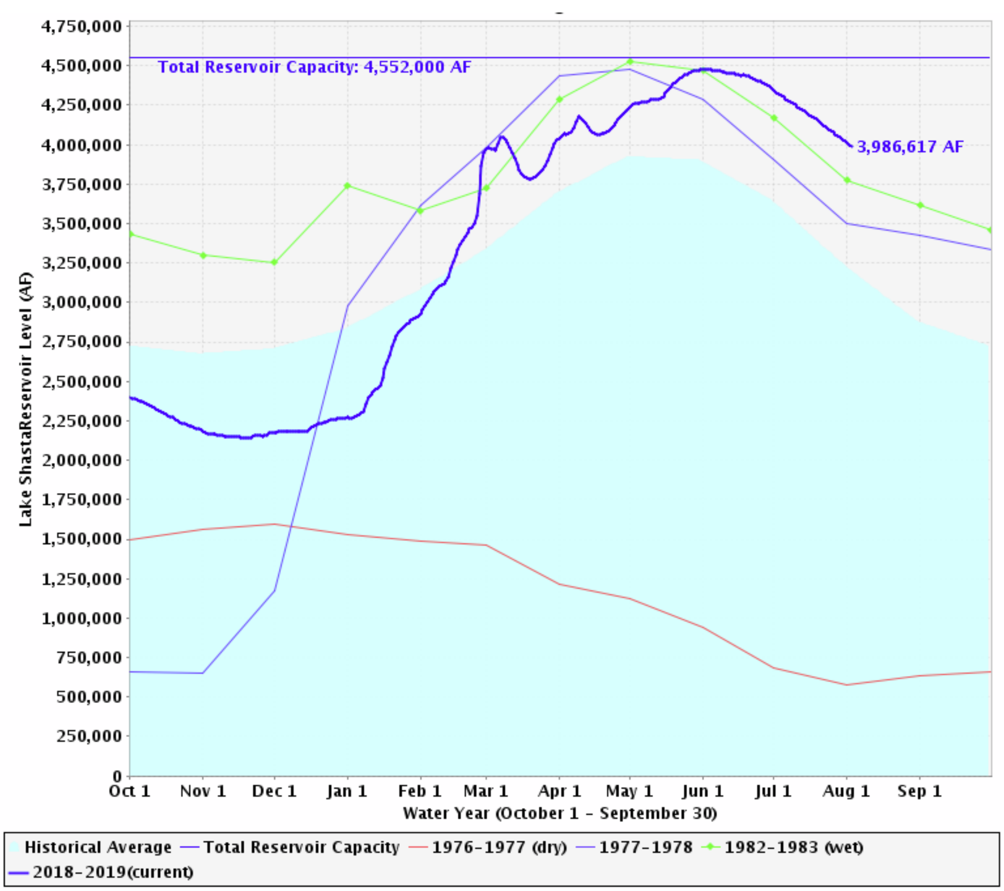



**Figure 3-1 – Lake Shasta Storage Levels for the Sacramento River Index – Wet, Dry and Average Years (California DWR, 2019)**

As can be seen from **Figure 3-1** and **Figure 3-2,** one wet year can considerably affect water levels, taking the lake from extremely low to full or nearly full. However, the timing of rain events during the water year is a major factor in whether or not the lake refills completely. This is due in part, to flood control considerations. Starting on October 1st of every year, a portion of the lake's storage capacity is reserved for flood control purposes. This volume is called "conservation storage" and is determined by the Army Corps of Engineers. This amount increases daily until December 22 when it reaches a maximum of 1.3 million-acre feet. If runoff into the lake causes storage to exceed the calculated "Top of Conservation Storage," releases are then increased until the required flood control storage is restored. It is not until approximately the middle of May that the amount of conservation storage is reduced to zero. The effects of the conservation storage requirements are evident in the storage levels shown in **Figure 3-1** (above) for the 2018-19 water year and in **Figure 3-2** (below) for the 2016-17 water year. The sudden downturns in water storage seen in both March and April of 2019 (in **Figure 3-1,** above)**,** as well as in every month from January 2017 through May 2017 (as can be seen in **Figure 3-2**) were caused by increased releases, in order to return the storage in Lake Shasta to below the "Top of Conservation Storage."

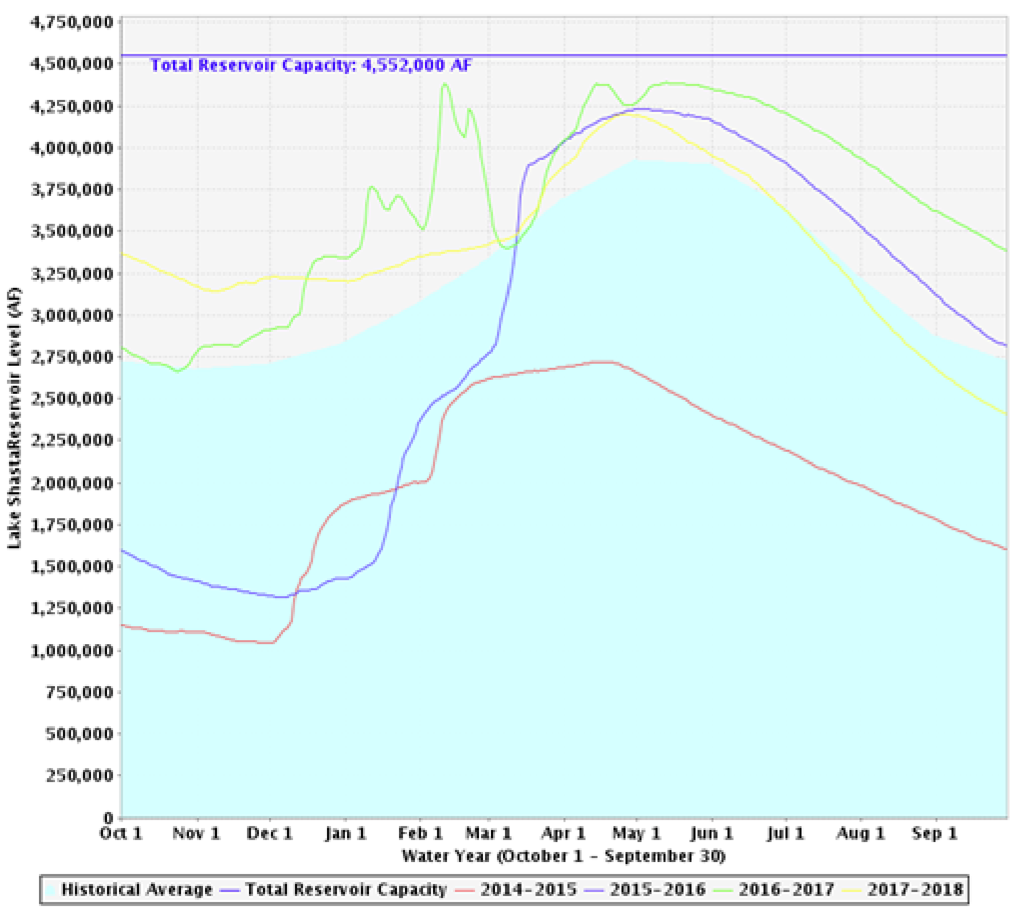



**Figure 3-2 – Lake Shasta Storage Levels for Sacramento River Index – Recent Years (California DWR, 2019)**

Due to its heavy reliance on CVP water deliveries, the District has been monitoring water storage levels in Shasta Lake since the early 1990s. The District will continue to monitor storage in Shasta Lake as a high priority indicator of water supply conditions, as described in the Drought Triggers section at the end of this chapter below.

Since the Central Valley Project is operated as an "integrated" project, meaning that Reclamation considers all of its water resources before making decisions regarding releases and allocations, the District must be cognizant of storage in all of Reclamation's reservoirs. The graphic below, from the California Data Exchange Center (CDEC), shows water storage in all major CVP and State Water Project (SWP) reservoirs and is updated at midnight each day. It provides a good overview of water supply conditions throughout the state which may impact decisions by DWR and Reclamation that could influence water allocations. The District has been monitoring this interactive graphic via CDEC since 2005 and will continue to do so as a part of this plan.

Water stored in the CVP and SWP is a good indicator of the amount of water that will be available for future M&I and agricultural usage throughout the state. Having ample water storage at the end of the water year (September 30) provides some expectation that with near normal precipitation water allocations will be sufficient to meet normal demands. Correspondingly, low water storage at the end of the water year without fall and early winter precipitation portends reduced water allocations.

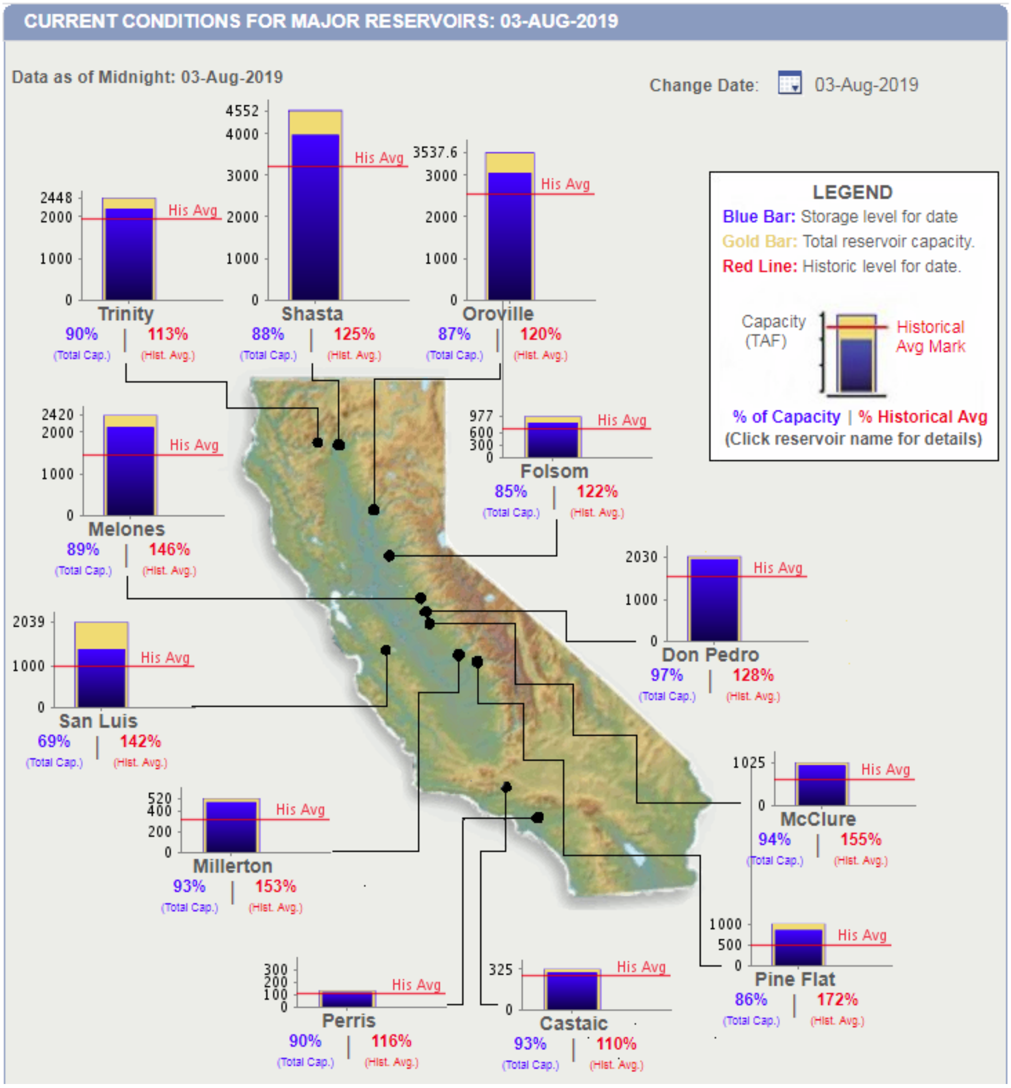



**Figure 3-3 – Current Conditions for Major Reservoirs 03-August-2019 (California DWR, 2019).**

### 3.2.2 Northern Sierra Precipitation and Snowpack

The California Department of Water Resources maintains numerous automatic monitoring stations, located throughout northern CA, that monitor precipitation in the form of both rain and snow. This data for the last seven years in the Northern Sierra region is summarized in the "8-Station Index" shown in Figure 3-4.

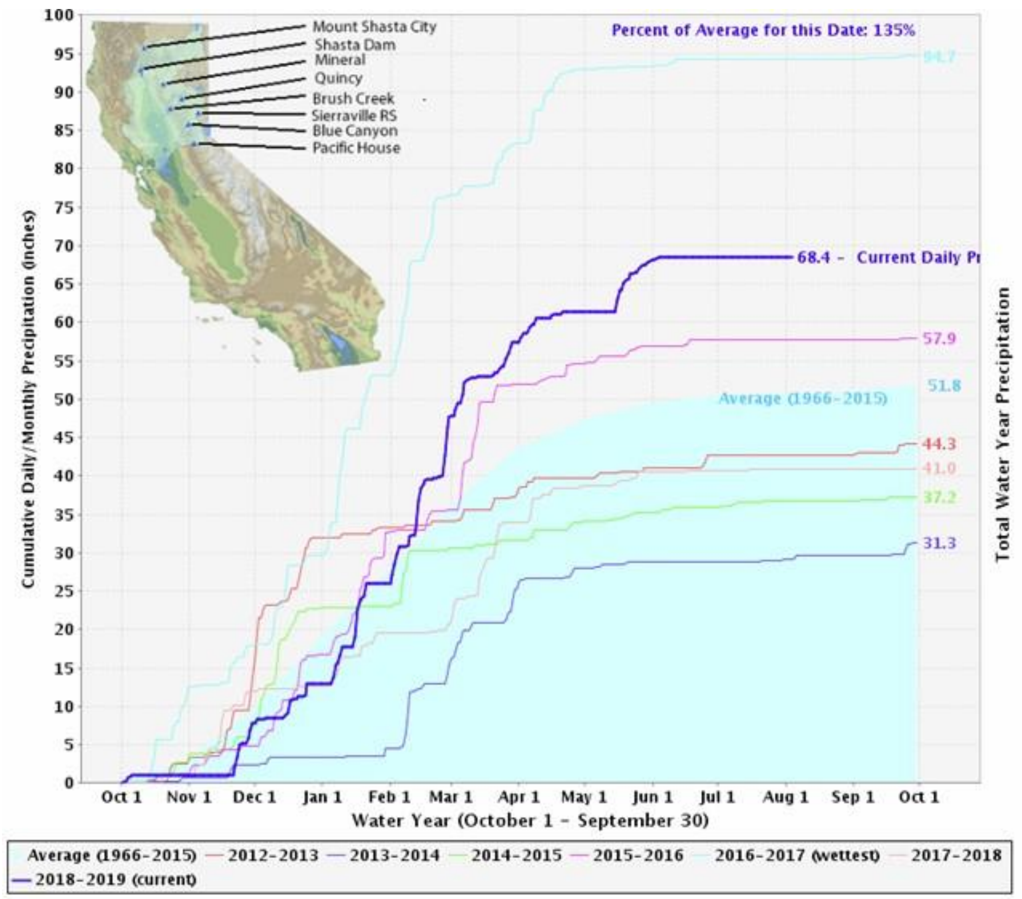



**Figure 3-4 – Northern Sierra Precipitations: 8-Station Index – Recent Data**

Additionally, more historical data is represented in Figure 3 5 which includes the 1976-77 (driest year), as well as the 1982-83 and 1997-98 (wettest) years.

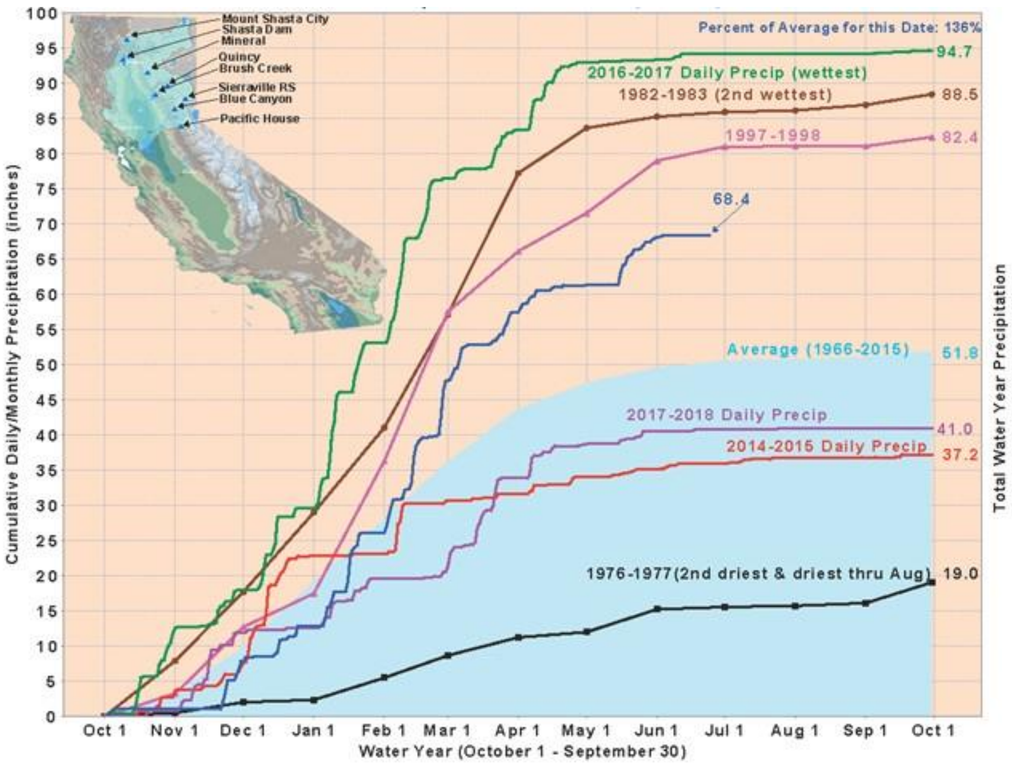



**Figure 3-5 – Northern Sierra Precipitation:8-Station Index – Historical Highs and Lows** (California DWR, 2019)

The Sierra Nevada snowpack is the primary source of both spring and summer runoff for much of the state. In years with lower snow water content, more water must be withdrawn from storage to meet the region's water demands. Successive low snow water content years are a key indicator of drought conditions. In order to forecast anticipated spring and summer runoff, the State Department of Water Resources performs monthly snow surveys and has numerous automatic monitoring stations throughout the state. These results are typically reported as a percent of the April 1 average visible in the Figure 3-6 below.

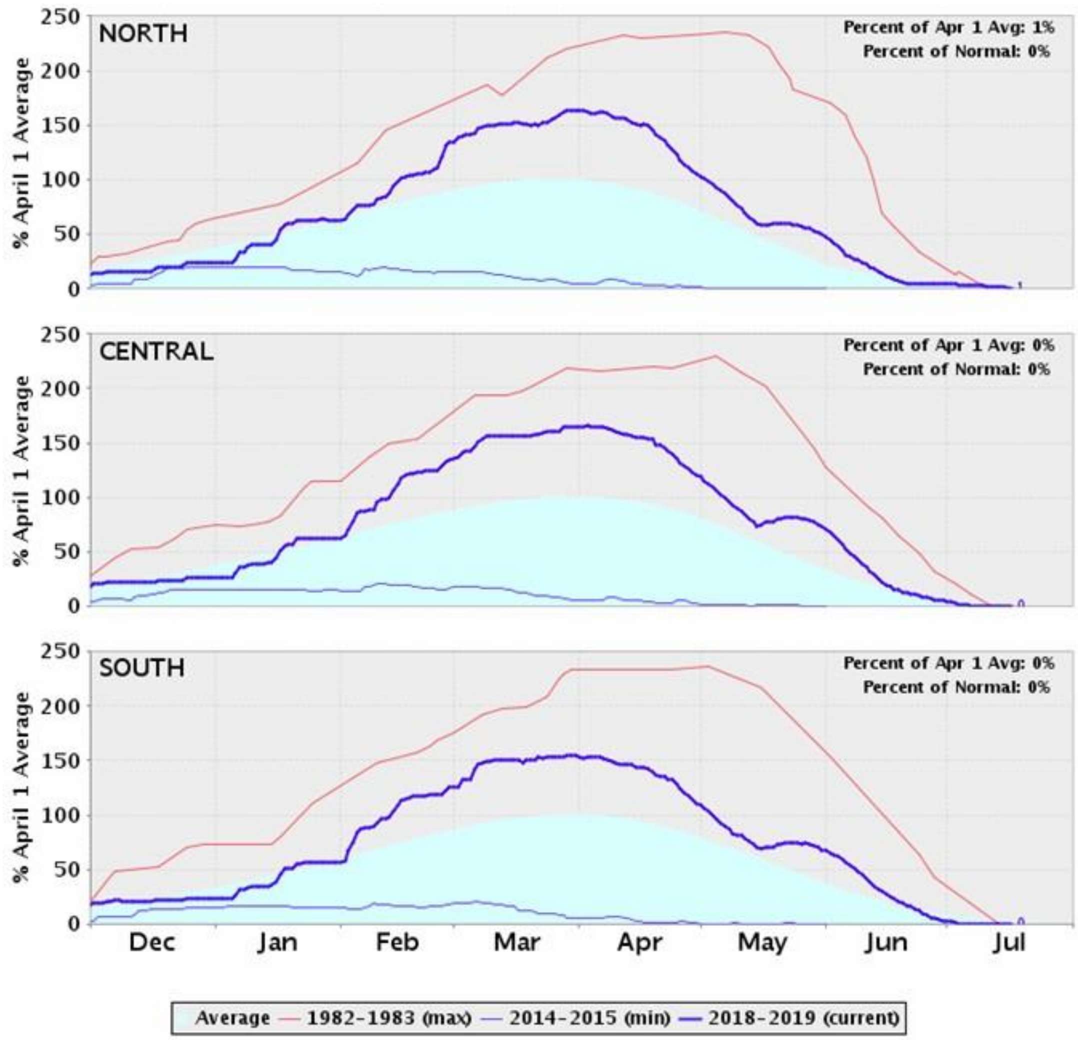



Figure 3-6 contains graphs for the “North,” “Central,” and “South” regions of the Sierra Nevada for the maximum (1982-83), minimum (2014-15), average, and 2018-2019 water years.

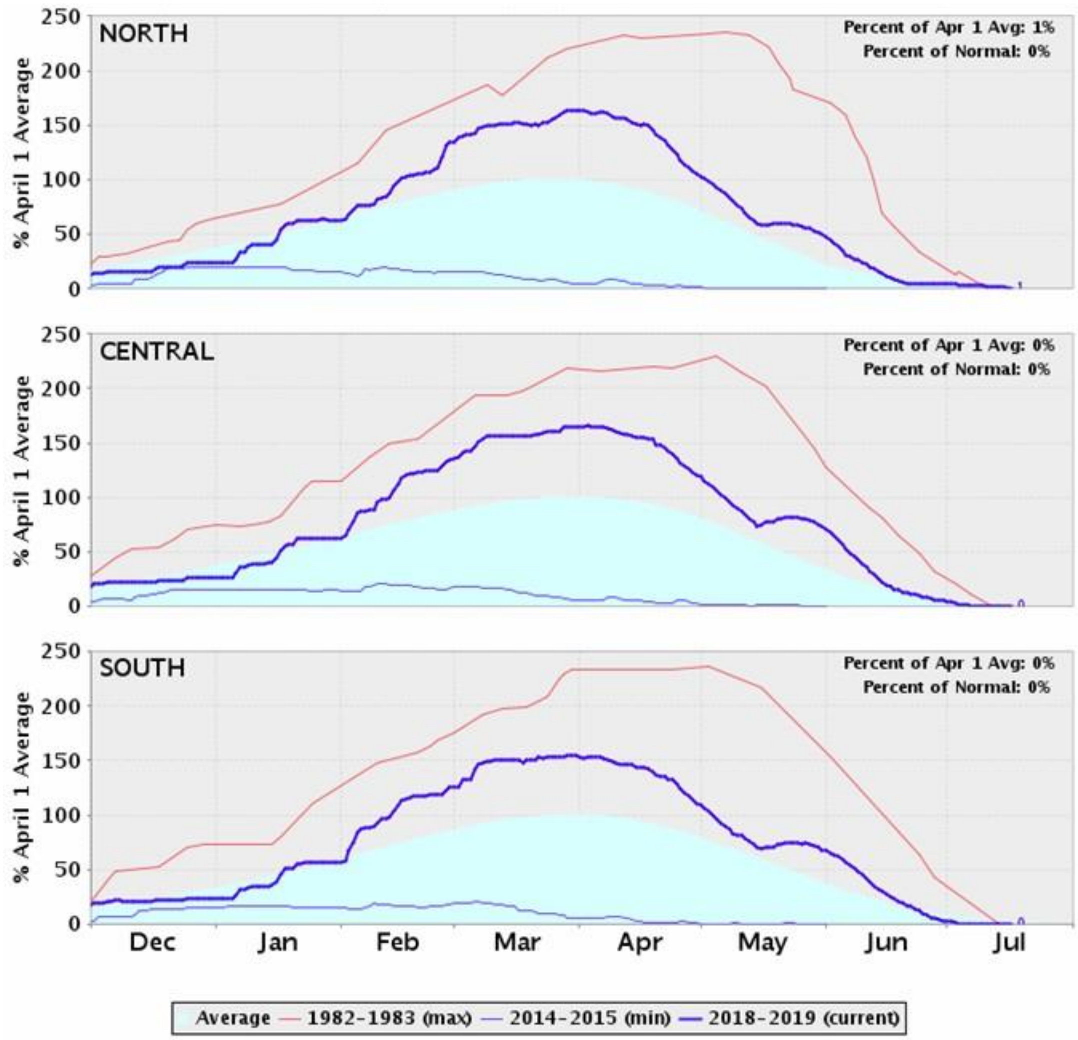



**Figure 3-6 – California Snow Water Content: Percent of April 1 Avg for 2019** (California DWR, 2019)

### 3.2.3 Sacramento Valley Index

The Sacramento Valley Water Year Index (Sacramento Valley Index/SVI) is the sum of the unimpaired flow in million acre-feet at the following locations:

(1) Sacramento River above Bend Bridge (just north of Red Bluff)
(2) Feather River at Oroville (a.k.a. inflow to Lake Oroville)
(3) Yuba River near Smartville (approximately 20 miles ENE of Yuba City)
(4) American River below Folsom Lake

Unimpaired runoff represents the natural water production of a river basin, unaltered by upstream diversions, storage, and export of water to or import of water from other basins. **Figure 3-7** shows the Sacramento Valley unimpaired runoff for the period of 1995 through 2018.

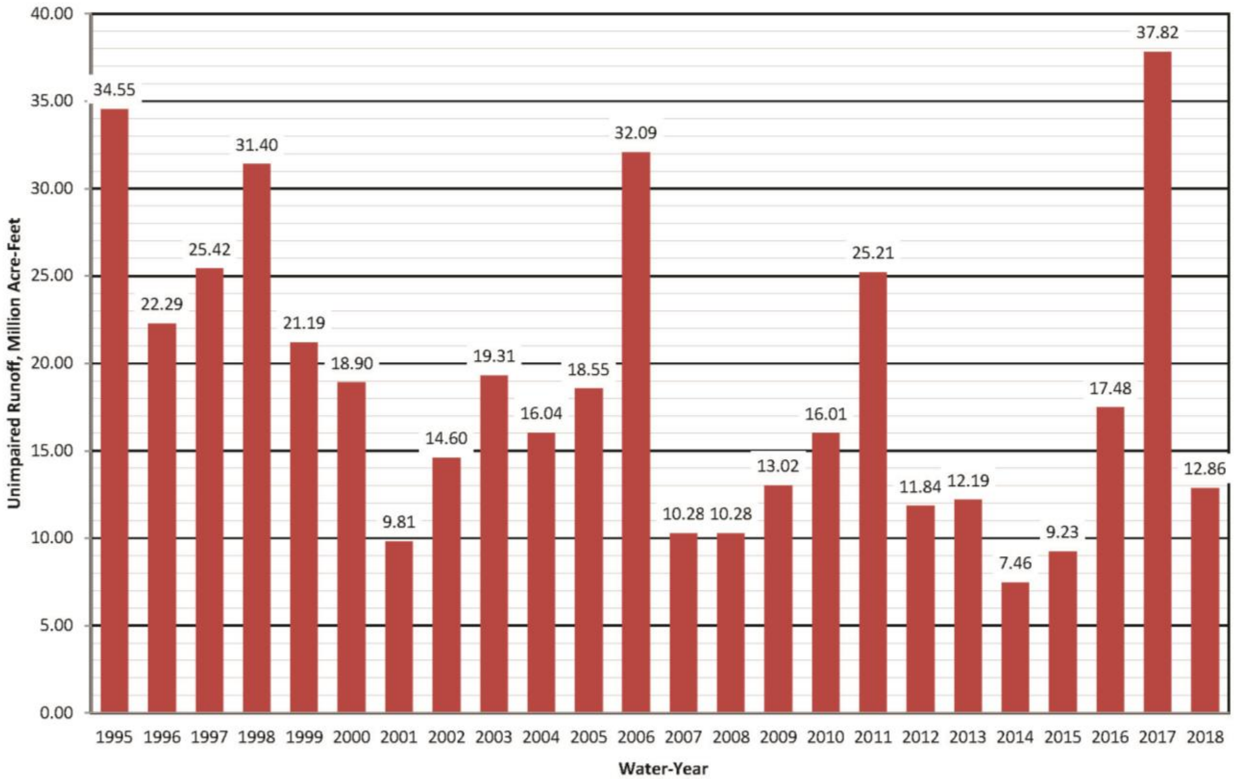



**Figure 3-7 – Sacramento Valley Unimpaired Runoff**

Water-year classification systems like the SVI provide a means to assess the amount of water originating in a basin. Because water-year classification systems are useful in water planning and management, they have been developed for several hydrologic basins throughout California. The Sacramento Valley 40-30-30 Index was developed by the State Water Resources Control Board (SWRCB) for the Sacramento River hydrologic basin as part of SWRCB's Bay-Delta regulatory activities. The index defines one "wet" year classification, two "normal" classifications (above and below normal), and two "dry" classifications (dry and critical), for a total of five water year types.

The Sacramento Valley Index = (0.4) x Current Apr-Jul unimpaired runoff forecast (in million acre-feet) + (0.3) x Current Oct-Mar unimpaired runoff (in million acre-feet) + (0.3) x Previous Water Year's Index (if the Previous Water Year's Index exceeds 10.0, then 10.0 is used). The values associated with each water year type are shown in **Table 3-2**.

### Table 3-2 – Sacramento Valley Index Water Year Classifications

| Sacramento Valley Water Year Type Classification<br>Index based on flow in million acre-feet: | |
|---|---|
| Wet | Equal to or greater than 9.2 |
| Above Normal | Greater than 7.8, and less than 9.2 |
| Below Normal | Greater than 6.5, and equal to or less than 7.8 |
| Dry | Greater than 5.4, and equal to or less than 6.5 |
| Critical | Equal to or less than 5.4 |

This index, originally specified in the 1995 SWRCB Water Quality Control Plan, is used to determine the Sacramento Valley water year type as implemented in SWRCB D-1641. Year types are set by first of month forecasts beginning in February. The final determination is based on the May 1, 50 percent exceedance forecast. **Figure 3-8** includes the cumulative probability distributions of the Sacramento Valley 40-30-30 water year indices for three different periods: (a) full available historical period 1906-2016 (111 years), (b) the 82-year period used for CALSIM II operations modeling (1922-2003), and (c) the 16-year period used for most DSM2 water quality modeling (1976-1991). The D-1641 transitions between water year types are shown as horizontal black lines (SWRCB-21, page 188).

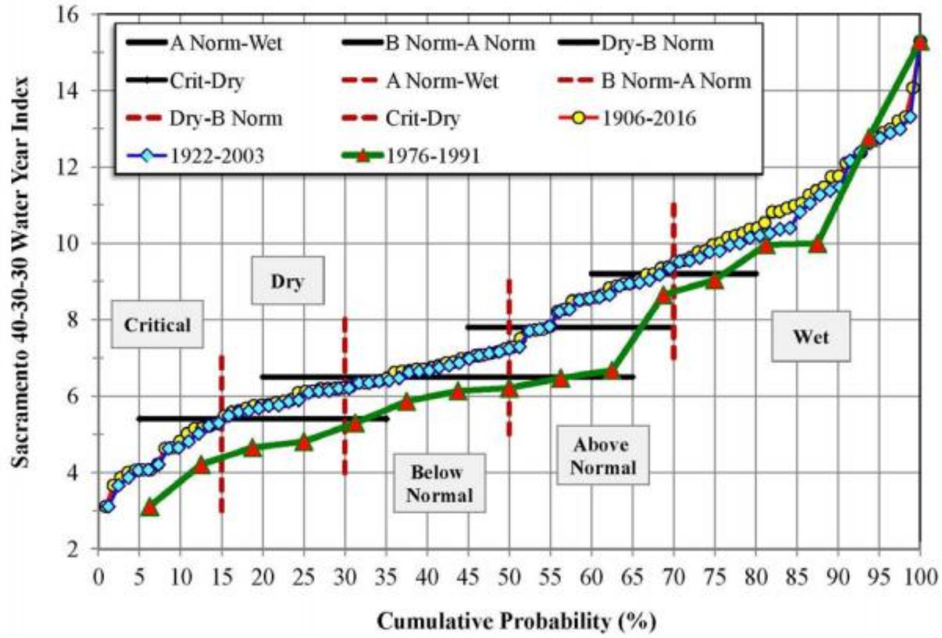



**Figure 3-8 – Sacramento Valley 40-30-30 Water Year Index** (California Department of Water Resources, 2019)

Although water allocations to the District under its CVP water service contract are not tied directly to this index, its value has a large impact on the allocation that the District can expect from the Reclamation. **Table 3-3** compares the Sacramento Valley Water year type to the final CVP Water Supply Allocations to M&I contractors north of the Delta for the years 1995 through 2018.

Although many factors and data sources are utilized by Reclamation in determining its CVP water supply allocations, Table 3-3 shows a good correlation between the Sacramento Valley Water Year Index and CVP allocations to the District from 1995 through 2018. Historically, when the index has been in "Wet," "Above Normal" and "below Normal" water year classifications the District has received a 100% allocation (the exceptions being 1995, 1997, and 1999 when the District received 100%/95%, 90%/100%, and 100%/95% allocations for Irrigation/M&I, respectively). When the index has been "Critical" the District has seen its CVP water allocation significantly reduced, as it was in 2008, 2014 and 2015. However, in the four "Dry" years during this same period the District received a full supply in two years and reduced allocations two of those years.

### Table 3-3 – Comparison of Sacramento Valley Water Year Type & CVP Allocation 1995-2018

| Water Year | Sac. Valley Unimpaired Runoff | Sac. Valley Water Year Index | Year Type Classification | Irrigation | Municipal & Industrial |
|---|---|---|---|---|---|
| 1995 | 34.55 | 12.4 | Wet | 100% | 95% |
| 1996 | 22.29 | 9.7 | Wet | 100% | 100% |
| 1997 | 25.42 | 11.0 | Wet | 90% | 100% |
| 1998 | 31.4 | 12.4 | Wet | 100% | 100% |
| 1999 | 21.19 | 10.0 | Wet | 100% | 95% |
| 2000 | 18.9 | 9.2 | Wet | 100% | 100% |
| 2001 | 9.81 | 5.9 | Dry | 60% | 85% |
| 2002 | 14.6 | 6.5 | Dry | 100% | 100% |
| 2003 | 19.31 | 8.0 | Above Normal | 100% | 100% |
| 2004 | 16.04 | 7.7 | Below Normal | 100% | 100% |
| 2005 | 18.55 | 7.4 | Below Normal | 100% | 100% |
| 2006 | 32.09 | 13.0 | Wet | 100% | 100% |
| 2007 | 10.28 | 6.2 | Dry | 100% | 100% |
| 2008 | 10.28 | 5.4 | Critical | 40% | 75% |
| 2009 | 13.02 | 5.5 | Dry | 40% | 75% |
| 2010 | 16.01 | 6.9 | Below Normal | 100% | 100% |
| 2011 | 25.21 | 10.0 | Wet | 100% | 100% |
| 2012 | 11.84 | 6.9 | Below Normal | 100% | 100% |
| 2013 | 12.19 | 5.8 | Dry | 75% | 100% |
| 2014 | 7.46 | 4.0 | Critical | 0% | 50% |
| 2015 | 9.23 | 4.0 | Critical | 0% | 25% |
| 2016 | 17.48 | 7.1 | Below Normal | 100% | 100% |
| 2017 | 37.82 | 14.9 | Wet | 100% | 100% |
| 2018 | 12.86 | 7.2 | Below Normal | 100% | 100% |

### 3.2.4 Shasta Lake Unimpaired Inflow

A portion of the District's water supply comes from a long-term transfer agreement with the Anderson-Cottonwood Irrigation District (ACID). ACID has a settlement contract with Reclamation that includes constraints on the availability of CVP water during a "Critical Year." A Critical Year is defined as any year in which either the following eventualities exists:

(1) The forecasted full natural inflow to Shasta Lake for the current Water Year, as forecasted by Reclamation on or before February 15 and reviewed thereafter as conditions and information warrant, is equal to or less than 3.2 million acre-feet; or
(2) The total accumulated actual deficiencies below 4 million acre-feet in the immediately prior Water Year or series of successive prior Water Years each of which had inflows of less than 4 million acre-feet, together with the forecasted deficiency for the current Water Year, exceed 800,000 acre-feet.

In the 2014-15 water year, the projected 50% exceedance for the Shasta Lake unimpaired inflow was less than 3.2 MAF so water allocations to North-of-Delta Settlement Contractors were reduced by 25%. In the 2018-2019 water year, the projected 50% exceedance for the Shasta Lake unimpaired inflow was greater than 3.2 MAF, so the North-of-Delta Settlement Contractors received 100% of their allocations and consequently, the District received 100% of its ACID transfer water supply. Hence, this index can be useful in estimating the availability of the ACID water to the District. In the 12 years since the ACID water transfer agreement was executed in 2008, the water transfer quantity has been reduced only twice, in 2014 and 2015.

**Table 3-4 – 2014 Sacramento River Water Year Forecast**

Shasta Lake Unimpaired Inflow [taf]

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | WY | Apr-Jul | WY % avg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 99% | 171 | 171 | 177 | 178 | 170 | 185 | 160 | 137 | 107 | 93 | 90 | 92 | 1,730 | 496 | |
| 90% | 171 | 171 | 177 | 178 | 199 | 220 | 210 | 180 | 140 | 120 | 103 | 106 | 1,975 | 650 | |
| 75% | 171 | 171 | 177 | 178 | 240 | 270 | 255 | 210 | 155 | 135 | 122 | 126 | 2,210 | 755 | |
| 50% | 171 | 171 | 177 | 178 | 300 | 315 | 325 | 275 | 185 | 165 | 155 | 153 | 2,570 | 950 | 43% |
| 25% | 171 | 171 | 177 | 178 | 490 | 520 | 445 | 362 | 255 | 221 | 180 | 180 | 3,350 | 1,283 | |
| 10% | 171 | 171 | 177 | 178 | 636 | 667 | 635 | 515 | 350 | 280 | 220 | 210 | 4,210 | 1,780 | |
| | | | | | | | | | | | | 1961-2010 avg | 5,979 | 1,806 | |

Source: (California Department of Water Resources, 2019)

**Table 3-5 – 2019 Sacramento River Water Year Forecast**

Shasta Lake Unimpaired Inflow [taf]

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | WY | Apr-Jul | WY % avg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 99% | 186 | 222 | 299 | 784 | 480 | 505 | 400 | 310 | 220 | 170 | 160 | 163 | 3,900 | 1,100 | |
| 90% | 186 | 222 | 299 | 784 | 560 | 585 | 465 | 360 | 240 | 185 | 175 | 173 | 4,235 | 1,250 | |
| 75% | 186 | 222 | 299 | 784 | 635 | 660 | 525 | 410 | 260 | 205 | 190 | 188 | 4,565 | 1,400 | |
| 50% | 186 | 222 | 299 | 784 | 690 | 760 | 585 | 460 | 280 | 225 | 205 | 198 | 4,895 | 1,550 | 84% |
| 25% | 186 | 222 | 299 | 784 | 765 | 815 | 635 | 495 | 310 | 240 | 220 | 208 | 5,180 | 1,680 | |
| 10% | 186 | 222 | 299 | 784 | 840 | 870 | 685 | 530 | 340 | 255 | 235 | 223 | 5,470 | 1,810 | |
| | | | | | | | | | | | | 1966-2015 avg | 5,831 | 1,756 | |

Source: (California Department of Water Resources, 2019)

### 3.2.5 Monitoring Databases

Several other regional datasets provide information that may be useful in tracking and predicting drought conditions.

1. **Evaporative Demand Drought Index**. The Evaporative Demand Drought Index (EDDI) serves communities by providing indicators of rapidly evolving "flash droughts" as well as longer lasting sustained droughts. The EDDI database exposes early warning signs of drought stress at weekly and monthly intervals by analyzing real-time atmospheric datasets. ***EDDI Website***-https://www.esrl.noaa.gov/psd/eddi/
2. **National Integrated Drought Information System**. The National Integrated Drought Information System (NIDIS) utilizes data from the National Oceanic and the Atmospheric

Administration to organize and track current prediction systems on both seasonal and sub-seasonal timescales. ***NIDIS Website***- https://www.drought.gov/drought/what-nidis

3. **United States Drought Monitor**. The United States Drought Monitor (USDM), initiated in 1999, is a multi-agency partnership that includes the National Drought Mitigation Center from the University of Nebraska in Lincoln, the National Oceanic and Atmospheric Administration and the Department of Agriculture. The USDM releases a weekly map indicating five classifications: (D0) Abnormally dry areas or areas that may be exiting or entering times of drought, (D1): Moderate drought, (D2): Severe drought, (D3): Extreme drought, and (D4): Exceptional drought. ***USDM Website***- https://droughtmonitor.unl.edu/

These important resources will be further utilized by the District; however, they are classified in this plan as lower priority indices since they are broad regional forecasts and do not adequately take into consideration local water conditions.

## 3.3 Identifying Drought Triggers

According to the *Reclamation Drought Response Program Framework* (Reclamation, 2015), triggers are indicator or index values that can be used to define a specific drought stage, a specific response, or a mitigation action. District staff will monitor the drought indices on a regular basis. Hard triggers initiated by specific thresholds are not practical for the District due to the complexity and diversity of the information. Rather, as has been done in the past, the process will be accomplished with a subjective decision based on the various data sources and local conditions. Furthermore, the District's experiences during the recent drought (2013-2016) will be drawn upon in defining the appropriate dates for the evaluation of the triggers and for determining the prospect for shortage conditions to materialize. When appropriate, specific triggers will be declared resulting in specific water shortage allocations and policies. **Table 3-6** summarizes the priority of indicators/indices, timing of monitoring, and trigger threshold values that would lead to consideration of response actions.

The District Engineer will maintain the responsibility for both data collection, as well as all associated public notifications.

Due to the inability of the District to reschedule or carry-over water from one CVP water year to the next and the low water usage in the months of December through February there are no extraordinary actions that the District needs to take prior to the initial announcement of the CVP allocations. The October 1, December 1, and February 1 trigger dates contained in Table 3-6 are intended to provide the District notice of the potential need to implement its Water Shortage Contingency Plan at the start of the upcoming water year. Steps that the District can take include updating of notices, ensuring that its billing system is ready to implement any drought charges, and begin discussions with other agencies regarding the potential for water transfers.

Historically in California, consecutive dry years typically occur before response actions are considered or implemented. Nevertheless, the proposed monitoring should be used in all years, regardless of the conditions from the previous water year (e.g., if the previous year was wet).

### Table 3-6 – Summary of Drought Contingency Plan Triggers

| Summary of Drought Contingency Plan Triggers | | |
|---|---|---|
| **Indicator/Index** | **Timing of Reporting** | **Threshold Value** |
| Lake Shasta Reservoir Storage | October 1 | <2,000,000 acre-feet |
| | December 1 | <1,500,000 acre-feet |
| Northern Sierra Precipitation | February 1 | <50% of average for February 1 |
| | March 1 | <50% of average for March 1 |
| | April 1 | <50% of average for April 1 |
| | May 1 | <50% of average for May 1 |
| Sacramento Valley Index | February 1 | Dry (Greater than 5.4, and equal to or less than 6.5 MAF) or Critical (Equal to or less than 5.4 MAF) |
| | March 1 | |
| | April 1 | |
| | May 1 | |
| Unimpaired Inflow into Lake Shasta | February 1 | The forecasted full natural inflow to Shasta Lake for the current Water Year, as forecasted by Reclamation on or before February 15 and reviewed thereafter as conditions and information warrant, is equal to or less than 3.2 million acre-feet; **or** series of successive prior Water Years each of which had inflows of less than 4 million acre-feet, together with the forecasted deficiency for the current Water Year, exceeds 800,000 acre-feet |
| | March 1 | |
| | April 1 | |
| | May 1 | |

## 3.4 Review and Refine Water Shortage Stages

In order to manage a water supply shortfall, five demand reduction stages are defined within the District's current M&I Water Shortage Contingency Plan. The total demand reduction goal for each stage increases from less than 15% to 70% or more of normal demand from Stage 1 to Stage 5. The stages are summarized below in **Table 3-7**. The District defines a water supply shortage as the difference between demand and the sum of the reduced CVP allocation and additional secure sources of supply. Changes in water shortage stages are communicated to District customers by way of billing inserts, newspaper advertising, on the District's webpage (*www.bvwd.org*), and by verbal communication between District Staff and consumers.

Additionally, as outlined in new Water Code requirements (*10632 a. b.*), Water Shortage Contingency Plans must include six standard water shortage levels, which correspond to the progressive ranges of <10%, 10%, 20%, 30%, 40%, and 50% as shown below in **Table 3-8**. This change will be required as part of 2020 Urban Water Management Plan updates.

### Table 3-7 – Current 5 Stages of Water Shortage

| Stage[1] | % Supply Reduction | Water Supply Condition |
|---|---|---|
| 1 | Up to 15% | Normal Water Supply (85% to 100% of Normal[2]) |
| 2 | 15-30% | Moderate Water Shortage (70% to 85% of Normal) |
| 3 | 30-50% | Severe Water Shortage (50% to 70% of Normal) |
| 4 (long-term and short-term) | 50-70% | Extreme Water Shortage (30% to 50% of Normal) |
| 5 (long-term and short-term) | 70% or more | Critical Water Shortage (less than 30% of Normal) |

1 – Long-term conditions are greater than 45 days and are typically due to hydrologic conditions. Short-term conditions occur for 45 days or less and may be attributed to infrastructure, water quality, or power issues, as well as hydrologic conditions.
2 – "Normal" refers to the average water supply during the last 3 years with unconstrained supplies.

### Table 3-8 – Updated Stages of Water Shortage

| Stage | % Supply Reduction | Water Supply Condition |
|---|---|---|
| 1 | Up to 10% | Normal Water Supply (90% to 100% of normal demand) |
| 2 | 10-20% | Moderate Water Shortage (80% to 90% of normal demand) |
| 3 | 20-30% | Severe Water Shortage (70% to 80% of normal demand) |
| 4 | 30-40% | Extreme Water Shortage (60% to 70% of normal demand) |
| 5 (long-term and short-term) | 40-50% | Critical I Water Shortage (50% to 60% of normal demand) |
| 6 (long-term and short-term) | 50% or more | Critical II Water Shortage (less than 50% of normal demand) |

During the recent 2014-2015 drought District water supplies were greatly reduced. CVP allocations for the District were 50%/0% and 25%/0% (M&I/Irrigation) for the 2014 and 2015 water years, respectively. At these allocations the District would have been at Stage 5 in 2014 and at Stage 6 in 2015 based on the stages of water shortage shown in Table 3-8. Fortunately, the District was able to secure short-term water transfers and run its wells to produce additional supplies and reduce the impact on its customers.

## 3.5 Process for Determining Shortage Conditions

The District Engineer will be responsible for collecting and analyzing data from the various drought indices. The District Manager will be kept updated on a regular basis, and the District Board of Directors will be updated at monthly Board meetings. Once a trigger is observed meeting a threshold value in **Table 3-7**, the District will perform an assessment of their supplies to determine if hydrologic conditions will affect current and future water allocations from Reclamation. Due to the water-year used by Reclamation (March 1 through the last day of February), and the low water demands at that time of year, no changes to the water shortage stages are normally implemented prior to March 1st. However, due to public notice requirements and the District's 2-month billing cycle, the District needs to be prepared to implement water demand reduction actions immediately following Reclamation's announcement of its initial water allocations for BVWD. The public will be noticed through the District website and with billing inserts.

As will be discussed in the Vulnerability Assessment chapter of this plan the District does not have a water supply shortage based on water demands in recent years until the CVP allocation drops below 60%/10% (M&I/Irrigation). As previously discussed, at a 50%/0% allocation the District would be at a water shortage Stage 5 and at a 25%/0% allocation the District would be at Stage 6.

Demands must be monitored frequently during water shortages to enable the District to effectively manage the balance between supply and demand. Following are procedures for monitoring reductions during the different stages shown in **Table 3-8**:

- In normal water supply conditions (Stage 1), production and pumping amounts are recorded daily. Totals are reported monthly to the District Engineer.
- During Stage 2, 3, and 4 water shortage conditions, weekly production and pumping amounts are reported to the District Engineer to compare the weekly data to the targets to verify that the reduction goal is being met.
- During a Stage 5 or 6 water shortage, a daily production and pumping report will be provided to the District Engineer to verify that the reduction goal is being met.

Specific response actions that will be implemented in each stage are described in Chapter 5 – Response Actions.

# 4 Vulnerability Assessment

## 4.1 Introduction

Vulnerability is a weakness or gap in a system that exposes the system assets to specific hazards. The primary vulnerabilities in Bella Vista Water District are drought and water scarcity. The purpose of this chapter is to identify and categorize potential effects of drought on resources throughout the greater service area of the District. This will be accomplished by estimating the frequency, magnitude, and severity of droughts and examining how local resources are impacted by drought. This assessment will drive the development of potential mitigation and response actions to offset the effects of future droughts. The District's water system faces several other vulnerabilities including cyber threats, terrorism, power outages, water contamination, etc. These other vulnerabilities are not discussed in this report, which focuses exclusively on drought and water scarcity.

The primary topics discussed in this chapter include:

- Vulnerability of District water supplies
- Existing vulnerability and climate change studies
- Identification and prioritization of vulnerable resources
- Assessment of risks at different drought stages
- Economic impacts of droughts

The subsequent section discusses the vulnerability of the District's water supplies to climatic conditions and regulatory restrictions in more detail.

## 4.2 Vulnerability of District Water Supplies

The District has two sources of water to meet customer demands. These include surface water pumped from the Sacramento River and groundwater pumped from the District's wells that are located near the southern boundary of the District. The District also has interconnections with four neighboring water agencies. These are generally only used during an emergency or short-term water shortages caused by interruptions in power supplies, equipment failures or maintenance, and line breaks. They are not designed or intended as solutions to water supply shortages.

The District does not hold any water rights permits of its own to divert water from the Sacramento River or any of the surface water supplies within its service area. Diversions from the Sacramento River are made under the "Water Service Contract" with Reclamation and the long-term transfer agreement with the Anderson-Cottonwood Irrigation District. Water rights permits for the Central Valley Project (CVP) are held by the U.S. Bureau of Reclamation for the benefit of CVP. The District does have five groundwater wells that can currently meet wintertime demands on a short-term basis; however, they are insufficient to meet water demands associated with outdoor irrigation.

In normal years, approximately 95% of the District's supply is CVP water with the remaining 5% being water supplied from the District's wells. As a result, the District is highly dependent on the water it receives from Reclamation and is highly vulnerable to cutbacks in its CVP supply. Unfortunately, the CVP has very limited water storage capacity that limits the amount of water that it can carryover from one water year to the next. While carry-over provisions are included in BVWD's water contract, the Reclamation has not approved any carryover storage in recent years. **Attachment 4.1** is a copy of a recent letter from Reclamation refusing the District's request for carryover storage. This makes the CVP supplies highly dependent on each year's precipitation and runoff. As a result, single year and multi-year droughts require significant cutbacks in water allocations to CVP water contractors.

Below are detailed discussions on the following topics:

- Various causes of drought in the area
- Regulatory impacts on water supplies
- Drought impacts on water supplies
- Constraints on water transfers and exchanges

**Causes of Drought**

Drought is caused by prolonged weather conditions and climatic events that provide significantly less than average precipitation in the forms of rain and snowpack, which in turn reduce the amount of stream runoff available for beneficial use.

Weather and climate conditions that may cause or contribute to drought include:

- Above average temperature causing stream runoff to occur faster or earlier than average and may result in:
  - Increased snow level elevations
  - Above average loss of existing snowpack
  - Increased evaporation from water body surfaces
  - Alterations to weather patterns and jet streams
  - Environmental/ecosystem stress/degradation
- Less than average precipitation causing depletions of stream flow, snowpack, and groundwater recharge that may result in:

- Diminished water storage in reservoirs
- Diminished water storage in the Sierra Nevada snowpack
- Lowering of groundwater levels
- Restriction/limitations on water availability/use
- Environmental/ecosystem stress/degradation

- Irreversible climate change: permanent changes to historical averages of the above described weather patterns that may result in:
  - Flooding/drought
  - Permanent loss of glaciers and snowpack
  - Permanent losses and changes to existing specialized ecosystems

**Regulatory Impacts on Water Supplies**

Over time, federal regulatory changes and State Water Resources Control Board decisions have resulted in more and more water being dedicated to environmental purposes including water quality standards, minimum river flow requirements, Delta outflow requirements, and water temperature management. These conditions create what is often called a “regulatory drought.”. From 1992 through 2010, the cumulative impact of these changes and decisions are estimated to have rededicated more than 3.5 million acre-feet/year of CVP & State Water Project (SWP) annual yield in the State (see **Figure 4-1**), which represents at least 25% of the dedicated supplies.

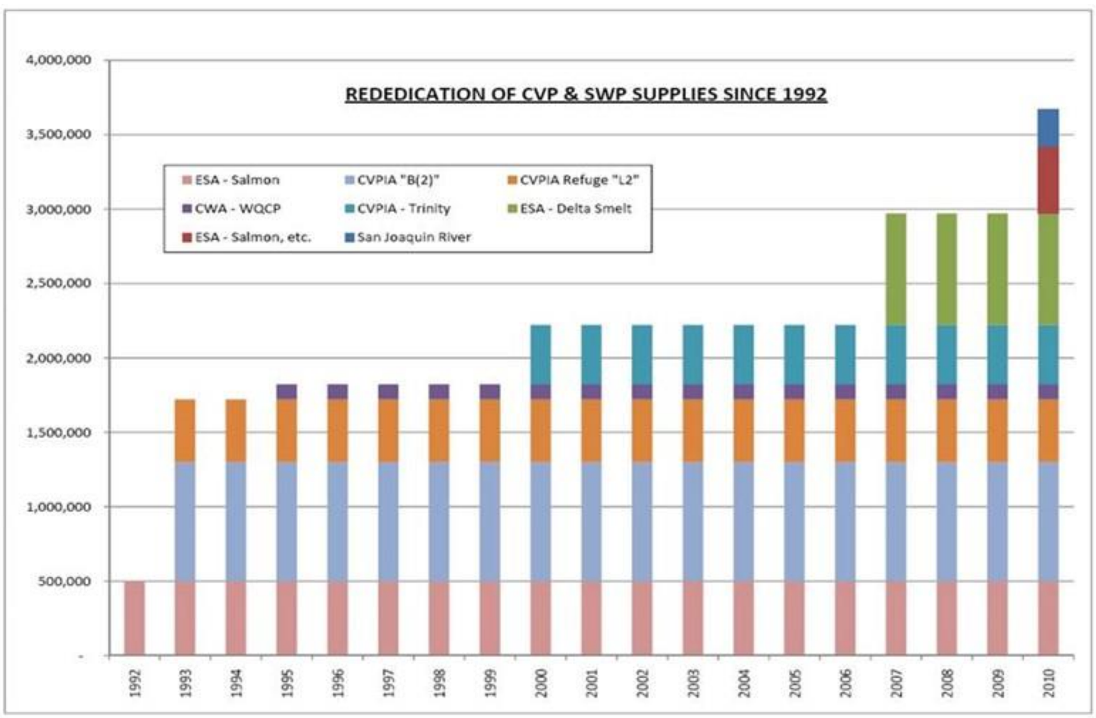
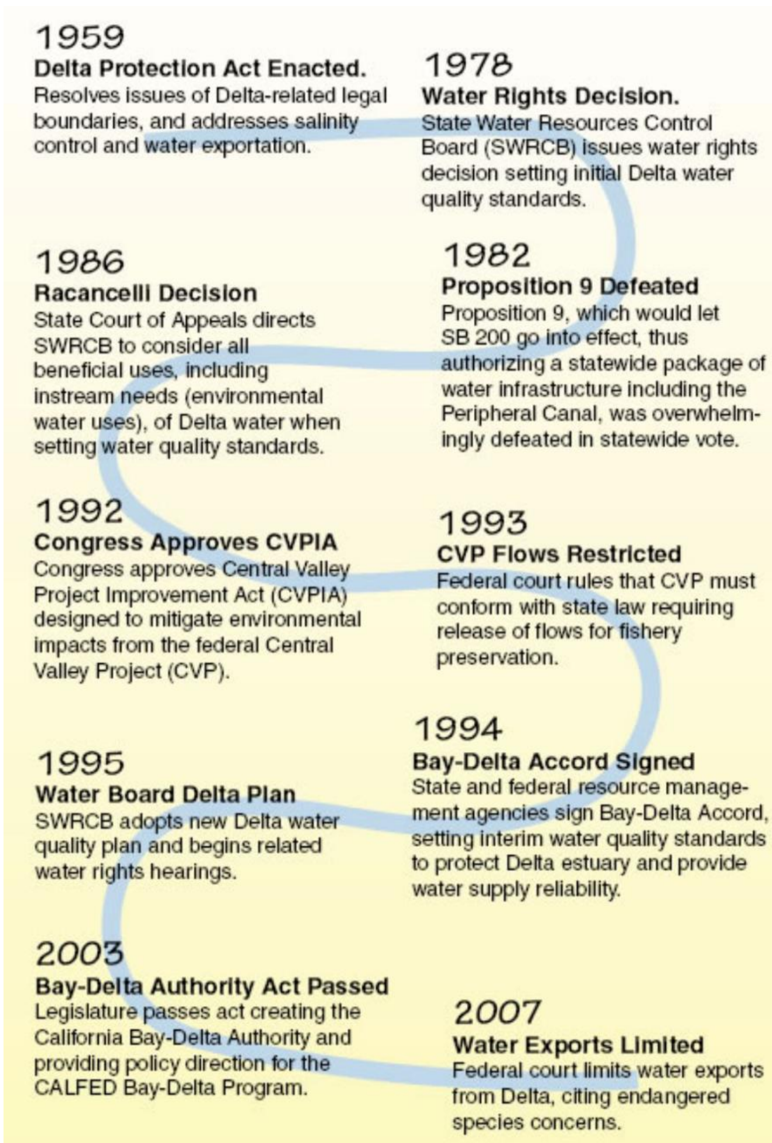



Figure 4-1 – Rededication of Water Supplies due to Regulatory Decisions

Dates and brief descriptions of the more significant Federal regulations and State Water Resources Control Board (SWRCB) decisions affecting the Central Valley Project, and consequently water supplies available to the District, are shown in **Figure 4-2** below. These are also reflected in Figure 4-1, above. The Shasta Reservoir has been affected by conflict between various agencies along the Sacramento River and in the local groundwater basins for many years. These conflicts are likely to increase with climate change, future droughts, and concerns for endangered species.

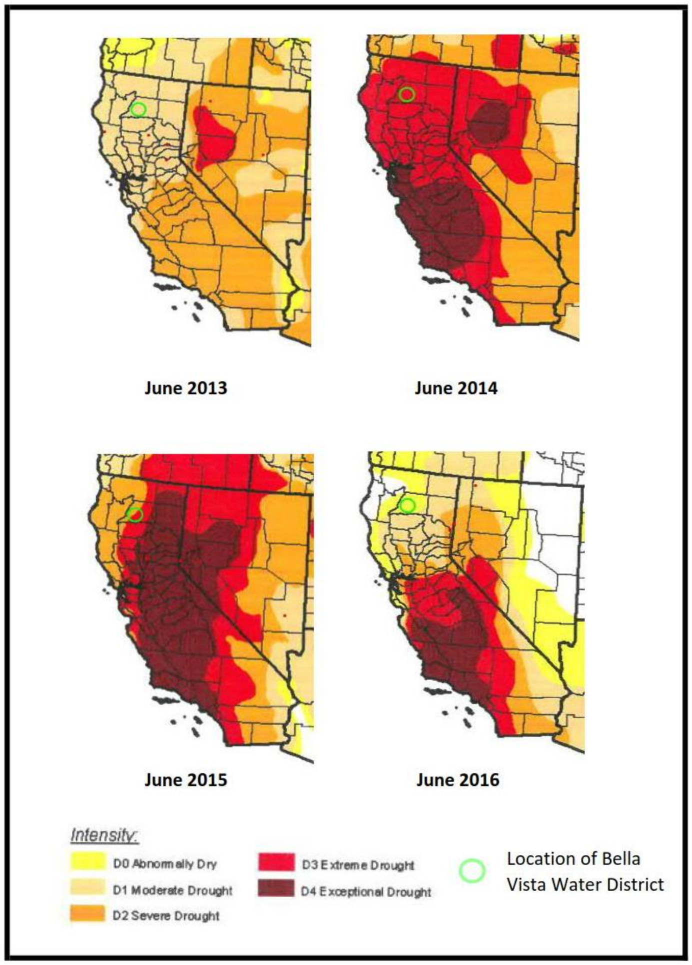



Source: https://lao.ca.gov/2008/rsrc/water_primer/water_primer_102208.aspx#chapter1

**Figure 4-2 – Regulatory Decisions Impacting Water Supplies**

**Drought Impacts on Water Supplies**

In recent years, many areas of California, including the District, have experienced periods of drought ranging from "abnormally dry" to "exceptional drought" as can be seen in **Figure 4-3** below.




Source: United States Drought Monitor (http://droughtmonitor.unl.edu/)

**Figure 4-3 – United States Drought Monitor (2013-2016)**

These dry natural conditions are coupled with reductions in surface water allocations that exacerbate the drought conditions.

The diversion of water from lakes, rivers, and streams in California is governed by a complex system of "water rights" as administered by the State Water Resources Control Board. When the amount of water in California's lakes and rivers are insufficient to meet the needs of all potential diverters, "senior" water rights holders get their full supplies before "junior" water rights holders get any water. Unfortunately, the Central Valley Project is a junior water rights holder and deliveries to senior water rights holders get precedence over CVP water service contractors (such as the District). Consequently, deliveries to the District can be limited or unreliable, especially in dry periods. As a result of this junior status, the District's water allocation from Reclamation has often been subject to a reduction from its full contract amount. Figure 4-4 shows the District's historical allocations from Reclamation since 1977.

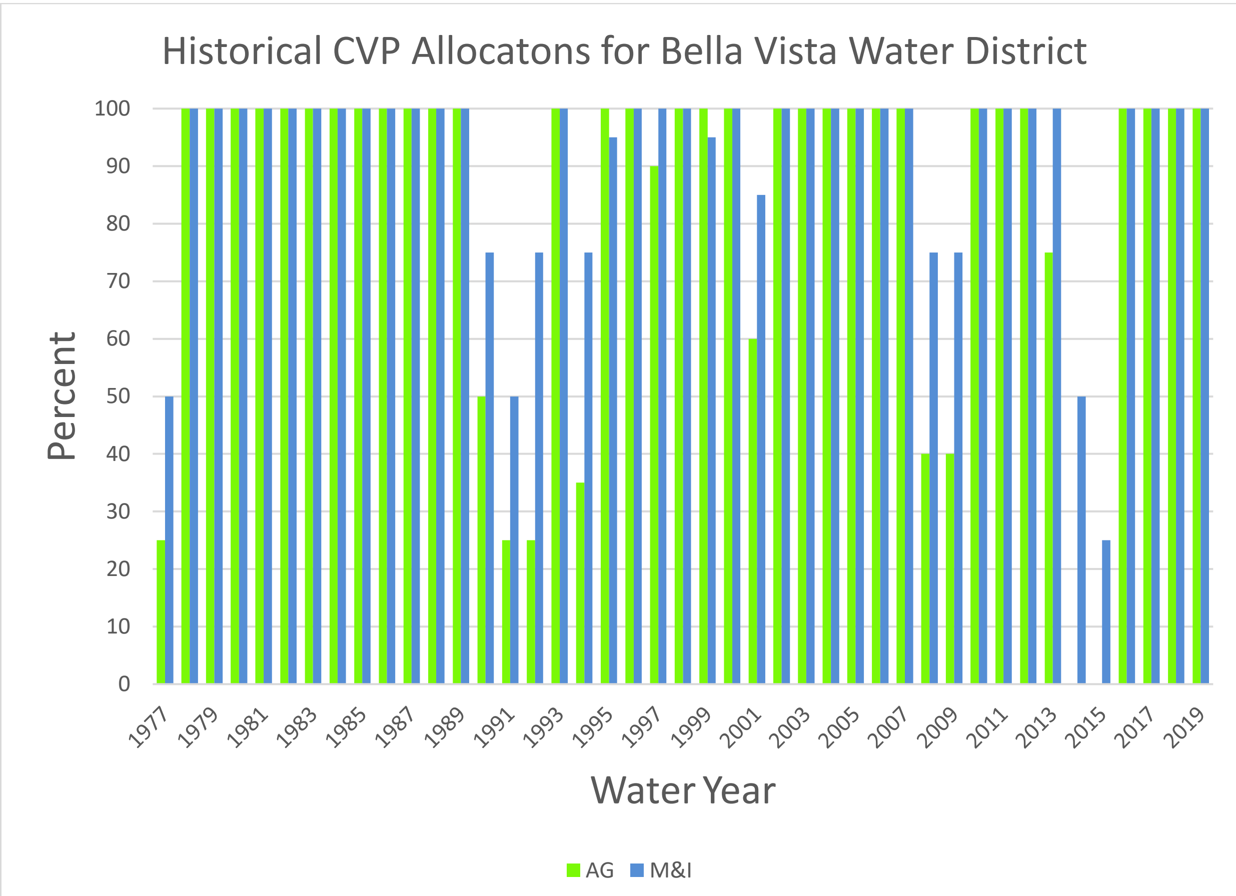



**Figure 4-4 – Historical CVP Allocations for BVWD**

Since the 2014-2015 drought, the District has experienced significant reductions in water usage by both M&I and Agricultural water users. A variety of factors have led to this reduction including: (1) a reduction in the total number of agricultural customers, (2) some of the largest agricultural water users ceasing or significantly reducing their operations, (3) increases in the water rates paid by both agricultural and M&I customers, (4) milder summers, (5) average or above average precipitation, and (6) water conservation (including residual impacts from the recent drought).

As a result, total water production in the past few years has been approximately 10,000 AF/year compared with 13,674 AF of production in calendar year 2013. Water usage by the District's Agricultural customers represents approximately 28% of the total and M&I usage represents approximately 66% of the total with "unaccounted for/losses" representing the remaining 6%. If you include the unaccounted for/losses in the M&I and agricultural totals, then M&I usage represents 70% of the total (7,000 AF/year) and agricultural usage represents 30% of the total (3,000 AF/year).

The District's CVP allocations during conditions of shortage is based on past water usage. Hence, the recent reductions in total water usage will result in lower allocations during future shortages. **Figure 4-5** shows estimated CVP allocations to the District based on the Historical CVP Allocations for the District and 'present day' water usage.

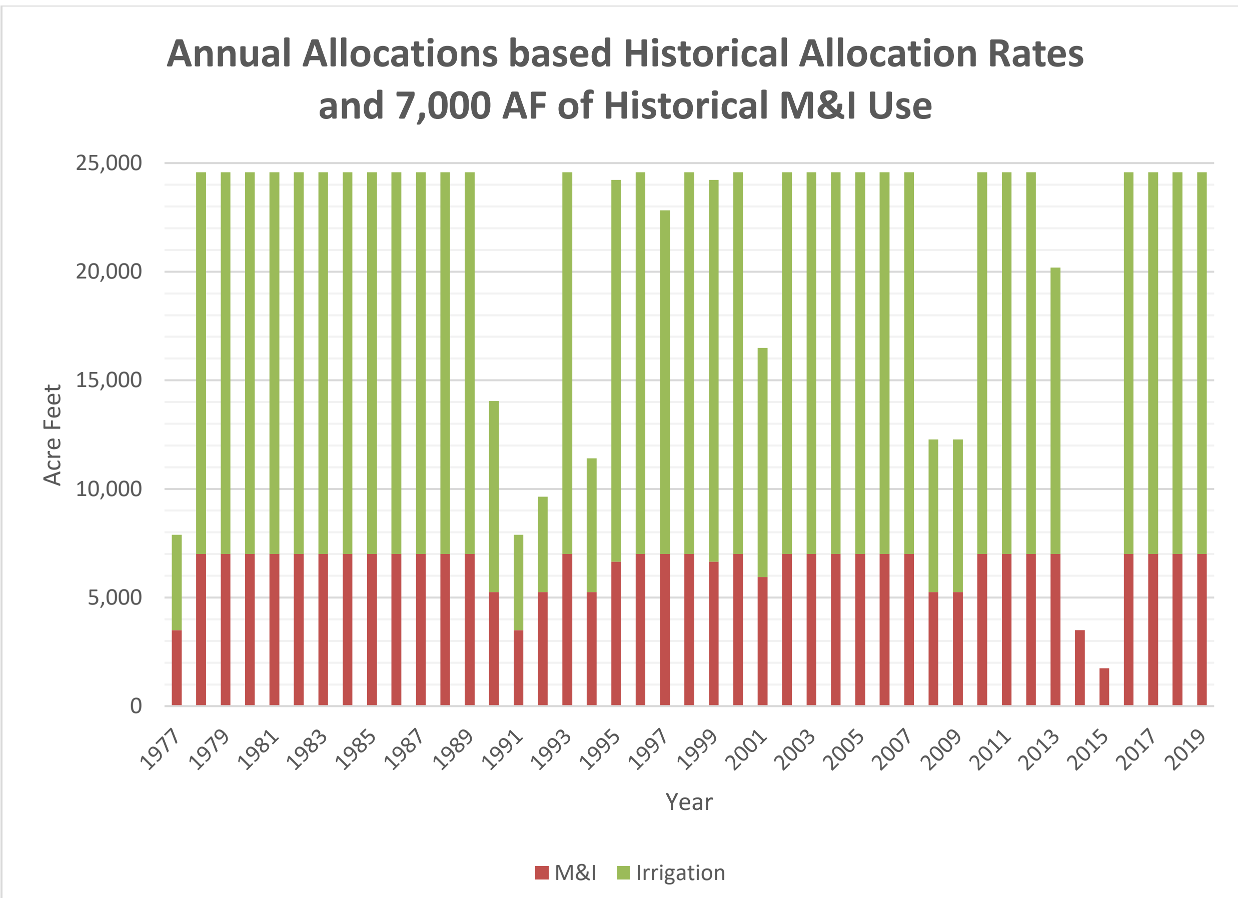



**Figure 4-5 – Annual CVP Allocation based on Recent Usage**

**Figure 4-5** shows that annual allocations would have been sufficient to meet the District's current needs in 38 of the past 43 years (based on historical allocations), it must be noted that the current environmental and regulatory constraints under which Reclamation operates have changed significantly since 1977. Prior to 2014, the Irrigation allocation had never been less than 25% and only once before had the M&I allocation been as low as 50%. In both 2014 and 2015 the Irrigation allocations were zero, and in 2015 the M&I allocation was only 25%, causing a tremendous hardship on the District and its customers.

In planning for the future, the District must anticipate that allocations like those experienced in 2014 and 2015 may reoccur, and that cutbacks may also occur with a greater frequency than they have over the past 43 years.

**Constraints on Water Transfers**

Water transfers are a common tool used by many agencies to secure additional water in droughts. These are possible because some agencies have: 1) reliable water contracts even in droughts, 2) alternate or backup water supplies, or 3) greater ability to reduce demands in dry years. This typically results in an "open market" for water with many water transfers occurring throughout the State. These opportunities are most available to agencies with access to major water bodies, rivers, or conveyance facilities. BVWD is near the Sacramento River and just a few miles downstream from Shasta Dam. Most potential water transfer partners also divert from the Sacramento River, but further downstream. In recent years, BVWD has found little to no opportunity for transfers with other agencies on the Sacramento River, even though some of them have additional water supplies to sell. Attempts to broker water deals have been thwarted since State and Federal agencies claim that diverting the water by BVWD reduces the instream flow benefit, since the water would be diverted earlier than if it were to flow to its original downstream water user. Without this important tool in their portfolio to augment dry-year water supplies the District is more vulnerable to water shortages and must explore other options to meet its customers water needs.

## 4.3 Existing Vulnerability & Climate Change Studies

Two different Reclamation studies evaluated the potential impacts of climate change on the Sacramento Valleys. These include:

- Reclamation, West-Wide Climate Risk Assessment, Sacramento and San Joaquin Basins Climate Impact Assessment, September 2014
- Reclamation, Sacramento and San Joaquin Basin Study, March 2016.

These studies outline the following major effects of climate change on temperature, precipitation, and runoff:

**Temperature.** Temperatures are projected to increase steadily during this century, with generally greater changes occurring farther inland. In the Sacramento region, warming is projected to increase by about 1.8 degrees Fahrenheit (°F) to 5.4°F at mid-21st century (2055), and about 3°F to 9°F at end-of-century (2084) (Reclamation, 2014).

**Precipitation.** Projections of future precipitation have a much greater range of variability than those for temperature. In the northern part of the Sacramento Valley, projections indicate a slight increase of about 2 percent in precipitation around the mid-century period with increases continuing into the late century (Reclamation, 2016).

**Snowpack.** Snowpack, as measured by April 1st snow water equivalent (SWE), is projected to decrease continuously throughout the 21st century. Snowmelt from the Sierra Nevada currently provides an annual average of 15 million acre-feet of water, slowly released between April and July each year. The greatest changes will occur in the lower elevations of the watersheds. By 2025, the Sacramento Valley watershed is projected to experience decreases in the April 1st snow water equivalent (SWE) in the range of from 10 percent in the higher portions of the watershed to 70 percent in the lower elevations. By the end of the century, even the highest elevations may see a decrease of 70 percent (Reclamation, 2016).

**Evapotranspiration.** Evapotranspiration is projected to increase continuously during the 21st century due to warmer temperatures. This would result in longer growing season lengths, thus increasing the amount of water needed for permanent crops, urban landscaping, and environmental water (Reclamation, 2016).

**Runoff.** Projected runoff in the Sacramento Region varies by climate scenario. Under the no climate change scenario, average annual runoff was about 22,700 thousand acre-feet (TAF)/year in the Sacramento Region. Across the range of all climate scenarios, average annual runoff ranged from 18,000 to 31,900 TAF/year for 2012-2040; 17,000 to 29,100 TAF/year for 2041-2070; and 18,400 to 28,700 TAF/year for 2071-2099 (Reclamation, 2014). In the median climate scenario, average annual runoff was only slightly higher than the no climate change scenario.

**Timing of Runoff.** Higher temperatures during winter are projected to cause more precipitation to occur as rainfall causing increased runoff, less snowpack water storage, and earlier spring snowmelt runoff with reduced volume. This seasonal shift is greater in basins where the elevations of the historical snowpack areas are relatively low and, therefore, more susceptible to warming induced changes in precipitation from snow to rain (Reclamation, 2014).

These climate change projections are merely estimations; however, it is well accepted that the future climate is uncertain, and changes could occur that negatively impact the District's water supplies. As a result, the District recognizes the need for redundancy and resiliency in their water supplies.

## 4.4 Identification and Prioritization of Vulnerable Resources

Vulnerable resources in BVWD are separated into two categories:

1) District resources

2) Community resources

The District resources include their water sources, infrastructure, and District finances. Community resources include private property, business and commerce, and the environment. These resources are illustrated in the figure below.

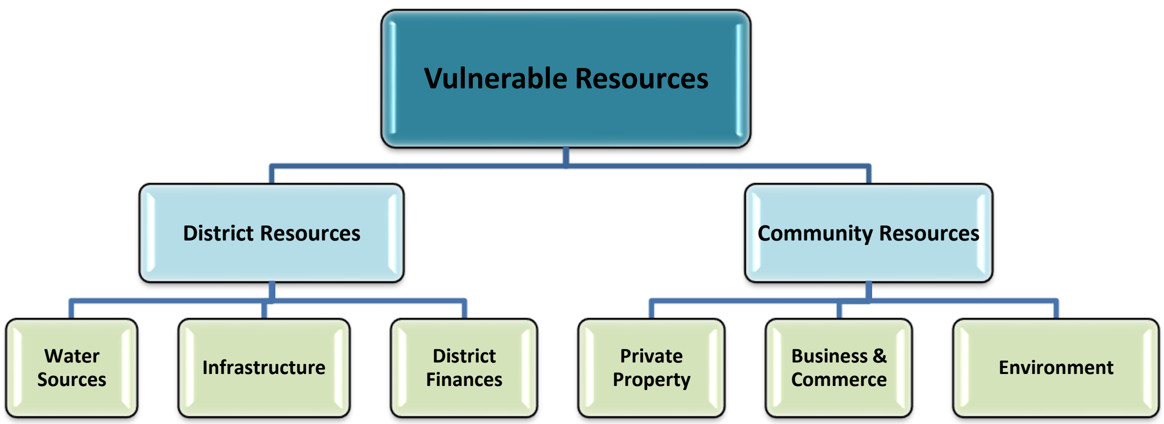



**Figure 4-6 – Vulnerable Resources**

The following sections discuss the key vulnerable resources in BVWD and how each is impacted by droughts. These discussions are generally qualitative.

### 4.4.1 District Resources

*Water Sources*

The District's water supply is a combination of a long-term contract for CVP water with Reclamation, groundwater from its five wells, and a long-term transfer agreement with the Anderson-Cottonwood ID. The District also occasionally enters into short-term water transfer agreements.

In order to understand and successfully identify all potential vulnerabilities the District could face in times of drought, it is important to examine the various aspects of their water supply. When the District's CVP water supply is reduced, they must place increased reliance on their groundwater wells and seek out short-term water transfers. All these options, however, have limited capacity and may be insufficient to meet normal water demands during a severe drought.

When CVP supplies are severely reduced, the amount of water available through the District's long-term transfer agreement with ACID is likely to be reduced by 25 percent (from 1,536 AF to 1,132 AF). Maintaining a well-rounded understanding on how these water supplies work together is important for evaluating the vulnerabilities the region faces. The following sections outline the various water sources utilized by BVWD.

*1. Federal Contract Water*: The District depends mostly on surface water from the Sacramento River. The Shasta Dam, on the Sacramento River near Redding, California, serves to control floodwaters and store surplus winter runoff for irrigation in the Sacramento and San Joaquin Valleys. In 2005, the District entered into a long-term (25-year) renewal contract with the Reclamation (Contract No. 14-06-200-851A-LTR1) that authorizes the District to divert up to 24,578 AF from the Sacramento River supply via the Central Valley Project (CVP). However, Reclamation is often unable to deliver the full contract quantities due to hydrological conditions and environmental regulations. In these shortage years Reclamation follows its Municipal and Industrial Water Shortage Policy (M&I WSP) to set delivery allocations, and water is allocated based on historical usage. Due to the severe drought in 2014-2015 water years, the District received allocations of only 3,657 AF and 1,829 AF in 2014 and 2015, respectively. It should be noted that the District's water service contract with Reclamation provides for rescheduling of water; however, Reclamation has denied all of the District's requests to carry-over water from year to year, thus eliminating any safety net possible from storing wet year water for use in future dry years. **Figure 4-7** shows what the District's water allocations under its CVP contract would be at various allocation percentages in accordance with Reclamation's M&I WSP. As can be seen from this graph, the District's CVP water supply alone is sufficient to meet the District's current water needs until the allocations fall below the 75% and 25% levels for M&I and Irrigation, respectively.

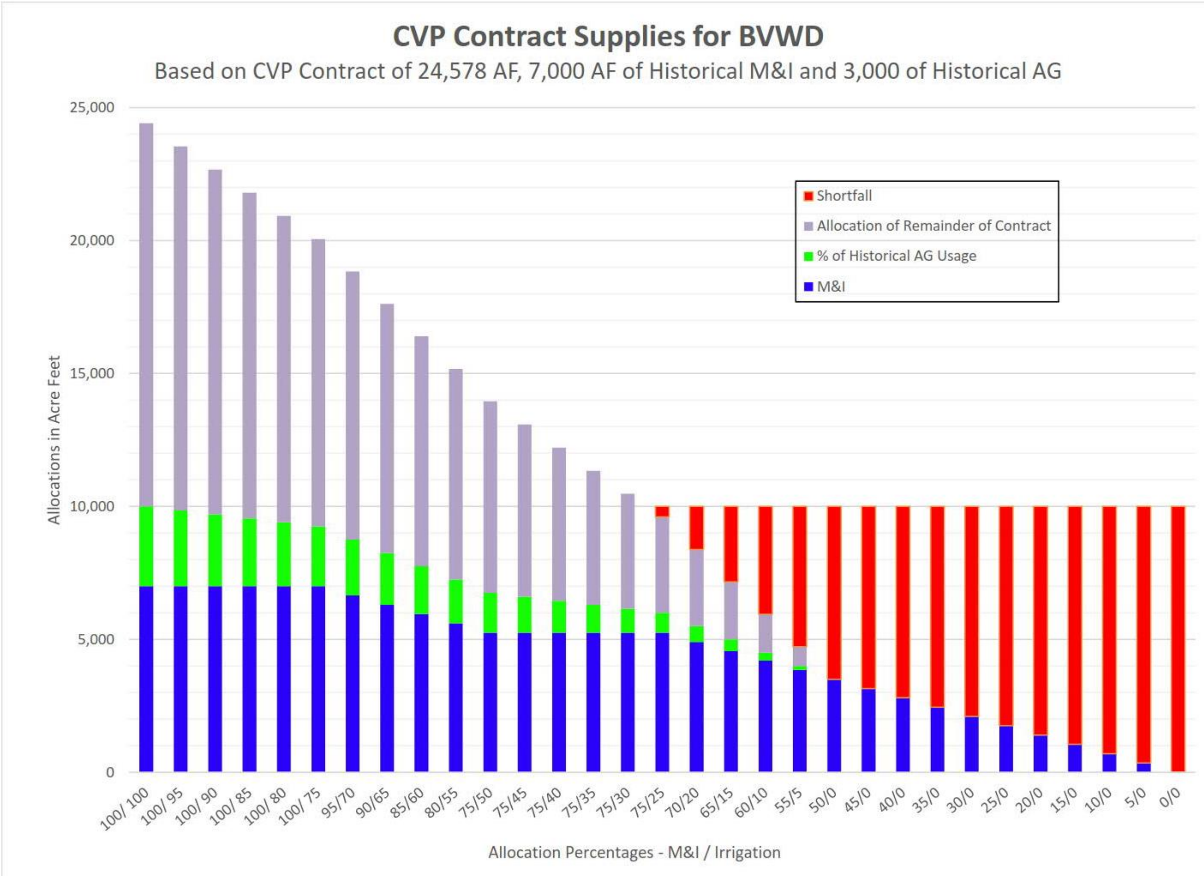



**Figure 4-7 – Annual CVP Allocation based on Recent Water Usage**

*2. Anderson-Cottonwood Irrigation District Supply*: The District has a long-term transfer agreement with the ACID for 1,536 AFY of CVP water. However, in drought years ACID's allocation may be reduced by 25% under its water settlement contract with Reclamation. The reduction in ACID's allocation is passed through to the District resulting in a 25% reduction in this water transfer (to 1,152 AFY) in dry years. Due to the high cost for the water provided under this contract, the costs for this long-term agreement are borne almost entirely by the District's M&I rate payers (a small fraction of the costs are included in the 0.5 acre-foot of M&I water that is included in the base rate for the District's agricultural customers). While the M&I water users bear this cost, they also benefit from the higher reliability of M&I water supplies.

**Figure 4-8** shows the total water supplies available to BVWD including CVP water, ACID water, and current well usage. The CVP allocations are based on Reclamation's February 1, 2017, Municipal and Industrial Water Shortage Policy. The graph assumes that the annual well production is 210 AF and that the long-term water transfer from ACID is reduced from 1,536 AF to 1,152 AF once the allocation from Reclamation is reduced to 25% for Irrigation Water and 75%

of historical use for M&I. (Note: "Historical Use" is defined as the average quantity of CVP water put to beneficial use, within the Contractor's CVP Service Area, during the last three years of unconstrained CVP water deliveries.)

As previously discussed, the District has sufficient water supplies during wet and normal years, but dry years present a challenge due to a heavy reliance on their CVP supply, which can be significantly curtailed in droughts. As can be seen in the figure below, with the addition of the ACID supply and the 210 AF pumped from its wells, the supplies are currently sufficient to meet the District's normal water needs until the CVP allocations falls below the 70/20 (M&I/Irrigation) level.

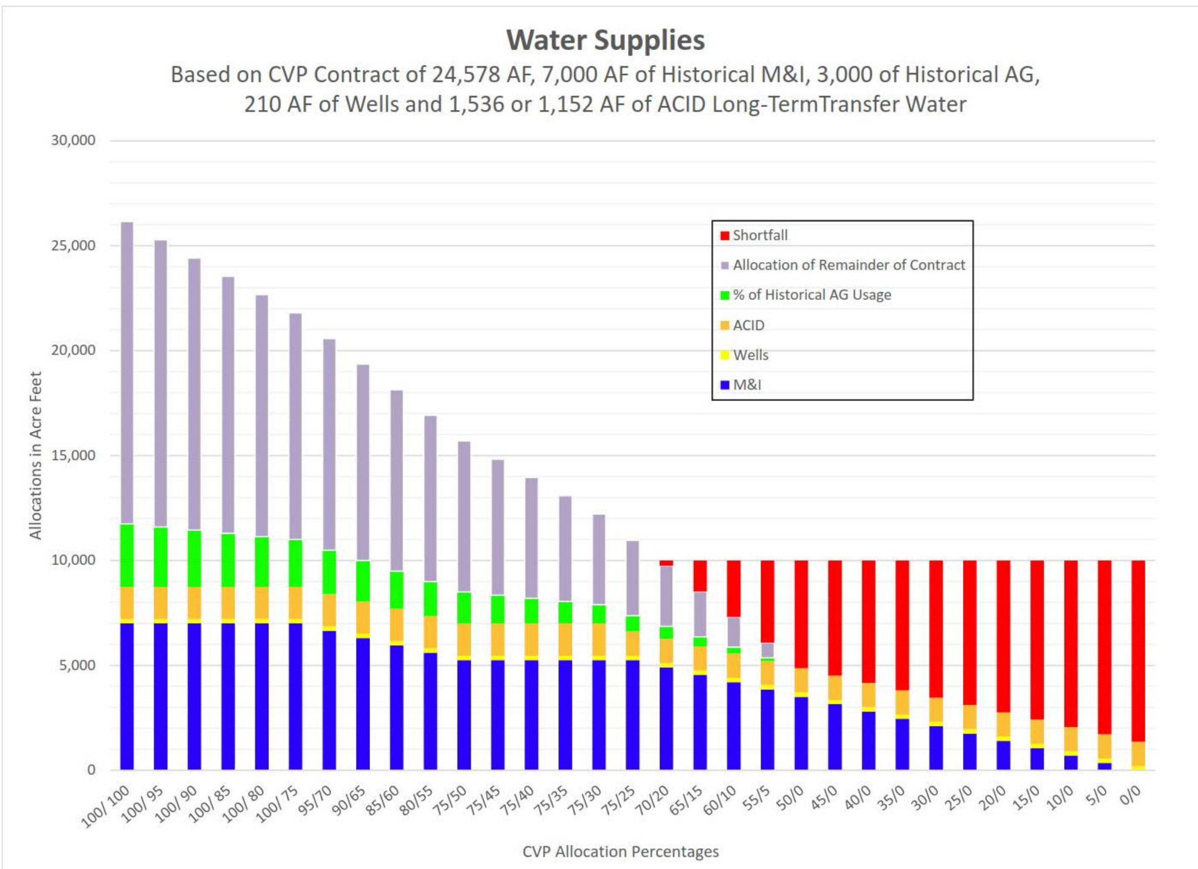



**Figure 4-8 – Total Water Supplies Available (current conditions as of 2019)**

*3. Groundwater:* The District has five wells with a combined production capacity of approximately 12 acre-feet/day. However, the wells can only be utilized for about 50 to 75 percent of their full capacity due to operational constraints including times of the year and times of the day when the total output of the wells would exceed water demands. In addition, during an extended drought, it can be anticipated that well production will decrease due to higher demands on the local aquifer and temporary lowering of groundwater levels.

In a normal year, the District typically operates on its well supplies continuously for approximately one month during the winter producing approximately 210 acre-feet of water. They are typically run for this period of time to allow for major maintenance on the District’s Water Treatment Plant and the Wintu Pump Station. During drought years the wells can be run to augment the District’s water supplies; however, due to the higher energy, chemical, labor and maintenance costs associated with well water production they are only run on a limited basis.

The volume of water the wells can produce on an annual basis is limited by low daily demands during from November through March when water usage for outdoor irrigation is low. At other times, the production may be limited due to the diurnal variation in water demands and the limited amount of treated water storage in the District’s distribution system. The District estimates that the wells could produce approximately 3,000 AF/year during an extended drought.

If the District’s well production is increased from the 210 AF produced in a normal year to an annual rate of 3,000 AF, then the resultant water supply from all sources (as shown in **Figure 4-9**) would be sufficient to meet the District’s normal needs until the CVP allocations fall below the 60/10 (M&I/Irrigation) level. The estimated drought year production of 3,000 AF far exceeds the District’s maximum annual well production of 1,325 AF in CY 2014, a drought year.

Pumping and treating the well water is 1.5 to 2 times more expensive than CVP M&I water. All these costs are normally borne by the District’s M&I customers. In the case of increased well pumping, some of these supplies could be used to meet agricultural needs; however, the increased costs would need to be passed along to the agricultural customers through increased rates and possibly the District’s Supplemental Water Program.

Overall, the wells could potentially meet up to 30% of water demands in a typical year. It is believed that the District’s potential groundwater resources are underutilized, and additional groundwater development will be pursued.

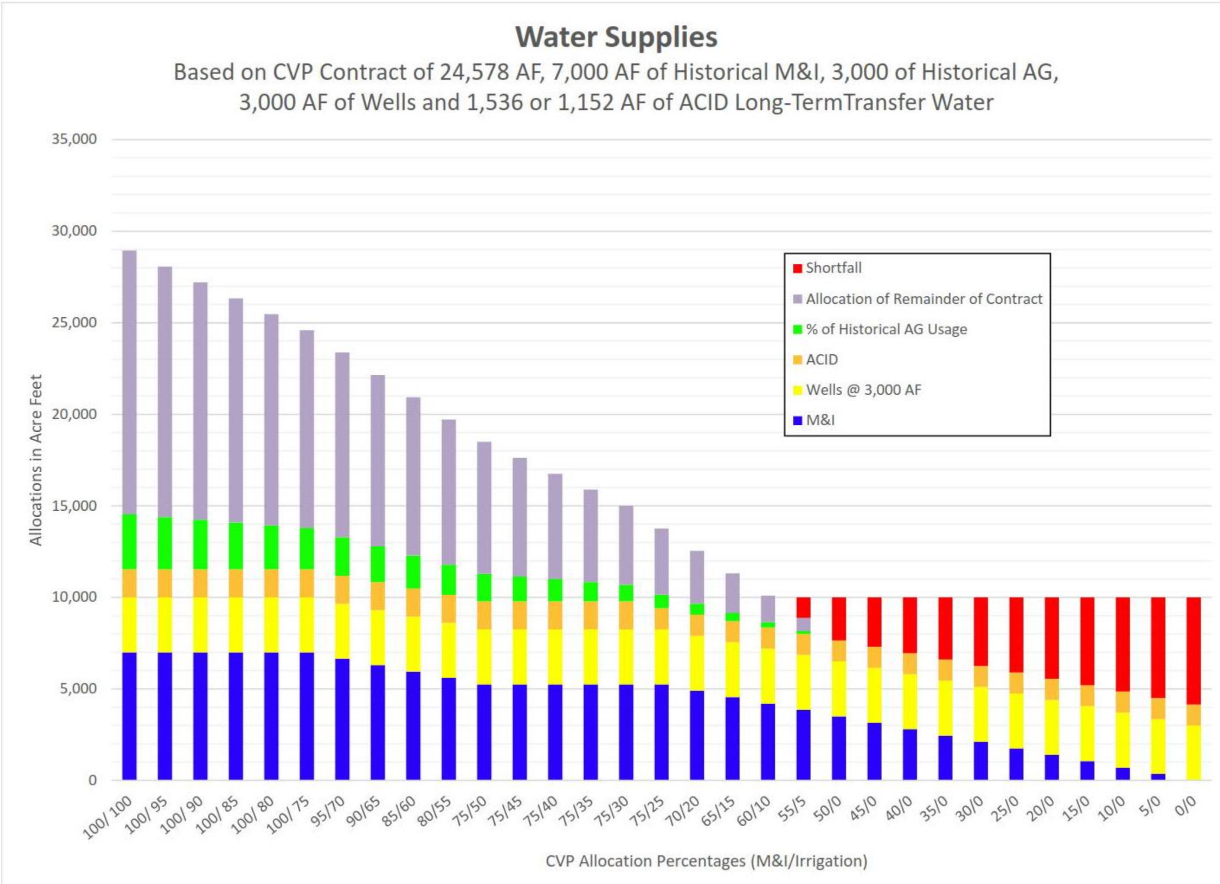



**Figure 4-9 – Water Supplies based with Expanded Groundwater Production**

*4. Water Transfers:* The District has participated in short-term water transfers to make up for water shortages. However, these supplies are limited, especially in dry years, and cannot be relied on. Furthermore, BVWD is less than 15 miles downstream of Shasta Dam, while most other CVP water users divert much further downstream on the Sacramento River. As a result, BVWD generally cannot obtain necessary approvals to exchange water with downstream water agencies, since part of the in-stream flow benefit is lost when the water is diverted by BVWD at the Wintu Pump Station. Therefore, geographically, BVWD is at a disadvantage when it comes to new transfers and exchanges as well as not being able to benefit from proposed off-stream storage projects downstream of the District’s diversion.

### *Infrastructure*

The District’s water system consists of four water storage tanks, ten pumping plants, the main treatment plant, five wells, and over 200 miles of pipeline (ranging from 4-inch to 54-inch in diameter). All the water is pumped for delivery. Surface water is pumped from the Sacramento River at the Wintu Pumping Plant, which is located outside of the District’s boundary. From the

Wintu Pumping Plant water is sent to a surge tank and then to the Water Treatment Plant (WTP). All water delivered by BVWD to its customers is treated to the same standards, regardless of whether the water is used for domestic or agricultural purposes.

#### *District Finances*

The District is financed largely through water use fees. The District's finances are important for purchasing water, employing staff, purchasing equipment and supplies to operate the system, and ensuring the long-term stability of the District.

### 4.4.2 Community Resources

#### *Public and Private Property*

Public and private property includes municipal, commercial, institutional, residential, and agricultural assets. The District provides services to 5,819 residential units, two colleges, seven public and private schools, 317 commercial/public institutional water customers, and 33 landscape irrigation customers. The District also has 2,364 acres of agricultural land.

#### *Business and Commerce*

Business and Commerce has been divided into two categories: Agriculture and Commercial. In this case, the reference to Agriculture refers more directly to larger industrial agricultural productions who meet the requirements of the District's water service contract with Reclamation. Commercial refers to local commercial businesses and enterprises.

#### *Environment*

Important environmental resources include soil, land, groundwater, and surface water.

**Table 4-1** includes a list of the drought related impacts on the vulnerable resources.

**Table 4-1 – Impacts of Drought on Vulnerable Resources**

| | Resources | Impacts |
|---|---|---|
| 1. District Resources | A. Water Sources | 1. Reduced Water Allocation<br>2. Policy Changes<br>3. Groundwater quantity and quality |
| | B. Infrastructure | 1. Threat of Wildfire<br>2. Deferred Maintenance |
| | C. District Finances | 1. Loss of Revenue<br>2. Higher Water Purchase Costs |
| 2. Community Resources | A. Private Property | 1. Threat of Wildfire<br>2. Deferred Maintenance<br>3. Changes in Property Value<br>4. Health and Safety<br>5. Lifestyle Changes<br>6. Increased Water Costs to Customers |
| | B. Business & Commerce | 1. Economic Hardship<br>2. Changes in Property Value<br>3. Unemployment<br>4. Lower Agricultural Production<br>5. Increased Water Costs to Customers<br>6. Water Supply Uncertainty |
| | C. Environment | 1. Increased Threat of Wildfire<br>2. Other Impacts |

Following are brief descriptions of each of the impacts presented in the table above.

**DISTRICT RESOURCES**

### *1-A Impacts to Water Sources*

1. Reduced Water Allocation
   - Droughts can cause reductions in available supplies and lead to mandatory reductions in water supplies that can impact all BVWD customers.
2. Policy Changes
   - Droughts can trigger both local and Statewide policy changes to address the water shortage. These changes impact both the District and their water users.
3. Groundwater Quantity and Quality
   - Drought can lead to greater dependence on groundwater leading to groundwater overdraft, which can negatively impact groundwater quality.

### *1-B Impacts to Infrastructure*

1. Fire
   - Wildfires can damage facilities, limit access to facilities for proper operation, and cause power outages that constrain use of pumping and treatment equipment.
2. Deferred Maintenance
   - Deferred maintenance occurs during droughts when funding is limited due to lower revenue (from lower water sales) or higher operating costs (due to the need for alternate water supplies). Delaying maintenance puts facilities at greater risk of failure that can lead temporary shutdowns.

### *1-C Impacts to District Finances*

1. Loss of Revenue
   - Loss of revenue, due to lower water sales in droughts, can be felt both intermittently and over prolonged periods.
2. Higher Water Purchase Costs
   - Higher water purchase costs can impact the District if they cannot pass the higher costs on to the customer. In these cases, they create a negative cash flow or reduce the District’s reserves.

**COMMUNITY RESOURCES**

### *2-A Impacts to Private Property*

1. Wildfire
   - Wildfires can damage private property, including crops, soils, domestic wells, buildings, and equipment, and can cause livestock mortality.
2. Deferred Maintenance
   - Maintenance of facilities could be deferred due to drought induced economic hardships. This could increase the chances of equipment or facility failures.
3. Changes in Property Value
   - Higher water costs, landscaping restrictions, limited grazing potential, and recurring drought can impact the attractiveness of real estate resulting in lower

property values.
    - Damage from fire or increased fire risk can also reduce property values.
4. Health and Safety
    - Health and safety can be at risk if minimum water supplies for washing, sanitation, and culinary purposes are not available.
5. Lifestyle Changes
    - These changes can be both subtle and substantial and may include adapting daily household practices to potentially affecting recreational choices and private property landscape opportunities.
6. Increased Costs to Customers
    - Higher water costs could be passed directly on to customers. In addition, fines and penalties for overuse are often enforced during droughts.

### *2-B Impacts to Business and Commerce*

1. Economic Hardship
    - Increased water costs can cause significant hardships for many local businesses.
    - Water scarcity, unreliability, and insecurity can contribute to limited growth potential for certain businesses and communities.
    - Increased unemployment can be a potential result of stunted economic development.
    - Limited investment potential can be seen in areas throughout the Western United States where water scarcity and unreliability has caused property values to drop significantly.
2. Changes in Property Value
    - Higher water costs, landscaping restrictions, limited grazing potential, and recurring drought can impact the attractiveness of real estate resulting in lower property values.
    - Damage from fire or increased fire risks can also reduce property values.
3. Unemployment
    - Drought can lead to economic hardships resulting in potential loss of seasonal or permanent jobs.
4. Lower Agricultural Production
    - Agricultural production can be impacted by reductions in water supplies. Severe water restrictions could lead to agricultural land fallowing.
5. Increased Costs to Customers
    - Higher water costs could be passed directly on to customers. In addition, fines and penalties for overuse are often enforced during droughts.
6. Water Supply Uncertainty
    - Water supply uncertainty increases risks and reduces confidence. This can result in short-term or long-term reductions in investments, growth, or credit.

### *2-C Impacts to the Environment*

1. Wildfire
    - Drought can lead to increased fuel in the form of dry and dead vegetation, thus

increasing the risk of urban, rural, or wildland fires. Wildfires are a significant risk in the area during droughts. In 1999 and 2004, large wildfires occurred in the nearby Jones Valley and over 100 homes were destroyed. With adequate water, urban and agricultural lands can be frequently watered and reduce the threat of fire.

2. Other Impacts
    - Drought affects the environment in many different ways. Plants and animals depend on water, just like people. When a drought occurs, their food supply can shrink, and their habitat can be damaged. Sometimes the damage is only temporary and their habitat and food supply return to normal when the drought is over. But sometimes drought's impact on the environment can last a long time, maybe forever. Examples of environmental impacts include:
        - Losses or destruction of fish and wildlife habitat
        - Lack of food and drinking water for wild animals
        - Increase in disease in wild animals, because of reduced food and water supplies
        - Migration of wildlife
        - Increased stress on endangered species or even extinction
        - Lower water levels in reservoirs, lakes, and ponds
        - Loss of wetlands
        - Wind and water erosion of soils

## 4.5 Assessment of Resource Risk at Different Drought Stages

Table 4-2 includes a matrix of drought impacts versus the drought stages in the District's Water Shortage Contingency Plan. Each impact has a threshold value when they start to occur. Some impacts begin during a minor water shortage, while others are only experienced during a major drought. The matrix was developed based on observations and the practical experience of District staff. The matrix does not include all possible impacts since some cannot be clearly or consistently associated with specific drought stages.

**Table 4-2 – Impacts of Various Drought Stages**

| Impacts | Stage 1 (90 to 100% of Normal demand) | Stage 2 (80-90% of Normal demand) | Stage 3 (70-80% of Normal demand) | Stage 4 (60-70% of Normal demand) | Stage 5 (50-60% of Normal demand) | Stage 6 (Less than 50% of Normal demand) |
|---|---|---|---|---|---|---|
| Reduced Water Allocation | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Policy Changes | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Groundwater Quality and Quantity | | | ✓ | ✓ | ✓ | ✓ |
| Fire | | | ✓ | ✓ | ✓ | ✓ |
| Deferred Maintenance | | | | | ✓ | ✓ |
| Loss of Revenue | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Increased Water Costs* | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Health and Safety | | | | | ✓ | ✓ |
| Lifestyle Changes | | | | | ✓ | ✓ |
| Economic Hardship | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Changes in Property Value | | | | ✓ | ✓ | ✓ |
| Unemployment | | | | | ✓ | ✓ |
| Lower Ag. Production | | ✓ | ✓ | ✓ | ✓ | ✓ |

*This Impact accounts for both increased water purchase costs for the District, as well as increased costs for the customer.

## 4.6 Economic Impacts of Drought

Drought conditions have several economic impacts to both the District and community resources. This became especially apparent during the severe California drought from 2012 to 2016. Following are the primary economic impacts from drought, which are also listed in **Table** 4-1**.**

**Economic Impacts to District**

- Loss of revenue
- Higher water purchase costs

**Economic Impacts to Community**

- Increased costs to customers
- Agricultural land fallowing
- Lower agricultural yield
- Changes in property values
- Economic hardship
- Increased threat of Wildfires

The list above only incudes some the drought impacts from **Table 4-1.** Other impacts are not listed because: 1) They represent non-economic impacts, or 2) due to various uncertainties, it is not practical or feasible to estimate an economic impact. Following are detailed discussions on the various economic impacts.

**Economic Impacts to the District**

**Loss of Revenue.** Water sales in BVWD are reduced during droughts due to both voluntary and mandatory conservation measures imposed by the District. In a severe drought the allocation of "Irrigation Water" under its CVP contract can and has been reduced to zero. In the most recent drought water sales were reduced from 12,400 AF in calendar year (CY) 2013 to 7,100 AF in CY 2014, a reduction of 43%. M&I water sales went from 8,000 AF to 5,700 AF, a reduction of just under 29%, while irrigation water sales went from 4,400 AF to 1,400 AF, a reduction of nearly 69%. The corresponding loss in revenues based on the base usage rates in effect at the time was approximately $600,000 (M&I - $470,000 and Agriculture - $130,000). During 2012-2015, the State imposed severe water use restrictions on most public water agencies, including BVWD. It is expected that these restrictions will increase with recent State legislation, leading to potentially greater revenue losses in future droughts.

During the recent drought, the District did not impose any drought surcharges, in part because they have an M&I Rate Stabilization Fund that can be used to cover revenue shortfalls and because of the revenues generated from penalty charges for overuse.

**Higher Water Costs.** During a drought, water costs are higher than in a normal water year for several reasons. These include:

- Less CVP Contract Water available for sale but little change in District overhead costs
- A reduction in the amount of ACID long-term transfer water being available (1,156 AF when their allocation is reduced versus 1,532 AF when they receive a full allocation)
- An increase in the amount of water produced from the District's groundwater wells which is more expensive to produce and treat than surface water pumped from the Sacramento River
- The purchase of transfer water that is priced much higher during a drought than during a normal water year

These higher costs must either be passed on to the customer or be paid for with District reserves.

**Economic Impacts to the Community**

**Increased Costs to Customers.** During a drought, District M&I customers are normally given a bimonthly allocation of water based on their previous three years of non-drought water usage.

The allocation is based on water use in normal years when water use restrictions are not in place. The drought allocation is some percentage (e.g.., 50%) of normal use.

All water usage up to the bimonthly allocations is charged at the unit price in effect at the time; however, for water usage above the allocation is charged at a tiered penalty rate. In 2015, there were two penalty tiers. Tier 1 was $1.50 per hundred cubic feet ($1.50 per 748 gallons) for usage between 100% and 120% of their bimonthly allocation, Tier 2 was $2.50 per hundred cubic feet for usage that was greater than 120% of their bimonthly allocation.

During severe droughts, the District has received zero allocations for agricultural use, and the District only had sufficient water supplies to cover agricultural customers' normal household use. Agricultural customers that need additional water for crop irrigation must participate in the District's "Supplemental Water" program. That program requires each customer to commit to the purchase of a quantity of water at the market price the District must pay. In 2015, the cost of the supplemental water was $350.00 per AF. The water must be paid for before deliveries begin, and District expenses for delivery of the water are billed after the water is used. Delivery charges for supplemental water in 2014 were $47.04 per AF. At a total cost of approximately just under $400 per acre foot in 2015 versus approximately $45 per acre foot in 2013, the supplemental water was approximately five times the cost of 2013 water rates and presented a significant financial burden to agricultural customers.

**Agricultural Land Fallowing.** Growers may be forced to fallow land if they find it uneconomical to buy supplemental water or if there is insufficient water to grow crops for a full season. **Table 4-3** shows the acreage of primary crops and their estimated harvest value in BVWD.

### Table 4-3 – 2015 Crop Acreage and Value in BVWD

| Crop Name | Acres | Value/Acre | Total Value |
|---|---|---|---|
| Alfalfa/Hay | 409 | $1,200 | $490,800 |
| Vegetables | 38 | $7,500 | $285,000 |
| Irrigated Pasture | 881 | $1,200 | $1,057,200 |
| Grapes, wine | 23 | $6,000 | $138,000 |
| Other fruits | 35 | $5,300 | $185,500 |
| Nuts 2 | 47 | $4,600 | $216,200 |
| Cereals | 36 | $330 | $11,880 |
| Total | 1,489 | | $2,384,580 |

Notes:
1) Source: California Department of Food and Agriculture, *California Agricultural Statistics Review 2017-2018*, 2018
2) Some crop values based on general or similar crop types

Land fallowing is a realistic possibility in BVWD since some lands are planted with annual crops. Damage to or loss of permanent crops is also a possibility. According to the District's annual "Crop and Water Data" reports to Reclamation for the 2014-2015 drought years, in 2014, 1,515 acres were dry cropped, fallowed or idled and in 2015, 1,542 acres were dry cropped, fallowed or idled compared with 1,009 acres reported as being dry cropped, fallowed or idled in 2013. **Table 4-3** shows that the total value of agricultural crops in BVWD is about $2.4 million.

**Lower Agricultural Yield.** Growers may experience lower agricultural yields if they choose to perform intentional deficit irrigation, they cannot water at optimal intervals due to water shortages, or they plant crops and later discover there are insufficient water supplies. Permanent crop owners may choose to deficit irrigate just enough to keep trees and vines alive until the following year. All these options can lead to lower crop yields and revenue.

**Changes in Property Values.** It is not possible to estimate the impact of drought on property values due to the volatility in real estate prices. However, drought can impact property values in several ways. For example, if a moratorium on new developments is enforced during a drought, then undeveloped land may go down in value, while developed land may rise in value. In addition, prospective buyers often want to see copies of local utility bills. High water bills, or knowledge of regular water shortages, may be a consideration in real estate offers. During the 2014-2015 drought, properties without 3-years of water usage history received base water allocations that allowed for very little outdoor use before the customer started incurring penalties for excessive water use, while properties in neighboring water service areas like the City of Redding did not encounter similar penalties. This probably discouraged home purchases within the District during the drought and for some time after drought restrictions were lifted - especially for new home sales.

**Economic Hardship.** Economic hardship can result from loss of revenue, loss of employment opportunities, and increased water and operational costs. Certain businesses that use water in their operations or service sectors will be the greatest impacted. During the 2014-2015 drought, businesses with high and inelastic water demands, like golf courses and breweries, incurred significant expenses for the purchase of more expensive supplemental water to satisfy their water needs and keep their businesses operating.

**Wildfires.** Wildfires have historically occurred in and around BVWD, especially during the summer and fall. Drought conditions greatly increase the risk of wildfires. Within the District, drought conditions can lead to land fallowing; the fallowed land will then convert to dry weeds and vegetation that are easily combustible. Soil and plant moisture can also be lower, which can enhance the ability of a fire to spread. Wildfires can destroy crops, damage private water facilities, erode soils, cause surface water quality problems, cause power outages, and damage District water infrastructure.

The Carr fire of Summer 2018 was at that time the 6$^{th}$ most destructive fire in California history, affecting Shasta and Trinity Counties. Below is a summary of impacts from the fire:

- 230,000 acres burned
- 1,604 structures destroyed
- 277 structures damaged
- 3 deaths
- Total damage of $1.6 billion

The Carr fire did not impact BVWD; however, it did reach the western end of the City of Redding and, therefore, was only within a few miles of BVWD. Similar fires will continue to occur in the future and pose a threat to BVWD.

# 5 Mitigation Actions

## 5.1 Introduction

Mitigation Actions, as defined here, include measures to obtain new water supplies and develop infrastructure projects that improve water supply or reliability during droughts. Demand reduction and water conservation measures are also used to address dry-year water shortages but are addressed in Chapter 6 – Response Actions.

The District has experienced water shortages due to drought conditions on several occasions since 1976. For example, the CVP allocations to the District have been less than 100% in 14 out of 33 years, with cutbacks of 25% or more to M&I supplies and 50% or more to Irrigations supplies in 9 of those years. The impacts from supply shortages are discussed in more detail throughout Chapter 3 -Vulnerability Assessment.

In response to these cutbacks in its primary source of water, the District has had to seek both additional supplies of water and implement demand reduction measures to ensure that it had adequate supplies to meet its customers' water needs. In the past, these water shortage mitigation measures have included: development of additional groundwater supplies, short-term water transfers, and long-term transfers. Demand reduction measures have included restrictions on water use, drought surcharges, and penalties for overuse.

This chapter assesses current mitigation actions and identifies and evaluates potential new mitigation actions. The primary topics discussed in this chapter include:

- Assessment of Existing Mitigation Measures
- Establishment of Mitigation Goal
- Potential Mitigation Projects
- Priority of Mitigation Projects
- Conceptual Evaluation of Priority Projects

## 5.2 Assessment of Existing Mitigation Measures

The District's current water supplies were discussed in Chapter 4 – Vulnerability Assessment. **Figure 4-7** compared available CVP water supplies to normal annual demand of approximately 10,000 acre-feet and showed that CVP water supplies alone would be able to meet normal demand if the CVP allocations were equal to or greater than 75%/30% for M&I/Irrigation (i.e., 75% for M&I and 30% for Irrigation). However, as recent years have shown, CVP allocations can be much lower than the 75%/30% levels. In 2014 and 2015 the allocations were 50%/0% and 25%/0%, respectively. Fortunately, the District is not solely reliant on its CVP contract supplies.

In response to the 1990-1992 drought, the District took several actions to be better prepared for future droughts. These actions primarily included: 1) development of additional groundwater supplies (two new wells) along with the installation of treatment systems for iron and manganese removal on all of its wells so that they could be utilized without creating water quality problems in the distribution system and 2) execution of a long-term transfer agreement with the Anderson-Cottonwood Irrigation District to increase the reliability of M&I water supplies. These actions are both discussed below.

**Groundwater Wells**

The District currently has five groundwater production wells with a combined capacity of between four and five million gallons per day (12 and 15 acre-feet per day). The wells are all located in the Enterprise sub-basin of the Redding Basin.

In normal supply years the wells are run for less than 60 days (typically during low-demand winter months when they can meet the entire demand of the District) producing a total of less than 200 acre-feet of water. This represents approximately two percent of the District's annual water production. In a normal water-year, the wells can meet the water demands of the District during the low demand months of November through March. However, in drought years like 2015 and 2016 when there was little rainfall in January and February, peak-day water demands in January, February, and March often exceeded the total production capacity of the wells. Additional treated water storage would be required in order to be able to meet peak-day water demands during the November through March period solely with well water.

During the 2015 and 2016 drought years, as a result of demand reduction measures and the procurement of additional water supplies through short-term water transfers, the District only needed to produce 432 and 521 acre-feet of water, respectively, from its wells to satisfy its water demands. In a future drought, the District estimates that the existing wells would be able to produce approximately 3,000 acre-feet of water annually.

Due to the high cost for the operation and maintenance of the wells, the annual expenses for the groundwater wells are borne almost exclusively by the District's M&I rate payers (a small fraction of the expense is included in the cost calculation for the 0.5 acre-feet of M&I water that is included in the Agricultural base rate).

**Anderson-Cottonwood Irrigation District (ACID) Long-Term Transfer Contract Supplies**

The District's long-term transfer agreement with ACID provides for the transfer of 1,536 acre-feet of water during a normal year. However, the amount of water available during a severe drought would likely be reduced by 25%, from 1,536 acre-feet to 1,152 acre-feet. As is the case with well water, due to the high cost of ACID water, the annual expenses for the ACID long-term transfer water are borne almost exclusively by the District's M&I rate payers (only a small fraction of the expense is included in the cost calculation for the 0.5 acre-feet of M&I water that is included in the Agricultural base rate).

**Supplemental Water Program**

In order to provide water supplies that meet at least some of the needs of its Agricultural customers when CVP Irrigation allocations are severely reduced, the District developed a "Supplemental Water Program." Under this voluntary program, Agricultural water users are asked to indicate how much water they need and indicate how much they are willing to pay for the water. The District then attempts to purchase "supplemental" water on the transfer water market. Unfortunately, due to the District's diversion point on the Sacramento River (in the middle of the zone of critical habitat designation), the District has only a few suppliers from which to seek transfers.

There are no guarantees that the quantities of water that the District's Agricultural customers want will be available at the price they are willing to pay. One of the purposes of this Drought Contingency Plan is to develop options for the District in their pursuit of more reliable supplies to mitigate future droughts.

**Total of Existing Non-CVP Contract Supplies**

In a normal year, the District's wells in combination with the Long-Term ACID transfer provide an average of 1,892 acre-feet of water. While in a water shortage year the combination of the ACID transfer and 3,000 acre-feet from the wells could produce up to 4,150 acre-feet of water (this assumes that the ACID transfer amount is reduced to 1,152 AF) to supplement the reduced amount of CVP contract supplies available during a severe drought. As discussed above, the expenses for the well supplies and the ACID transfer water are paid by the M&I users. Although these supplies are dedicated for M&I usage, they provide an indirect benefit to the agricultural users by augmenting the reduced CVP Contract supplies and enabling the District to meet its M&I and Agricultural demand even when the Irrigation allocation is severely reduced.

When CVP allocation is below 75%/25% (M&I/Irrigation), the District cannot meet its normal year water demands (of 10,000 AF) without augmenting its water production by water transfers and/or increasing its groundwater production. This is the point where the District would activate its Supplemental Water Program and determine how much of the more expensive water Ag customers would be willing to commit to purchasing.

Based on the District's current water demands (M&I + Irrigation) of approximately 10,000 AF/year, the 4,150 acre-feet of ACID and well production would enable the District to meet current demands without short-term water transfers as long as the CVP allocation was 60%/10% for M&I/Irrigation or greater.

In cases of extreme shortage, like that experienced in 2014 and 2015, the CVP allocations were 50%/0% M&I/Irrigation for the 2014 water year and 25%/0% M&I/Irrigation in the 2015 water year. Under these extreme circumstances, the combined supplies of CVP M&I water plus the District's existing mitigation measures would only be able to supply 7,499 AF (at the 50%/0% M&I/Irrigation allocation) and only 5,826 AF (at the 25%/0% M&I/Irrigation allocation). Thus, the District could potentially meet 100% of its historical M&I demand at the 50%/0% allocation and have a limited amount of well water (499 AF) available for its Supplemental Water Program. At the 25%/0% allocation, the District could meet approximately 80% of its normal M&I demand but none of its AG demand without short-term water transfers. At this point, District M&I customers would need to be under mandatory water conservation measures. In order to supply anything other than water for household use to its agricultural customers, the District would have to rely on its Supplemental Water Program.

In summary, the existing mitigation actions can provide drought protection of up to 4,150 acre-feet of water annually. Table 5-1 (below) summarizes the amounts of water available to the District from the above water supplies under potential CVP water shortage allocations based on historical CVP usage for water years 2017, 2018, and 2019.

## Table 5-1 – District Supplies during Various CVP Allocations

| CVP North of Delta Allocations | | BVWD Allocations in Acre-Feet | | | BVWD Water Supplies | | | | | Shortfall |
|---|---|---|---|---|---|---|---|---|---|---|
| M&I | Irrigation | M&I[1] | Allocation at the Irrigation Rate: Based on Historical Agricultural Usage | Allocation at the Irrigation Rate: Based on the Remainder of the Contract | BVWD's Contract Total CVP Supply | ACID Long-Term Contract Supply[2] | Total Water Supply without Wells | BVWD Well Supplies[3] | Total Water Supply with Wells | |
| 100% | 100% | 6,649 | 2,942 | 14,987 | 24,578 | 1,536 | 26,114 | 356 | 26,470 | 0 |
| 100% | 95% | 6,649 | 2,795 | 14,238 | 23,682 | 1,536 | 25,218 | 356 | 25,574 | 0 |
| 100% | 90% | 6,649 | 2,648 | 13,488 | 22,785 | 1,536 | 24,321 | 356 | 24,677 | 0 |
| 100% | 85% | 6,649 | 2,501 | 12,739 | 21,889 | 1,536 | 23,425 | 356 | 23,781 | 0 |
| 100% | 80% | 6,649 | 2,354 | 11,989 | 20,992 | 1,536 | 22,528 | 356 | 22,884 | 0 |
| 100% | 75% | 6,649 | 2,207 | 11,240 | 20,096 | 1,536 | 21,632 | 356 | 21,988 | 0 |
| 95% | 70% | 6,317 | 2,059 | 10,491 | 18,867 | 1,536 | 20,403 | 356 | 20,759 | 0 |
| 90% | 65% | 5,984 | 1,912 | 9,741 | 17,638 | 1,536 | 19,174 | 356 | 19,530 | 0 |
| 85% | 60% | 5,652 | 1,765 | 8,992 | 16,409 | 1,536 | 17,945 | 356 | 18,301 | 0 |
| 80% | 55% | 5,319 | 1,618 | 8,243 | 15,180 | 1,536 | 16,716 | 356 | 17,072 | 0 |
| 75% | 50% | 4,987 | 1,471 | 7,493 | 13,951 | 1,536 | 15,487 | 356 | 15,843 | 0 |
| 75% | 45% | 4,987 | 1,324 | 6,744 | 13,055 | 1,536 | 14,591 | 356 | 14,947 | 0 |
| 75% | 40% | 4,987 | 1,177 | 5,995 | 12,158 | 1,536 | 13,694 | 356 | 14,050 | 0 |
| 75% | 35% | 4,987 | 1,030 | 5,245 | 11,262 | 1,536 | 12,798 | 356 | 13,154 | 0 |
| 75% | 30% | 4,987 | 883 | 4,496 | 10,366 | 1,536 | 11,902 | 356 | 12,258 | 0 |
| 75% | 25% | 4,987 | 736 | 3,747 | 9,469 | 1,152 | 10,621 | 356 | 10,977 | 0 |
| 70% | 20% | 4,654 | 588 | 2,997 | 8,240 | 1,152 | 9,392 | 608 | 10,000 | 0 |
| 65% | 15% | 4,322 | 441 | 2,248 | 7,011 | 1,152 | 8,163 | 1,837 | 10,000 | 0 |
| 60% | 10% | 3,989 | 294 | 1,499 | 5,782 | 1,152 | 6,934 | 3,066 | 10,000 | 0 |
| 55% | 5% | 3,657 | 147 | 749 | 4,553 | 1,152 | 5,705 | 3,000 | 8,705 | 1,295 |
| 50% | 0% | 3,325 | 0 | 0 | 3,325 | 1,152 | 4,477 | 3,000 | 7,477 | 2,523 |
| 45% | 0% | 2,992 | 0 | 0 | 2,992 | 1,152 | 4,144 | 3,000 | 7,144 | 2,856 |
| 40% | 0% | 2,660 | 0 | 0 | 2,660 | 1,152 | 3,812 | 3,000 | 6,812 | 3,188 |
| 35% | 0% | 2,327 | 0 | 0 | 2,327 | 1,152 | 3,479 | 3,000 | 6,479 | 3,521 |
| 30% | 0% | 1,995 | 0 | 0 | 1,995 | 1,152 | 3,147 | 3,000 | 6,147 | 3,853 |
| 25% | 0% | 1,662 | 0 | 0 | 1,662 | 1,152 | 2,814 | 3,000 | 5,814 | 4,186 |
| 20% | 0% | 1,330 | 0 | 0 | 1,330 | 1,152 | 2,482 | 3,000 | 5,482 | 4,518 |
| 15% | 0% | 997 | 0 | 0 | 997 | 1,152 | 2,149 | 3,000 | 5,149 | 4,851 |
| 10% | 0% | 665 | 0 | 0 | 665 | 1,152 | 1,817 | 3,000 | 4,817 | 5,183 |
| 5% | 0% | 332 | 0 | 0 | 332 | 1,152 | 1,484 | 3,000 | 4,484 | 5,516 |
| 0% | 0% | 0 | 0 | 0 | 0 | 1,152 | 1,152 | 3,000 | 4,152 | 5,848 |

Notes:

1. Per the *"Central Valley Project Municipal and Industrial Water Shortage Policy Guidelines and Procedures"* the District can request an adjustment to their allocation based on its historical well production in unconstrained years. If approved by Reclamation this would increase the historical M&I production by 356 AF to 7,005 AF (based on the 2017-18, 2018-19 and 2019-2020 water years). The M&I allocations shown in this table would inrease accordingly (e.g., at the 50% allocation percentage the M&I allocation would increase by 50% x 356 AF = 178 AF).
2. The table assumes that the amount of water available from ACID Long-Term Transfer is reduced by 25% when the Irrigation allocation is reduced to 25%.
3. Well production in a normal year = 356 AF; well production ramps up to meet demands until it reaches its limit of 3,000 AF.

## 5.3 Establishment of Mitigation Goal

To assist in future planning, the District has set a dry-year mitigation goal, or in other words, a goal for the yield (AF/year) of existing and future mitigation projects during droughts. In establishing a mitigation goal of new water, one must consider several factors including:

1. The severity of future CVP allocation cutbacks anticipated
2. The amount of water cutbacks the District's customers is both willing and able to achieve
3. The costs for each incremental quantity of new water yield

Based on the District's experience during the 2014-2015 drought, a CVP allocation of 50%/0% M&I/Irrigation can be reasonably expected during the first year of a drought and an allocation of 25%/0% M&I/Irrigation is a reasonable expectation during the second year of a severe drought. If a severe drought were to continue for a third year, it is possible that the District's CVP allocation could be reduced even lower (possibly down to zero).

When the CVP allocations are severely curtailed, the allocation to the District would be reduced to either the "North of Delta" M&I allocation percentage or the amount required for "Public Health and Safety," whichever is greater.

According to the M&I Water Shortage Policy, Public Health and Safety needs is defined and calculated as follows:

**PUBLIC HEALTH AND SAFETY:** The amount of water determined to be necessary to sustain PHS is currently calculated to equal *D+ CI + I + L*

Where:

Domestic use (D) = Current Population X 55 gallons per capita per day

Commercial and Institutional (CI) = 70% of Projected Commercial Demand

Industrial (I) = 70% of Projected Industrial Demand

System (Conveyance) Losses (L) = 10%

Based on the District's reported 2019 population of 19,270 and historical commercial and institutional usage of 1,444 AF, the current (2020) PHS needs of the District are 2,418 AF as calculated below.

Population of 19,270 people x 55 gallons per day = 1,187 AF

Commercial, Institutional and Industrial Use of 1,444 AF x 70% = 1,011 AF

Subtotal of 2,198 AF

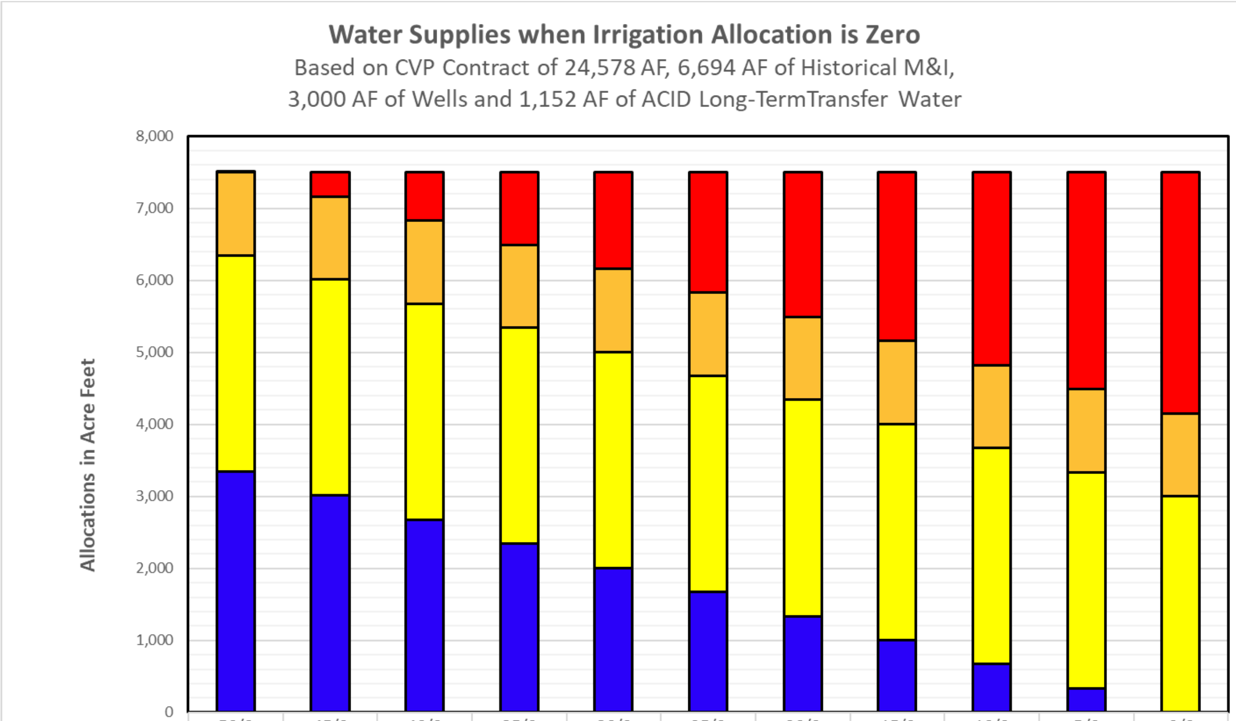
Conveyance Loss of 10% was applied (2,198 x0.10) = 220 AF

Total Estimated Demand of 2,198 AF + 220 AF = 2,418 AF

Because the District can meet the calculated Public Health and Safety (PHS) demand using non-CVP water supplies (the District's groundwater wells), the District does not qualify for an adjustment in its CVP water allocation to meet Public Health and Safety needs. As a result, as long as the annual production capacity of the District's wells exceeds the calculated PHS demands, the District will receive the North of Delta M&I allocation (which could theoretically be reduced to zero).

For the purposes of this plan, it is assumed that the District's existing Supplemental Water Program will continue to be used as the primary mitigation action for agricultural irrigation supplies whenever the CVP water allocation for Irrigation is reduced to fifteen percent or less. The following discussion of mitigation goals will therefore address only additional water supplies needed to meet municipal and industrial needs.

Under the CVP M&I Water Shortage Policy (WSP) when the Irrigation allocation is reduced to zero, the M&I allocation is 50%. The M&I allocation may be reduced below 50% as it was in 2015, when it was reduced to 25%. In fact, it can be reduced to the level that in combination with non-CVP water supplies meets Public Health and Safety (PHS) needs. As discussed above, for the 2019-20 water year the District's PHS needs were 2,418 acre-feet. **Figure 5-1** shows the resulting water supplies when the CVP allocation for M&I allocations from 50% to 0% (in 5% increments).




| | 50/0 | 45/0 | 40/0 | 35/0 | 30/0 | 25/0 | 20/0 | 15/0 | 10/0 | 5/0 | 0/0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M&I Shortfall | 1 | 336 | 670 | 1,005 | 1,340 | 1,675 | 2,009 | 2,344 | 2,679 | 3,013 | 3,348 |
| ACID | 1,152 | 1,152 | 1,152 | 1,152 | 1,152 | 1,152 | 1,152 | 1,152 | 1,152 | 1,152 | 1,152 |
| Wells @ 3,000 AF | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 |
| M&I | 3,347 | 3,012 | 2,678 | 2,343 | 2,008 | 1,674 | 1,339 | 1,004 | 669 | 335 | 0 |

CVP Allocation Percentages

**Figure 5-1 – Water Supplies when Irrigation Allocation is Zero**

Prior to 2015, the lowest M&I allocation that the District had ever received was 50% of historical, and many assumed that was the lower threshold for CVP M&I allocations. However, with the 25% allocation for M&I in 2015, it was clear that the new threshold is public health and safety (PHS) demands. Fortunately, the District's long-term transfer from ACID is considered a CVP supply and is not counted when calculating the District's non-CVP supplies. Unfortunately, as previously discussed, the District's well supplies are included when calculating the District's CVP water supplies necessary to meet PHS needs.

While the CVP M&I WSP establishes a minimum water supply requirement to meet Public Health & Safety, it is the District's goal to provide more than the minimum amount of water required to meet basic human needs. The District recognizes that many customers have made significant investments in landscaping, and many have vegetable gardens and fruit trees. Many landowners also have livestock, horses, and other animals that need water to survive; and many utilize evaporative coolers that use less energy than air conditioners to cool their homes.

During periods of severe reductions in CVP contract supplies, it is recognized that the District's supplies (from all its sources of supply) will not be able to meet normal demands and that extraordinary water conservation measures will need to be implemented to balance supplies with demands. During recent drought periods, the District's customers have demonstrated the ability to achieve significant reductions in their water usage.

While the table in **Table 5-1** shows an "M&I Shortfall" of approximately 2,850 AF when the District's CVP M&I allocation is reduced to zero, it would require a tremendous expenditure of money to develop the water supplies necessary to provide this quantity of water. It is more reasonable to use a combination of increased water supplies and demand reduction (i.e., water conservation) measures to balance water supplies with water demands. If one assumes that water demands can be reduced by 25% or more through extreme water conservation (this was achieved in Water Years 2013-2015), then the M&I water needs would be reduced from 7,000 AF per year to approximately 5,250 AF/year. Based on approximately 4,150 AF/year of existing supplies (3,000 AF of groundwater and 1,152 AF of ACID long-term transfer water), that would mean that the District's mitigation goal to meet current M&I demands would need to be approximately 1,100 AF/year. This represents the minimum goal to meet. Exceeding this goal would provide desired redundancy and flexibility in the District's operations.

District Drought Mitigation Goal = 1,100 AF/year

## 5.4 Potential Mitigation Projects

Potential mitigation projects are shown in the figure below. These could be developed individually or in combination:

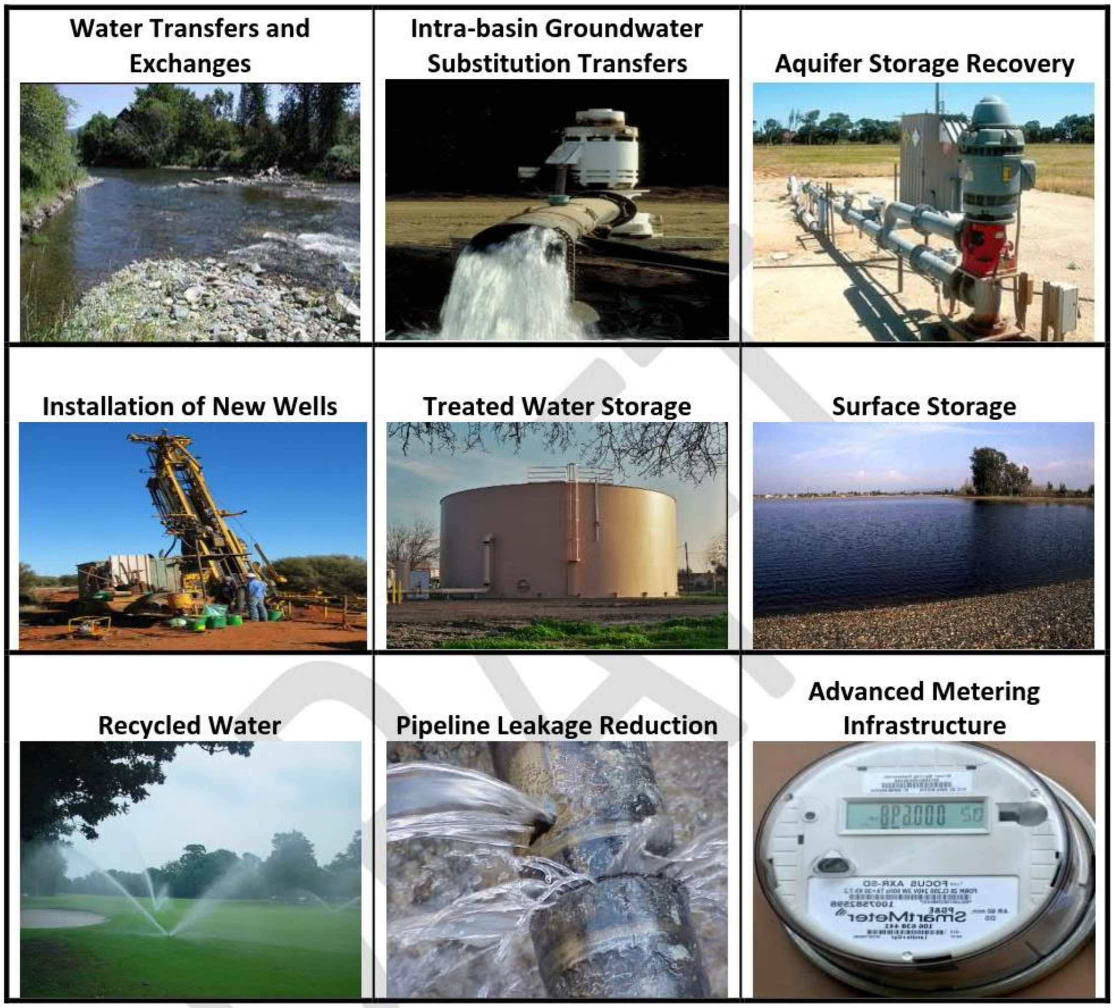



**Figure 5-2 – Potential Mitigation Projects**

**Water Transfers and Exchanges**

*Discussion:* The District has an existing long-term transfer with the Anderson-Cottonwood Irrigation District for 1,536 AF/year that is subject to a reduction of up to 25% (up to 1,152 AF/year) in dry years (as determined by the Shasta Inflow Index). In previous drought years the District has also entered into short-term water transfers with ACID to both augment M&I supplies and to provide water for Agricultural water users under the District's Supplemental Water program.

The District has also entered into short-term water transfer agreements with the McConnell Foundation and the City of Redding during previous droughts. However, there is no certainty that the quantity of water that the District needs will be available and, if available, what the price of that water would be. Under drought conditions, it is a seller's market and those with water to transfer can dictate the terms and conditions under which water would be available. Furthermore, due to the District's location just downstream of Keswick Dam, transfers with downstream agencies result in a loss of in-stream flow benefit and are typically not approved. While the District should continue to pursue water transfers if the terms are reasonable, the District generally cannot rely on transfer water being available during drought periods with certainty.

*Conclusions:* Water transfer opportunities are limited especially during dry periods. However, if terms of transfers are reasonable, and there is some potential for regulatory approval, they should be considered by the District.

**Intra-basin Groundwater-Substitution Transfers**

*Discussion:* Groundwater-substitution transfers can be utilized as a drought mitigation technique but can require extensive permitting, monitoring, and mitigation. Groundwater-substitution transfers involve one entity meeting their water demand needs by replacing their allocated surface water diversions with groundwater pumping and transferring the unused surface water to another entity. Two potential partners for groundwater-substitution transfers include ACID and the City of Redding.

Brewster (2017) discusses 11 successful groundwater-substitution transfers from 2014-2015 within the State of California, ranging in total volume transferred from 1,500 AF to a maximum of 9,500 AF. The volume of transferable water allowed is a function of the amount of water pumped minus the extent this pumping causes an impact on timing or decrease in surface streamflow (DWR and Reclamation 2013). Historically, 88% - 92% of the total groundwater volume pumped has been available for transfer as a surface water delivery by the State Water Resources Control Board (Scharf 2016).

Prior to commencing a transfer, an agency must identify a water right holder with enough dry-year surface water and who is also linked by existing water conveyance infrastructure. The regulatory requirements to approve these transfers can be expensive and time-consuming. The agency must abide by rules, regulations and policies set by the trading partner, State or Federal government, local Groundwater Sustainability Agency, and the local county (if county jurisdiction applies).

A groundwater-substitution transfer proposal with a pre-1914 water right holder, like the ACID, must submit evidence for no third-party impacts to Reclamation and DWR. The parties must provide evidence that the transfer will result in a calculated and measured amount of water transferred, protect instream beneficial uses, and cause no injury to other legal water users Topics covered in the proposals include:

- Documentation of surface water rights
- Method of quantification for surface water available to transfer
- Location and characteristics of the wells proposed for use in pumping groundwater
- Proposed volume and schedule of transfer-related groundwater pumping
- Monitoring plan designed to assess the effects of the transfer, including:
    - Monitoring well network
    - Groundwater pumping measurements
    - Groundwater levels
    - Groundwater quality
    - Land Subsidence
    - Coordination Plan
- Mitigation plan designed to alleviate possible third-party impacts

*Conclusions:* Groundwater-substitution transfers provide an option for drought mitigation. However, the success of these transfers depends on the District's ability to locate a trading partner with enough surface water and a mechanism for a transfer. Permitting and regulatory requirements can be extensive. The regulatory approval burden could increase in the next few years since Groundwater Sustainability Agencies may begin implementing additional restrictions.

**Aquifer Storage and Recovery**

*Discussion:* During the 2014-2015 drought, the District conducted a short-term aquifer storage and recovery (ASR) demonstration study. As part of the study, the District injected treated surface water into the ground at one of its wells (Well No. 2) at the end of the 2014 CVP water year. Then at the start of the following CVP water year, the District started running its wells in order to recover the water that was injected and to augment its water supplies during for the 2015 CVP water year.

The study demonstrated the feasibility of injecting and recovering most of the water on a short-term basis. However, since the District overlies only a small portion of the Redding Groundwater Basin any water injected by the District on a long-term basis would be subject to being extracted by the numerous private wells and public water supply wells that extract water from the local groundwater basin, and unrecoverable by the District.

A more practical option for carrying over water from one CVP water year to the next would be for Reclamation to allow the District to run its wells during the final months of the water year and "bank" that quantity of water in Lake Shasta for use in the following water year. If the District could bank the amount of water that is normally used during the months of January and February, it would allow the District carry over approximately 400 to 500 acre-feet of water for use during the following water year. However, in recent years Reclamation has not allowed BVWD to carryover any supply into the following water year.

*Conclusions:* Aquifer Storage and Recovery offers potential for short-term storage of supplies, which can prevent loss of some water if it's only available during a short period. In general, it is not suitable for long-term water storage or preparing for multi-year droughts.

**Installation of New Wells**

*Discussion:* In the early 1990s, BVWD drilled and developed several new wells order to augment its supplies during that drought period. Lawrence and Associates performed several studies and concluded that the development of additional groundwater supplies within the District capable of furnishing up to 24 million gallons per day (mgd) (75 acre-feet/day) was feasible. The studies also estimated that the yield from new wells could be anticipated to be approximately the same as the District's existing wells.

While the two wells that the District went on to develop in 1991-1992 provided much needed supplemental water supplies, their yield was less than previously existing wells. The combined production of the two new wells was approximately 1,300 gallons per minute (gpm) (5.75 AF/day), or an average of 650 gpm, compared to an average production of approximately 800 gpm (3.5 AF/day) for the District's previously existing wells. Due to the urgency to develop these new supplies (during the middle of a drought), the wells were drilled at sites that could be readily acquired and were not necessarily the best locations for high producing wells.

According to the Lawrence and Associates studies, the best locations for drilling new wells are along the southern boundary of the District's service area. In July 2016, Lawrence and Associates provided the District with updated maps of the southern portion of the District's service area showing aquifer permeabilities, depth to the Chico Formation (salt water), and predicted well yields. These maps confirm the earlier study's recommendations for the location of new wells near the southern boundary of the District.

The District is an active member of the Enterprise-Anderson Groundwater Sustainability Agency and the Management Committee for the development of the Enterprise Sub-basin Groundwater Sustainability Plan. This plan is currently under development and is required to be completed by January 31, 2022. All groundwater related activities by the District, including the siting and design of new production wells, will incorporate all requirements of the Sustainable Groundwater Management Act and the associated Sustainable Groundwater Management Plan for the Enterprise Sub-basin.

The District's existing wells can produce approximately 12 AF/day, and water usage demands typically are less than this amount for more than five months of the year. **Figure 5-3** shows the daily water production for the 2017, 2018, and 2019 water years.

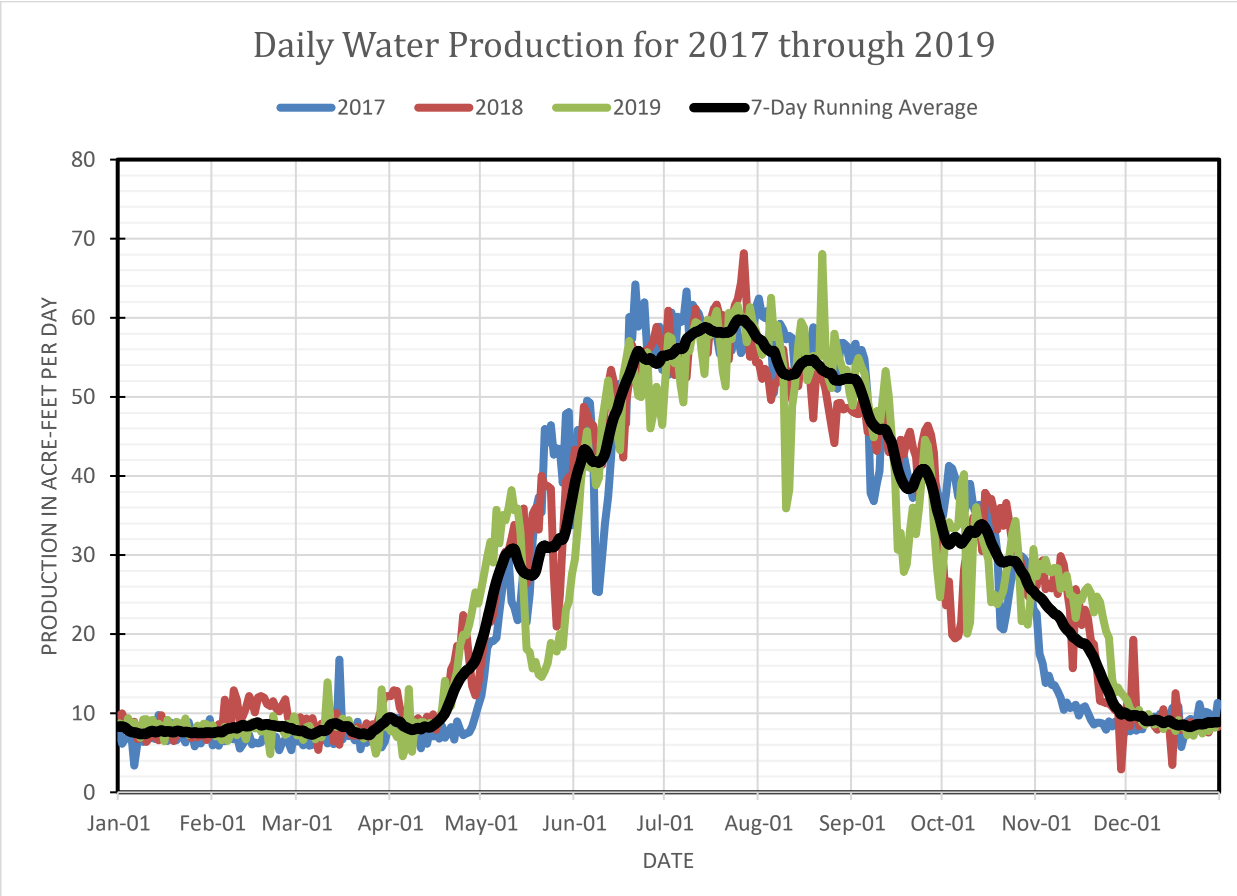
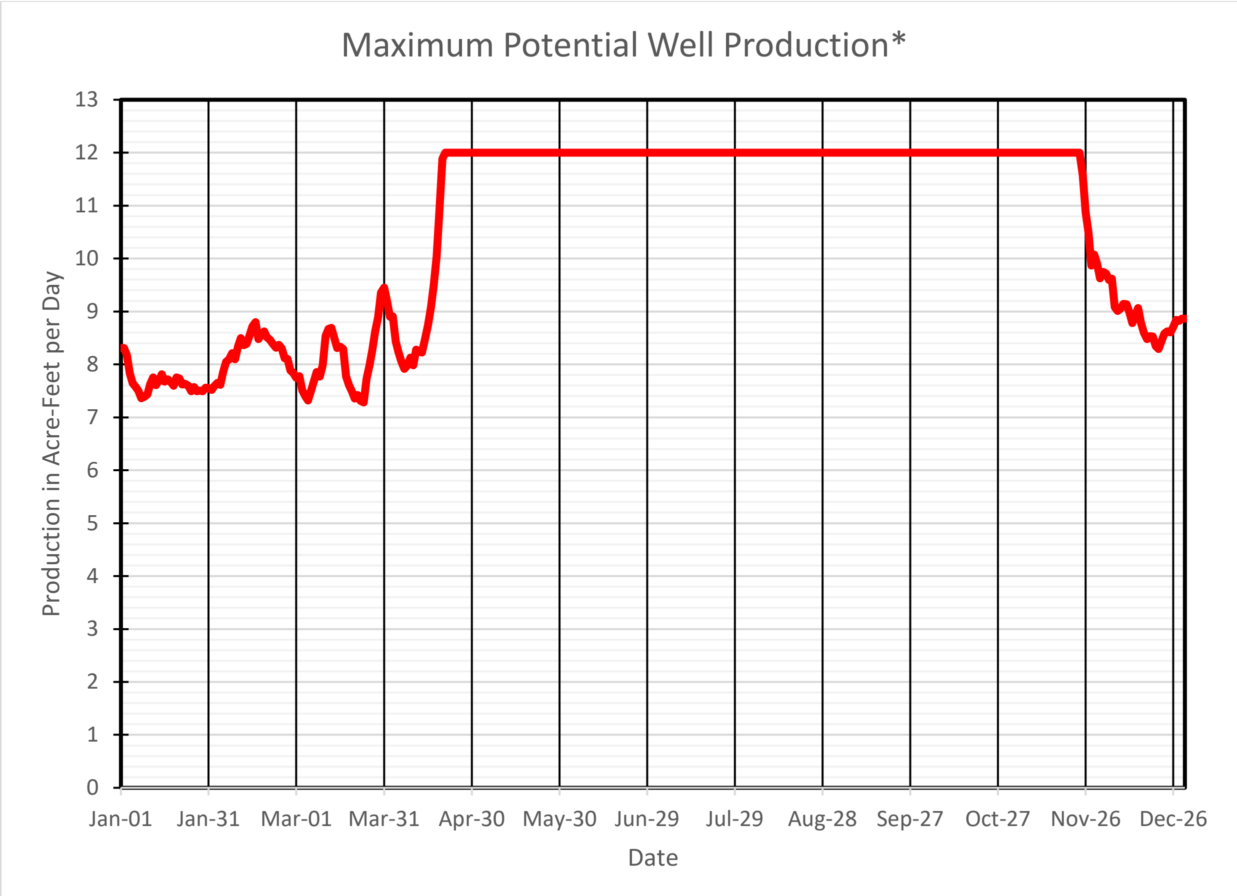



**Figure 5-3 – Daily Water Production for 2017 through 2019**

**Figure 5-4** shows what the maximum potential annual well production could be based on the 7-day running average of the 2017, 2018, and 2019 water years assuming that all of the District's wells are available throughout the year and assuming the District's wells could supply all daily demands of up to 12 AF/day. Based on these assumptions the total annual well production represented in the figure is 4,065 acre-feet. Note that from late November through mid to late April the demands are normally less than 12 AF/day.

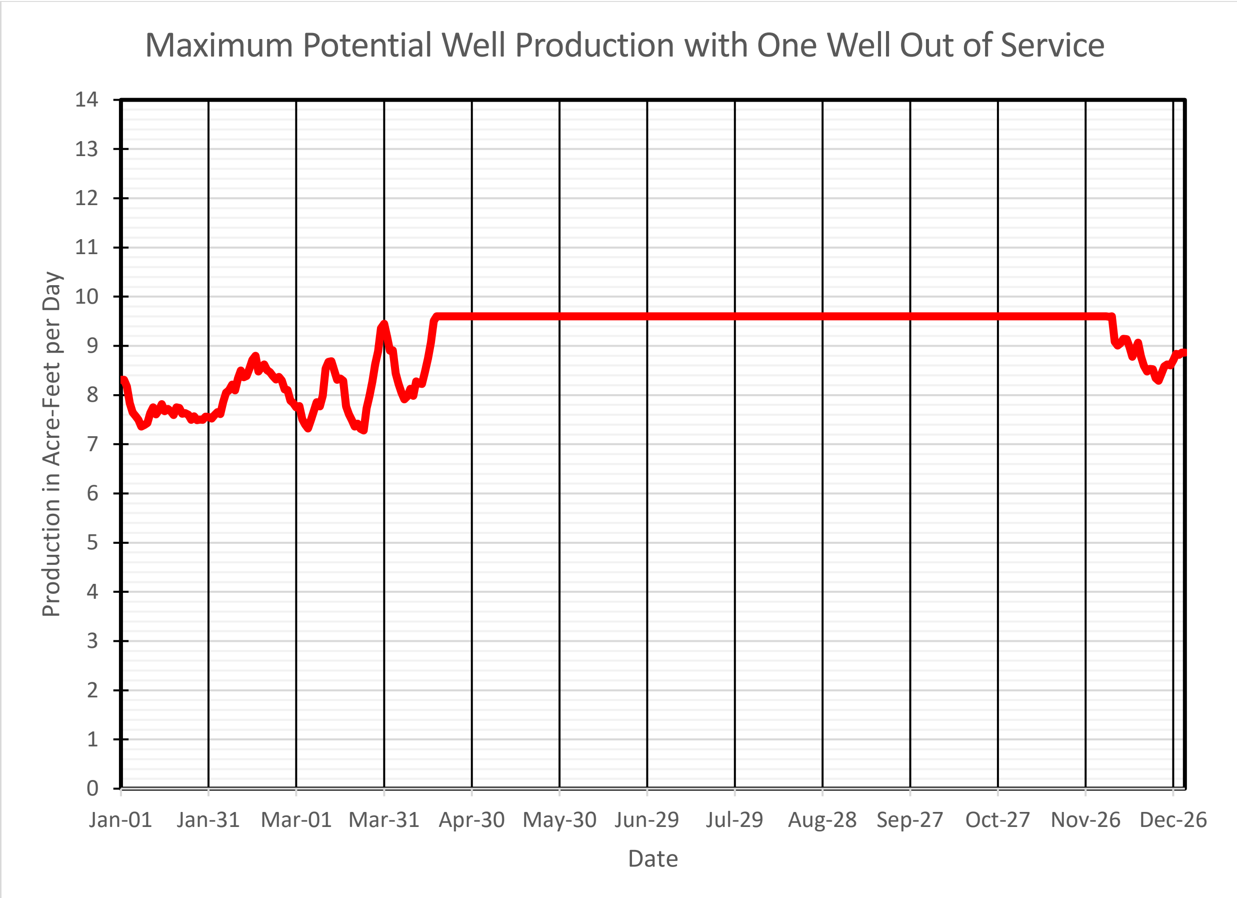



*Based on Average Daily Water Production for the 2017 through 2019 Water Years and all wells in service throughout the high usage spring-fall months

### Figure 5-4 – Maximum Potential Well Production

However, an allowance must be made for downtime due to equipment failures, repairs, routine maintenance, sludge removal, power outages (including Public Safety Power Shutoff events), etc.

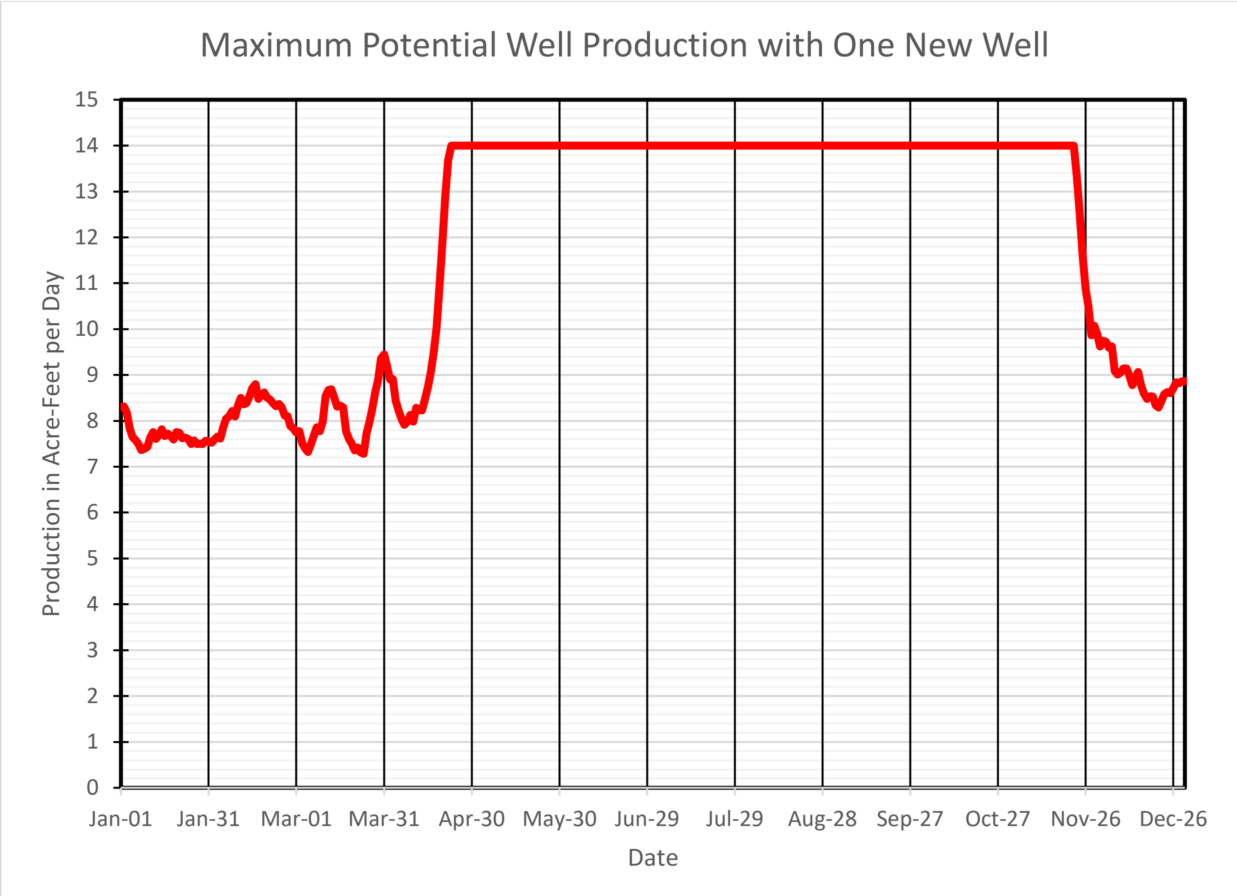
If it is assumed that one well is out of service at any given time for maintenance, repairs, or just to rest the well (i.e., that 4 of the District's wells are operational at all times), then the maximum daily production would drop to approximately 9.6 AF per day (9.6 = 4/5$^{ths}$ of 12). **Figure 5-5** shows the maximum potential well production based on the 9.6 acre-feet daily maximum and the total annual well production represented in this figure is 3,315 acre-feet. As one can see in the above graph, well production in a normal year is limited by daily demands of less than 12AF/day from late November through late April (a period of approximately 150 days). During a drought year one would expect water demands to increase earlier and not drop off until later in the fall thereby providing the opportunity for increased well production for more than the 215 days of higher demands in a normal year.




*Based on Average Daily Water Production for the 2017 through 2019 Water Years and 4 out of 5 wells in service throughout the high usage spring-fall months

### Figure 5-5 – Maximum Potential Well Production with One Well Out of Service

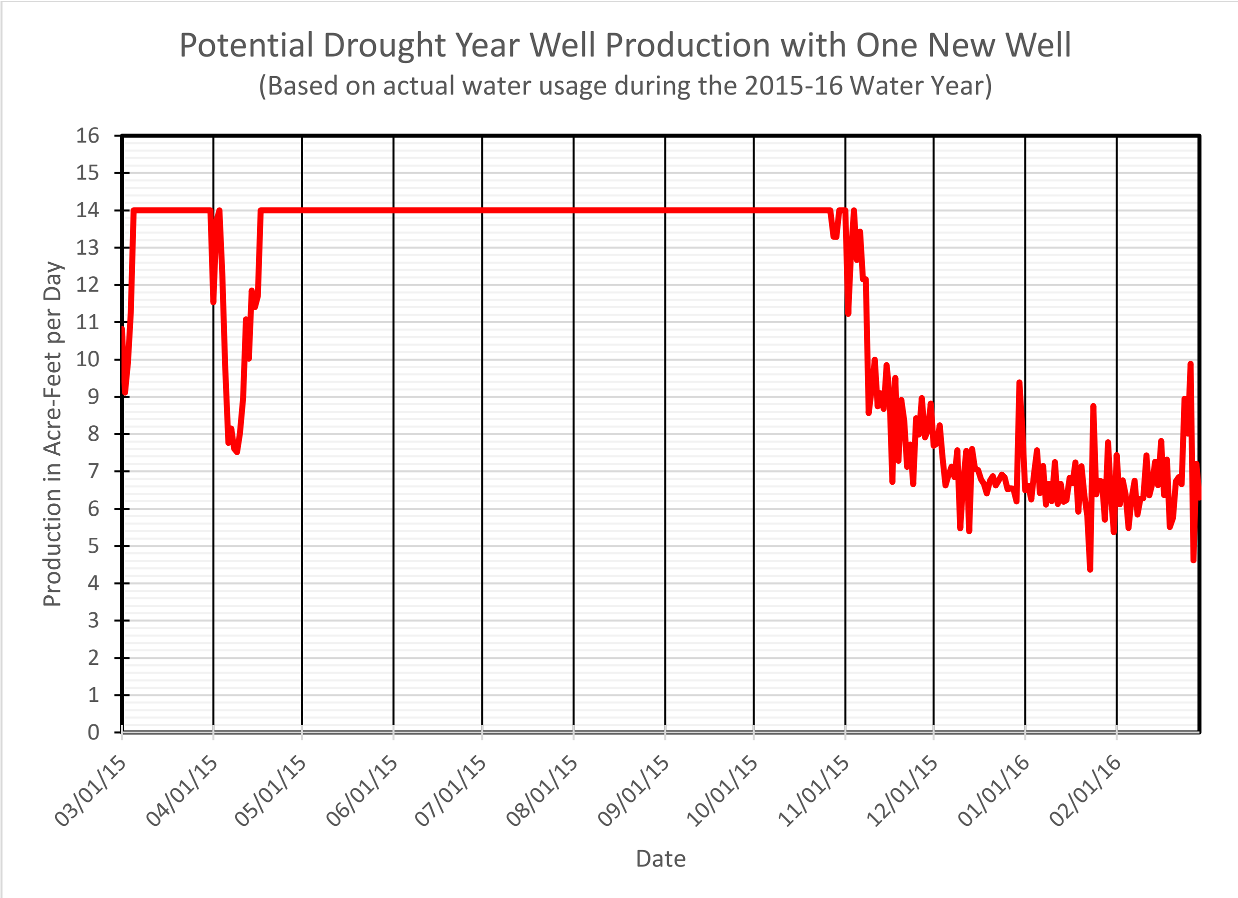
If the District were to construct one new well capable of producing 1,100 gpm (4.84 AF/day), this would bring the maximum daily production up to approximately 16.8 AF/day and based on an average of one well out of service at any given time the resulting maximum daily production would be approximately 14.0 AF/day (14.0 = 5/6$^{ths}$ of 16.8). The resulting graph for the maximum potential well production is shown in **Figure 5-6,** and the total annual well production represented in this figure is 4,280 acre-feet, providing an additional 965 AF/year of well water supplies compared with the District's current well supplies.




*Based on Average Daily Water Production for the 2017 through 2019 Water Years and 5 out of 6 wells in service throughout the high usage spring-fall months

**Figure 5-6 – Maximum Potential Well Production with One New Well**

In order to determine what the potential impact of one new 1,100 gpm well would be during a drought year, water production data for the 2014-15 water year (a drought year) were utilized to produce the following graph (**Figure 5-7**). The total annual well production represented in this figure is 4,259 acre-feet. This is an increase 1,040 AF/year of well water supplies compared with the District's current well supplies (based on 2015-16 water usage). It must be noted that in order to maximize the production from the wells, the new well and all of the District's existing wells would need to be added to the District's SCADA system.




*Based on Daily Water Production for the 2014-15 Water Year and 5 out of 6 wells in service throughout the high usage spring-fall months

**Figure 5-7 – Potential Drought Year Well Production with One New Well**

*Conclusions:* The construction of one new well capable of producing 1,100 gpm (4.84 acre-feet/day) would increase the maximum annual production from the wells from an estimated 3,219 AF to 4,259 AF (an increase of approximately 1,040 acre-feet). This would have a significant impact on the District's water supplies in an extreme drought. **Figure 5-8** shows that at a 20% M&I allocation and 0% Irrigation allocation the shortage for M&I users would only be approximately 230 acre-feet. At a 0/0 allocation the shortage would be approximately 1,600 AF or approximately 23 percent.

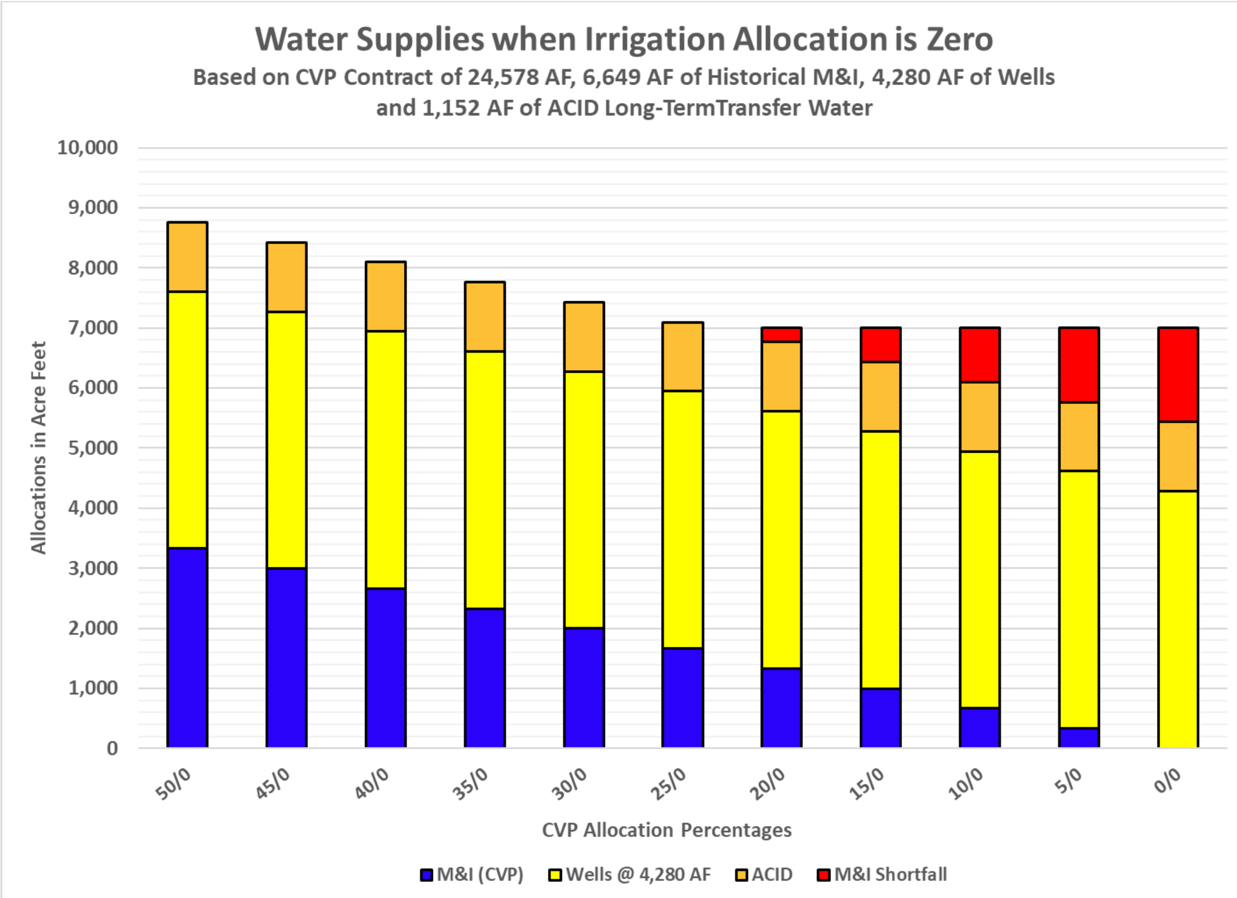



**Figure 5-8 – Water Supplies when Irrigation Allocation is Zero**

## Treated Water Storage

In order to maximize the output from the District's groundwater wells and avoid turning wells off, additional treated water storage will be required. Water demands vary considerably over the course of a typical day. Without adequate water storage, well pumps need to be turned off and on or throttled back in order to meet the fluctuating demands. This cycling and throttling of the wells could be avoided if the District had sufficient treated water storage to accommodate the varying demands. While additional treated water storage would also be beneficial in meeting summer water demands it is only during the low flow months that additional water storage would actually enable the District to maximize its well water production.

Currently, the District has three treated water storage tanks that provide approximately 1.35 million gallons of operational storage. In order to determine the amount of storage required to meet daily peak demands a diurnal curve was generated using water production and water storage volume changes over 30-minute intervals on a typical winter day. The resulting diurnal curve and treated water storage requirements are shown in **Figure 5-9**.

Even though there are significant variations in flows over the course of the day, the amount of usable storage required to accommodate these variable flows is relatively small. Assuming a constant rate of water production, the areas of the graph shaded in blue show times when water can be placed into storage while areas above the black line show times when water would be removed from storage (to satisfy water usage demands during periods of peak usage). The volume of storage required to store water during nighttime low demands (between 9:30 p.m. and 6:00 a.m.) represents approximately 10 percent of the average daily flow.

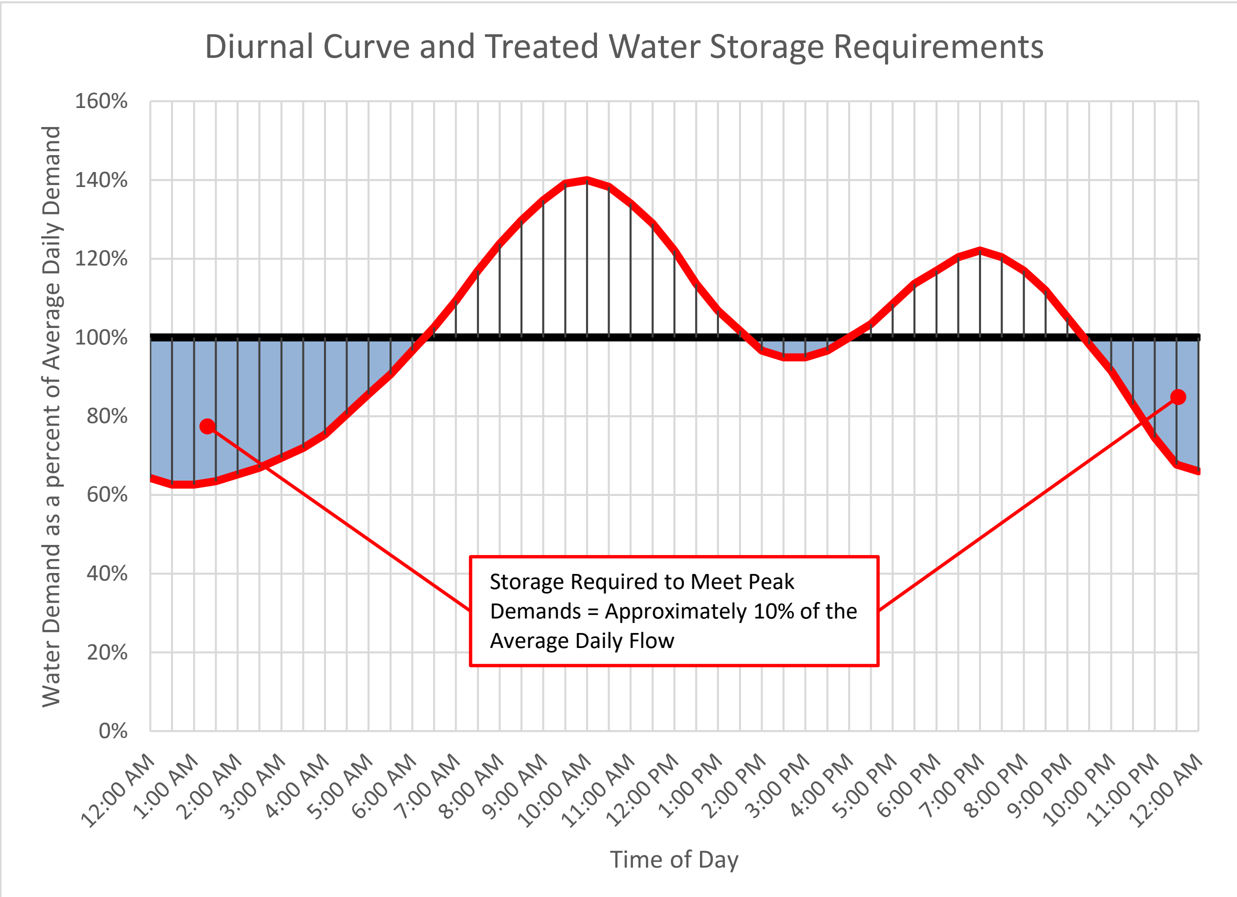



**Figure 5-9 – Diurnal Curve and Treated Water Storage Requirements**

During the months of December through March when average daily water production is less than 3 mgd (9 AF/day), the amount of storage required to meet the diurnal variation in flow is approximately 300,000 gallons, which can be met with the existing storage. However, if the District is running solely on its wells and the Wintu Pump Station or Water Treatment Plant is off-line, standby storage equal to one day's usage is recommended. One day's storage during the December through March period would be equal to approximately 3 million gallons.

Besides the obvious benefit of providing more operational flexibility and emergency/fire storage during normal years, the recommended 3 million gallons of additional storage would provide several unique benefits whenever the District is relying on its wells to meet all its water demands. These benefits include:

- **Backup Supply when Wells are Off-line.** Since only two of the District's wells are on its supervisory control and data acquisition (SCADA) system, staff must travel to non-SCADA wells to make any operational changes. In the event that a well is (or multiple wells) suddenly off-line due to an unplanned event such as a power fault or outage, equipment operators will not have to race around to manually start up or shut down wells, or start up the Water Treatment Plant to prevent unacceptable low water pressures within the distribution system.
- **Reduced Operational Costs for Water Treatment Plant Start-Up.** If the Water Treatment Plant has to be started up after being off-line for a day or more, all of the water in the section of the Main Aqueduct between the Wintu Pump Station and the Water Treatment (more than 500,000 gallons) must be flushed into the backwash ponds at the Water Treatment Plant. This takes approximately one hour to accomplish and requires several operators to ensure that everything is operating properly. If this occurs outside of normal working hours, it results in substantial overtime expenses. The additional 3 million gallons of storage would greatly reduce the likelihood that the Water Treatment Plant would have to be brought online.
- **Improved Management of Backwash Water.** In addition, while the water discharged to the backwash ponds when the plant is brought back online is normally recycled through the Treatment Plant, at a required recycle to total plant flow ratio of less than ten percent, more than five million gallons (15 AF) must be produced by the Water Treatment Plant before the water discharged to the ponds will be recovered. In a drought, this represents five million gallons (15 AF) of precious surface water that could have been produced by the wells.
- **Water Supply during Main Aqueduct Failure.** The additional 3 MG of storage at the recommended Regulation Station site would also provide the District the ability to isolate and supply water to the Deschutes, Cow Creek No.1, and Cow Creek No.2 pressure zones in case of a failure in the Main Aqueduct anywhere between the Simpson Pump Station and the Regulating Station.

*Conclusions:* No additional treated water storage is required to accommodate variations in demand during the day. However, an additional 3.0 million gallons of operational storage would provide the recommended one day of storage while the District is relying solely on its wells and significant operational benefits (mentioned above).

**Surface Storage**

*Discussion:* Construction of surface storage, such as a reservoir, that would allow the District to meet its drought water needs was evaluated but was determined impractical for a number of reasons including: (1) the District would need to acquire a parcel of land of sufficient size to store enough water to meet several years of reduced allocations; (2) water rights for diversions from all existing local surface water courses have been fully appropriated; (3) if treated surface water pumped from the Sacramento River was to be used to fill the reservoir, the quality of the water stored in an open reservoir would be subject to degradation by water fowl, other animals, and the growth of aquatic plants and organisms; (4) water stored in an open reservoir would be subject to losses from evaporation and seepage; (5) before the water could be returned to District's distribution system, it would have to be treated to meet current drinking water standards; and (6) environmental investigations and construction of both the reservoir and the required water treatment facilities would require years of studies and permitting before it could ever be put into service.

A more practical option, if Reclamation would allow it, would be for the District to bank or reschedule water from one water year to the next with the water remaining in Lake Shasta. No new facilities would need to be constructed. The District could schedule delivery of the banked water as it does its current CVP water supplies. While there would be a risk that the banked water would be lost if releases had to be made for flood control purposes, the District would only exercise this option when the likelihood of severely reduced CVP allocations was high.

*Conclusions:* Construction of a new, local surface storage facility is not practical due to economic, regulatory, and water quality issues. Storing water in Lake Shasta is a better alternative, if Reclamation would allow it.

**Recycled Wastewater**

*Discussion:* In 2011, the District participated in a recycled water study with the City of Shasta Lake. The study investigated the feasibility of using recycled water from the City's wastewater treatment plant for irrigation of the Tierra Oaks and Gold Hills golf courses. Ultimately, the City determined that the proposed recycle project was not feasible and proceeded with the design and construction of facilities that would allow the City to discharge the treated water directly into the upper portion of Churn Creek.

The District currently recovers and recycles all the backwash water and filter-to-waste flows produced by its Water Treatment Plant and its wells. As a result, 100% of the water that the District pumps from the Sacramento River and its wells is ultimately delivered to its water distribution system. The recycled water is not included in the District's water portfolio because it is internal to the water production and treatment facilities (they are basically closed systems. Therefore, the recycled water represents neither a decrease nor an increase in the quantity of water produced.

In 2011, the District ceased the discharge of settled backwash water and filter-to-waste flows at its Water Treatment Plant on Canby Drive. In 2018, the District recycled approximately 140.5 million gallons (431 acre-feet) of filter backwash water, equal to approximately 4.1% of the total treated water production for the year (previously this water was "lost" in that only approximately 95.9% of the water pumped from the Sacramento River entered the District's water distribution system).

In order to eliminate any surface water discharges and avoid the need for discharge permits, the District recycles all of the water generated during the backwashing of the filters water at each its wells. The amount of the water recycled is approximately 2% of each well production. The District anticipates that it would recover and recycle the backwash water and filter-to-waste flows at any future groundwater wells.

No other sources of reclaimed wastewater are available near or within the District's service area.

*Conclusions:* There are no opportunities for the District to use recycled water to satisfy water supply needs within the District.

**<u>Pipeline Leakage Reduction</u>**

*Discussion:* The District performs annual water audits to determine the amounts of water that are lost or unaccounted for in the operation of the District's water treatment facilities, water transmission lines, distribution facilities, and water storage facilities. In 2018, the audit calculated the total losses from the District's water system to be 507 acre-feet compared with 10,117 acre-feet of production or approximately 5.0% of the water entering the distribution system.

The District conducted a pipeline assessment study in 2017 on approximately 6,000 feet of 54-inch pipe between the Wintu Pump Station and its Water Treatment Plant. This pipeline was constructed in 1965 as part of the original Cow Creek Project and had been in service for more than 50 years. The study identified one area where the lining of the pipe was damaged. In 2018, the District took that portion of the pipeline out of service and repairs were made to the damaged area. In addition, two joints that appeared to be leaking were repaired.

Unfortunately, the transmission and distribution lines constructed as part of the original project do not have any in-line valves; therefore, it is not feasible to dewater the pipes to perform visual inspections. Additional pipeline evaluation projects are scheduled to be conducted in the next few years.

*Conclusions:* The relatively low water loss numbers for the District do not indicate that there is currently a need to undertake any pipeline leakage control projects. However, the District will continue to perform water loss audits as required by the state and should future audits indicate a significant increase in water losses, the District will need to pursue leakage identification and reduction projects.

**Advanced Metering Infrastructure (AMI)**

*Discussion:* As part of its 2015 WaterSmart Grant project, the District installed smart meters with AMI on 200 of its largest users. Advanced Metering Infrastructure systems include automatic meters that take readings at 15-minute intervals every day and a data transmission system to provide this water usage data to the District and customers who subscribe to the free app Eye on Water in near real time. Smart Meters on an AMI system can help to conserve water by the early identification of leaks and excessive use on the customer side of the meter. This installation of the AMI system and smart meters was completed within the last year, so the District is still evaluating the benefits and operational issues associated with the new AMI system. Once the District has enough operating experience with the smart meters on the AMI system, it will be in a better position to determine whether and how to deploy additional smart meters within its distribution system.

*Conclusions:* AMI and smart meters have the ability to conserve water, but the District would like to evaluate the results of recently installed smart meters before further investments are considered.

## 5.5 Priority of Mitigation Projects

A project evaluation matrix has been prepared to rank the various potential mitigation projects. The evaluation criteria are shown in the figure below:

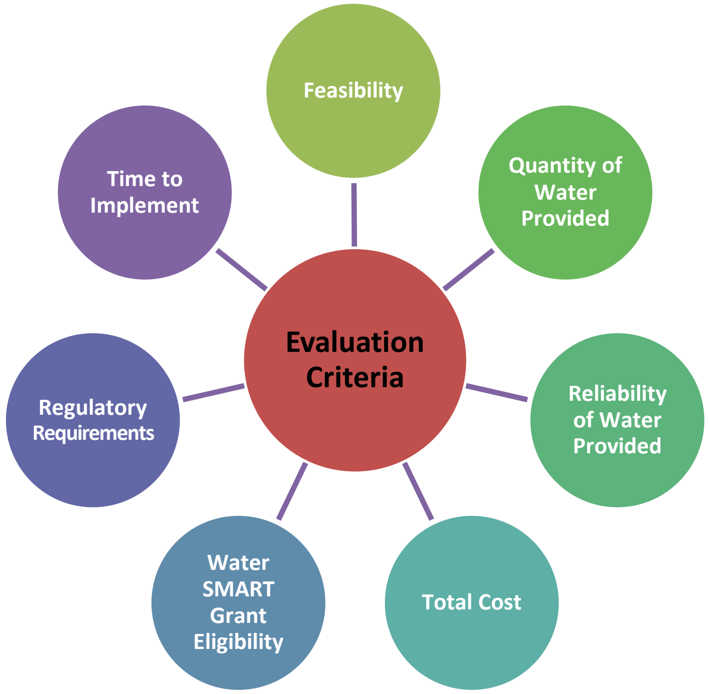



**Figure 5-10 – Project Evaluation Criteria**

Weighting factors for each of the above criteria and scoring for potential projects were determined through a collaborative process between District staff and Provost & Pritchard. The completed project evaluation matrix is shown in **Table 5-2** below. The evaluators' project "feasibility" scores represent the likelihood of completing the project successfully based the economic, technical, legal, and scheduling considerations for each conceptual project.

## Table 5-2 – Project Evaluation Matrix

| CRITERIA DESCRIPTION | | Feasibility | Quantity of Water Provided | Reliability of Water Provided | Total cost | Eligibility for WaterSMART Grant Funding | Regulatory requirements | Time to implement | WEIGHTED SCORE |
|---|---|---|---|---|---|---|---|---|---|
| WEIGHT | | 5 | 3 | 5 | 3 | 5 | 2 | 2 | 25.0 |
| WEIGHTING PERCENTAGES | | 20.0% | 12.0% | 20.0% | 12.0% | 20.0% | 8.0% | 8.0% | 100% |
| MAXIMUM POINTS AVAILABLE | | 20 | 12 | 20 | 12 | 20 | 8 | 8 | 100 |
| ALTERNATIVES | SCORING (0 = low to 5 = high) | | | | | | | | SCORING TOTALS |
| WATER TRANSFERS - PROJECT WATER | Score | 2 | 3 | 1.5 | 3 | 0 | 2 | 3.5 | 46.5 |
| | Points | 10 | 9 | 7.5 | 9 | 0 | 4 | 7 | |
| WATER TRANSFERS-GROUNDWATER SUBSTITUTION | Score | 2.5 | 3.5 | 1 | 2.5 | 0 | 2 | 3 | 45.5 |
| | Points | 12.5 | 10.5 | 5 | 7.5 | 0 | 4 | 6 | |
| AQUIFER STORAGE AND RECOVERY | Score | 2 | 1 | 1 | 2 | 2.5 | 1.5 | 3 | 45.5 |
| | Points | 10 | 3 | 5 | 6 | 12.5 | 3 | 6 | |
| NEW GROUNDWATER WELL(S) | Score | 3.5 | 2 | 3 | 2 | 4 | 1.5 | 2 | 71.5 |
| | Points | 17.5 | 6 | 15 | 6 | 20 | 3 | 4 | |
| NEW GROUNDWATER WELL + ADDITIONAL TREATED WATER STORAGE | Score | 4 | 4 | 4 | 0.5 | 4 | 1 | 1.5 | 78.5 |
| | Points | 20 | 12 | 20 | 1.5 | 20 | 2 | 3 | |
| ADDITIONAL TREATED WATER STORAGE | Score | 3 | 1.5 | 4 | 1.5 | 4 | 1.5 | 2 | 71.0 |
| | Points | 15 | 4.5 | 20 | 4.5 | 20 | 3 | 4 | |
| RECYCLED WATER | Score | 0.5 | 2.5 | 2.5 | 0.5 | 2.5 | 0.5 | 1 | 39.5 |
| | Points | 2.5 | 7.5 | 12.5 | 1.5 | 12.5 | 1 | 2 | |
| PIPELINE LEAKAGE REDUCTION | Score | 1 | 1 | 2 | 1.5 | 1.5 | 2.5 | 1 | 37.0 |
| | Points | 5 | 3 | 10 | 4.5 | 7.5 | 5 | 2 | |
| ADVANCED METERING INFRASTRUCTURE (Smart Meters) | Score | 1.5 | 1 | 1 | 1.5 | 2.5 | 2.5 | 1 | 39.5 |
| | Points | 7.5 | 3 | 5 | 4.5 | 12.5 | 5 | 2 | |
| SURFACE WATER STORAGE | Score | 1 | 2.5 | 2 | 0.5 | 0.5 | 0.5 | 1 | 29.5 |
| | Points | 5 | 7.5 | 10 | 1.5 | 2.5 | 1 | 2 | |

## 5.6 Conceptual Evaluation of Priority Projects

The highest priority projects identified include: 1) new groundwater wells plus the construction of additional treated water storage, 2) new groundwater wells (only), and 3) additional treated water storage.

Studies performed for the District by Lawrence and Associates in the early 1990s and in 2016 indicated that the best location for new wells are at or near the southern boundary of the District. The depth to the Chico Formation, which contains water with high levels of dissolved minerals, is shown in **Figure 5-11**. As can be seen in the figure, the elevation of the Chico Formation is at approximately 100 feet below mean sea level at the southern boundary of the District approximately ¾ mile south of Well No. 1. The contours for the Chico Formation rise as one proceeds north, west, or east from this location. Consequently, the best locations for future wells from the standpoint of the depth to Chico Formation would be in the area south of Well No. 1 with conditions being less favorable as one travels north, west, or east of this location.

The Lawrence and Associates studies also contained maps showing Aquifer Permeability and Predicted Well Yields. These maps also indicated that areas for best producing wells are generally south and a little east of the District's Well No. 1. **Figure 5-12** shows the Aquifer Permeability and **Figure 5-13** shows Predicted Well Yields.

Potential locations for new wells were identified using these figures in combination with the distances and feasibility of connecting the new wells to the District's existing water distribution system. **Figure 5-11** shows the four potential well sites in relation to the existing wells.

Well depths and yields were estimated for each of the proposed well sites using the hydrological data shown in **Figure** 5-11, **Figure** 5-12, and **Figure** 5-13. The estimated values are shown in **Table 5-3** below.

### Table 5-3 – Potential New Wells

| Potential Well Locations | Elevations (M.S.L.) | | Maximum Depth of Well* (feet) | Predicted Yield (gpm) |
|---|---|---|---|---|
| | Ground | Top of Chico Formation | | |
| Well Site A | 478 | 60 | 418 | 1,500 |
| Well Site B | 485 | 120 | 365 | 750 |
| Well Site C | 500 | -100 | 600 | 2,600 |
| Well Site D | 580 | -75 | 655 | 2,700 |

* Maximum Depth = Ground Elevation - Top of Chico Formation

Predicted yields and well depths for the District's existing wells based on the same hydrological data are presented in **Table 5-4** (below) for comparison. The new well yields were based on this data.

## Table 5-4 – Existing BVWD Wells

| Existing Wells | Elevations | | Maximum Depth of Well* | Predicted Yield, gpm | Finished Well Depth | Actual Yield, gpm |
|---|---|---|---|---|---|---|
| | Ground | Top of Chico Formation | | | | |
| No. 1 | 513 | -25 | 538 | 2200 | 325 | 1000 |
| No. 2 | 570 | 0 | 570 | 1400 | 475 | 900 |
| No. 3 | 452 | 40 | 412 | 1600 | 335 | 700 |
| No. 4 | 575 | 185 | 390 | 350 | 370 | 300 |
| No. 6 | 518 | 0 | 518 | 1700 | 400 | 600 |

* Maximum Depth = Ground Elevation - Top of Chico Formation

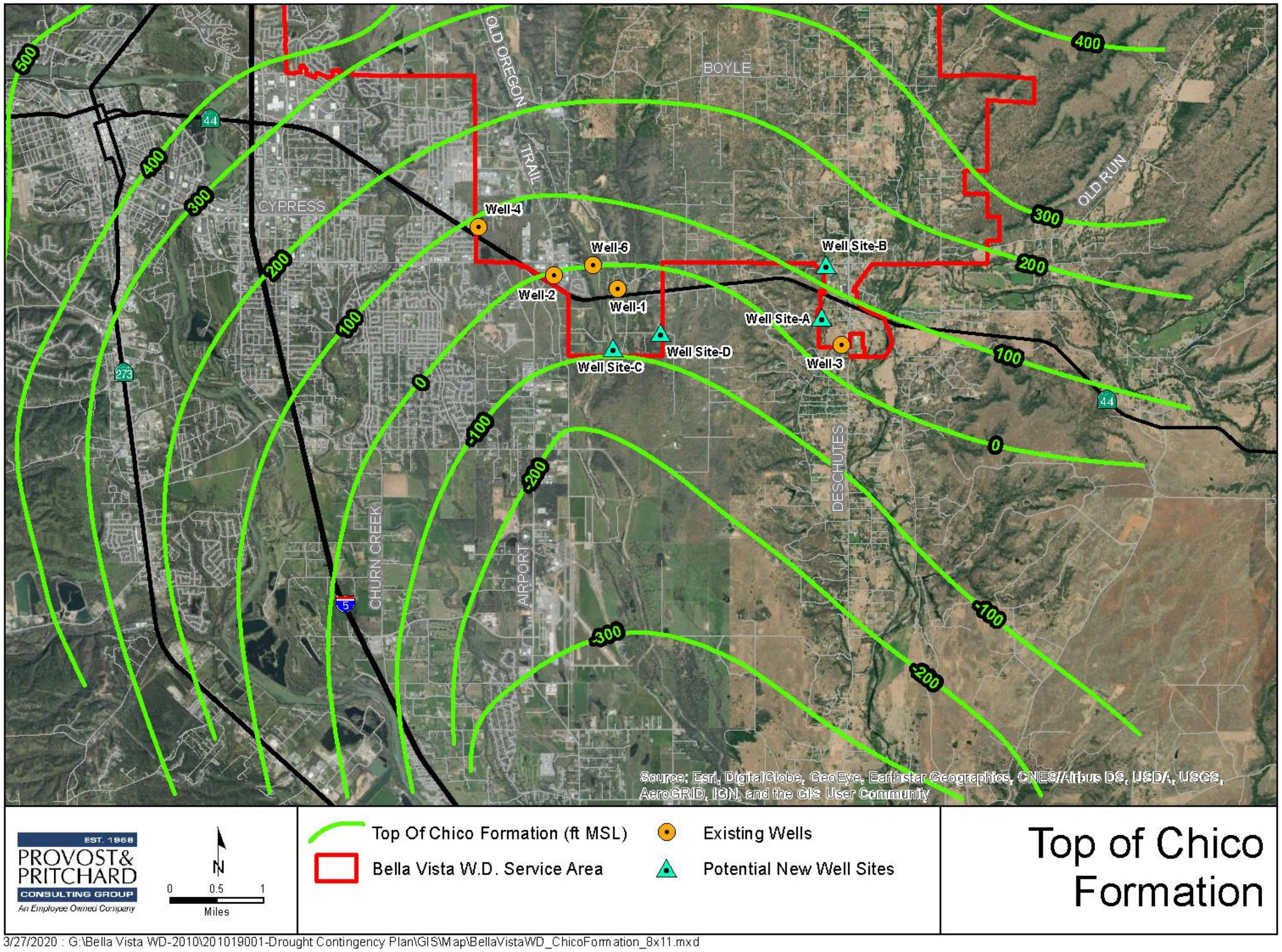



**Figure 5-11 – Top of Chico Formation**

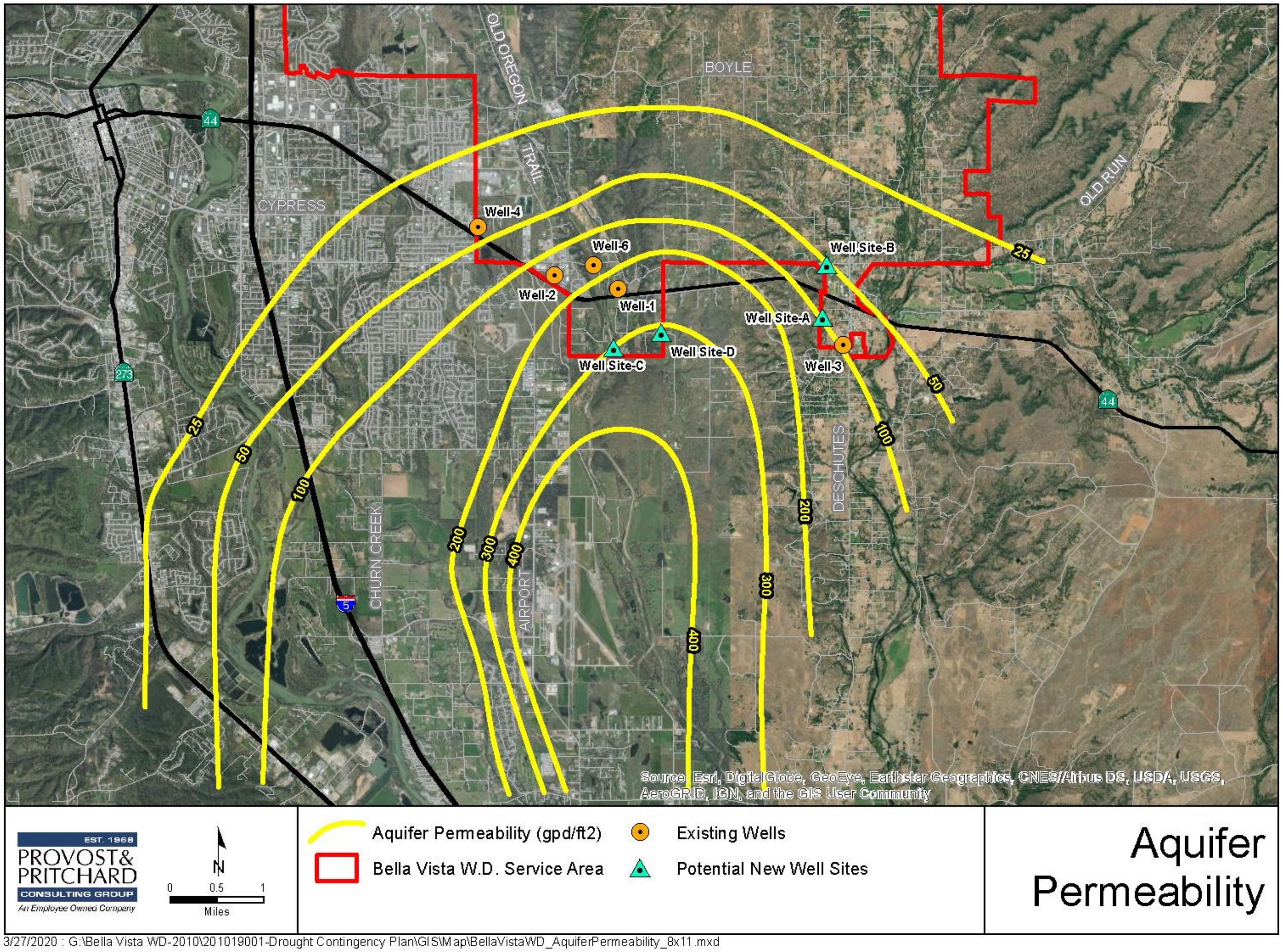



**Figure 5-12 – Aquifer Permeability**

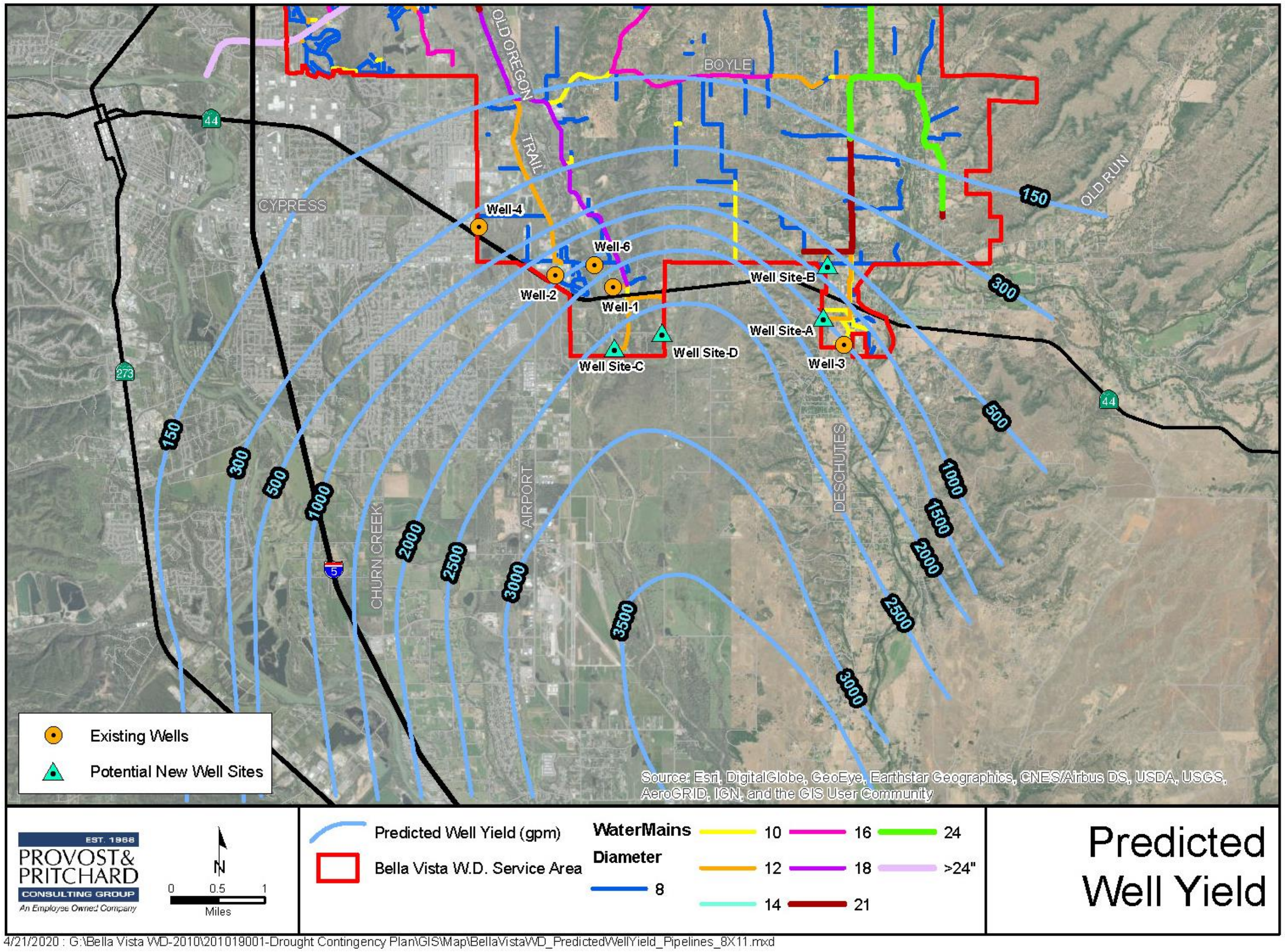



**Figure 5-13 – Predicted Well Yield**

**Well Site "A"**

Well Site "A" is in the vicinity of Topland Drive approximately 2,200 feet north-northwest of the District's Well No. 3 (see **Figure 5-14**). As shown in **Table 5-5**, the well would be drilled to a depth of approximately 400 feet and could be expected to produce up to 1,500 gallons per minute. However, based on the yield of nearby Well No. 3, a yield of somewhere between 700 and 1,400 gallons per minute (3.0 to 6.0 acre-feet per day) would be expected. One drawback with this site is that the water main in Deschutes Road is only a 10-inch main between the well site and approximately 400 feet north of Old 44 Drive (a distance of approximately 3,400 feet).

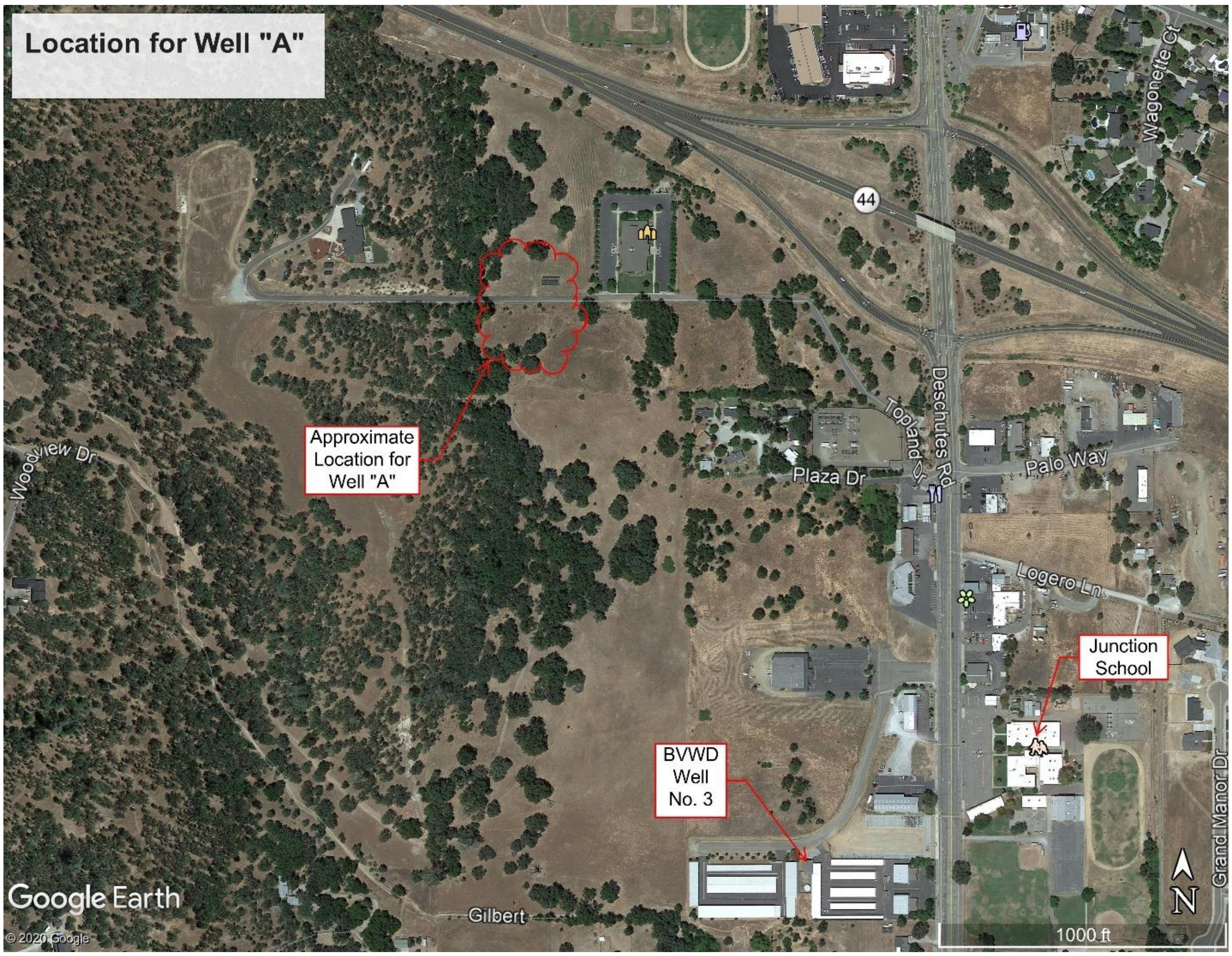



Figure 5-14 – Location for Well "A"

The 10-inch pipe is appropriately sized for a flow of between 700 and 1,000 gallons per minute, the flow of one of the wells. At these flows the velocity in the pipe would be between 2.8 and 4.0 feet per second with a resultant headloss of between 2.3 and 4.5 feet per thousand feet of pipe or approximately 1.0 and 2.0 psi per thousand feet. The headloss for the entire 3,400-foot section of pipe would be between 3.4 and 6.8 feet or approximately 1.5 and 3 psi.

However, with both wells running the combined flow would be 1,400 to 2,100 gpm, and the resultant velocity would be between 5.6 and 8.3 feet per second. The resulting headloss would be between 8.3 and 17.5 feet per 1,000 feet of pipe and the headloss in the 3,400-foot section of pipe would be between 28 and 60 feet (between 12 and 26 psi). Velocities this high pose significant water hammer risks and consume large amounts of energy to overcome. Therefore, a parallel 12-inch water main would be needed for 3,400 feet until it could be connected into the existing 21-inch main north of Old 44 Drive.

**Table 5-5 – Estimated Costs Well "A"**

| | |
|---|---|
| Well Drilling, Pump Testing, Well Pump, and Motor | $280,000 |
| Treatment Facilities and Well Building | $890,000 |
| Piping to Connect to Distribution System | $408,000 |
| Total Construction Cost | $1,578,000 |
| Engineering, Legal and Construction Services @22% | $347,000 |
| Subtotal | $1,925,000 |
| Contingency @ 10% | $193,000 |
| Total Project Cost | $2,118,000 |

**Well Site "B"**

Well Site "B" is in the vicinity of Old 44 Drive and the western entrance to the Bishop Quinn campus. It is approximately 4,600 feet north-northwest of the District's Well No. 3 (see **Figure 5-15**). As shown in Table 5-6, the well would be drilled to a depth of approximately 365 feet and could be expected to produce up to 750 gallons per minute. However, based on the yield of nearby Well No. 3, a yield of something less than 700 gallons per minute (3.0 acre-feet per day) would be expected.


**Figure 5-15 – Location for Well "B"**

An existing 8-inch pipe is in Old 44 Drive which then ties into the 10-inch line in Deschutes Road at which point it would combine with the flow from Well No. 3 for a distance of approximately 650 feet. The velocity of the combined flow would exceed 5 feet per second with headloss of approximately 5 feet. A better option would be to connect into the existing 21-inch water main that runs parallel to and is approximately 650 feet north of Old 44 Drive.

### Table 5-6 – Estimated Costs Well "B"

| | |
|---|---|
| Well Drilling, Pump Testing, Well Pump, and Motor | $245,000 |
| Treatment Facilities and Well Building | $980,000 |
| Piping to Connect to Distribution System | $78,000 |
| Total Construction Cost | $1,303,000 |
| Engineering, Legal and Construction Services @22% | $287,000 |
| Subtotal | $1,590,000 |
| Contingency @ 10% | $159,000 |
| Total Project Cost | $1,749,000 |

**Well Site "C"**

Well Site "C" is in the vicinity of Stillwater Road and Clough Creek Road approximately 3,600 feet southeast of the District's Well No. 1 (see **Figure 5-16)**. As shown in **Table 5-7**, the well would be drilled to a depth of approximately 600 feet and based on the hydrological maps could be expected to produce up to 2,600 gallons per minute. However, based on the yield of the District's nearby wells (Nos. 1, 2, and 6) a yield of between 1,000 and 1,700 gallons per minute (4.4 to 7.5 acre-feet per day) would be a more reasonable expectation.

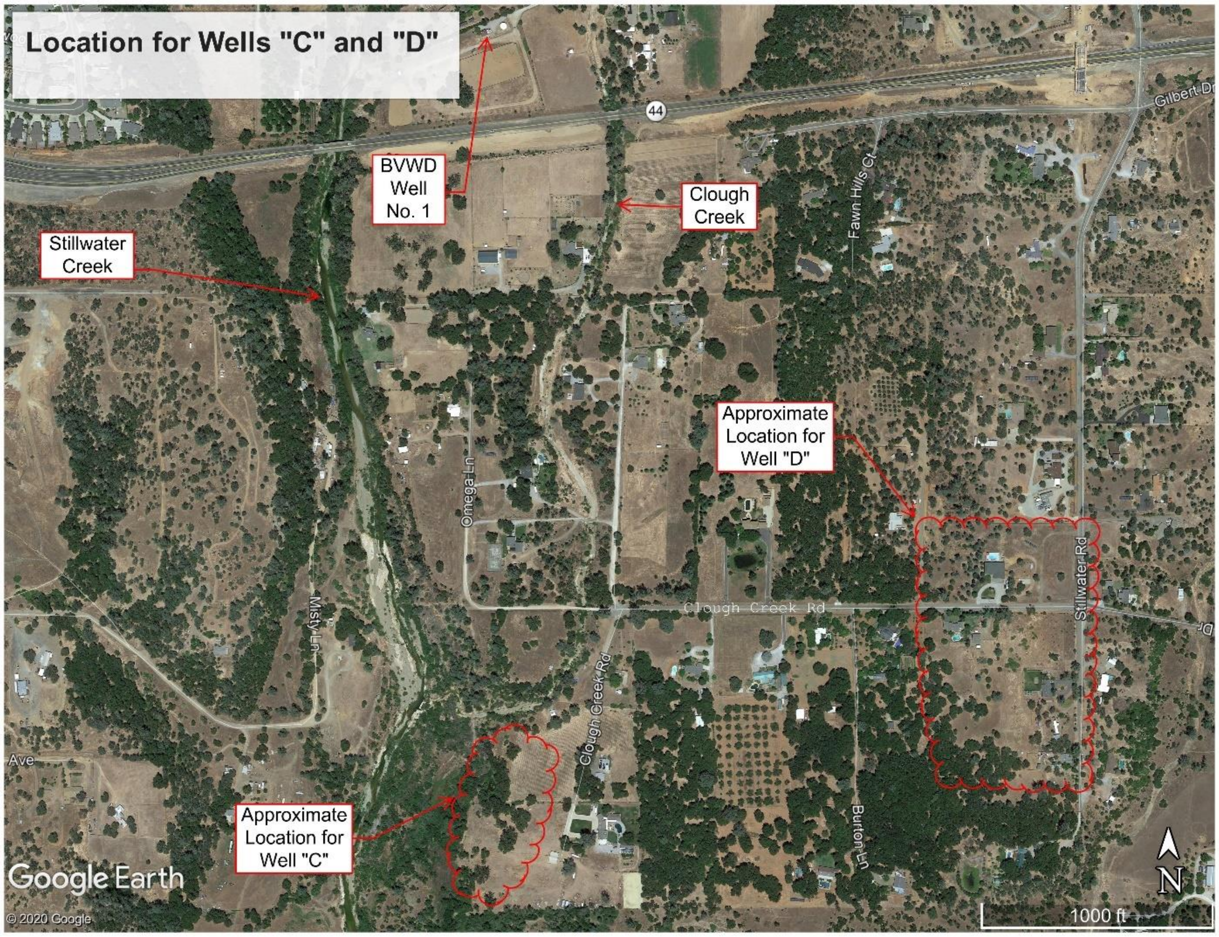



**Figure 5-16 – Location for Wells "C" and "D"**

No existing water mains are in vicinity of this proposed site. Therefore, approximately 4,000 feet of new 12-inch to 16-inch diameter pipe in Stillwater Road and Gilbert Drive up would be required to connect it up to the existing distribution system. An existing 10-inch line runs from Old 44 Drive southeast (crossing under Highway 44) to Gilbert Drive that the District could connect to. However, depending on the actual output of this well, the District may need to replace or parallel this 900-foot section of pipeline, too.

### Table 5-7 – Estimated Costs Well "C"

| | |
|---|---|
| Well Drilling, Pump Testing, Well Pump, and Motor | $380,000 |
| Treatment Facilities and Well Building | $1,050,000 |
| Piping to Connect to Distribution System | $560,000 |
| Total Construction Cost | $1,990,000 |
| Engineering, Legal and Construction Services @22% | $438,000 |
| Subtotal | $2,428,000 |
| Contingency @ 10% | $243,000 |
| Total Project Cost | $2,671,000 |

**Well Site "D"**

Well Site "D" is in the vicinity of Clough Creek Road approximately 800 feet south of Omega Lane and 3,000 feet south of the District's Well No. 1 (see **Figure 5-16**). As shown in Table 5-8, the well would be drilled to a depth of approximately 650 feet and based on the hydrological maps could be expected to produce up to 2,700 gallons per minute. However, based on the yield of the District's nearby wells (Nos. 1, 2, and 6) a yield similar to Well Site "C" would be expected (between 1,000 and 1,700 gallons per minute or 4.4 to 7.5 acre-feet per day).

As is the case with Well Site "C", no existing water mains are in the vicinity of this proposed site. Therefore, approximately 3,400 feet of new 12-inch to 16-inch diameter pipe in Clough Creek Road, Omega Lane, and a cross-country section are required to connect it up to the existing distribution system. As with Well Site "C" the connection would be to the existing 10-inch line that runs from Old 44 Drive southeast (crossing under Highway 44) to Gilbert Drive; and depending on the actual output of this well, the District may need to replace or parallel this 900-foot section of pipeline too.

### Table 5-8 – Estimated Costs Well "D"

| | |
|---|---|
| Well Drilling, Pump Testing, Well Pump, and Motor | $390,000 |
| Treatment Facilities and Well Building | $1,050,000 |
| Piping to Connect to Distribution System | $476,000 |
| Total Construction Cost | $1,916,000 |
| Engineering, Legal and Construction Services @22% | $422,000 |
| Subtotal | $2,338,000 |
| Contingency @ 10% | $234,000 |
| Total Project Cost | $2,572,000 |

The Table below compares the primary features of the four different well options including estimated project costs.

### Table 5-9 – Comparison of Proposed Well Locations

| Description | Predicted Yield, gpm | Pipeline Required, ft | Pipe Size, inches | Total Project Cost |
|---|---|---|---|---|
| Well "A" | 700 to 1,400 | 3,400 | 10 to 12 | $2,118,000 |
| Well "B" | less than 700 | 650 | 10 | $1,749,000 |
| Well "C" | 1,000 to 1,700 | 4,000 | 12 to 14 | $2,671,000 |
| Well "D" | 1,000 to 1,700 | 3,400 | 12 to 14 | $2,572,000 |

**Well Treatment Facilities**

All the District's existing wells have on-site treatment for iron and manganese removal. It is anticipated that any new well would require similar treatment facilities. The treatment facilities include pressure filters, chlorination equipment, a backwash tank, a thickened backwash tank, and recycling of the settled backwash water. The facility would be designed to have zero discharge and thereby avoid the need for a waste discharge permit. In order to be able to remotely monitor and control the well, the facility would be designed to integrate with the District's existing SCADA system. The estimated costs for the iron and manganese treatment facilities including a 20-foot by 20-foot control building are included in the well costs above.

**Additional Treated Water Storage**

As previously discussed, approximately 3 million gallons of additional treated water storage is required to enable the District to meet water demands when either the Wintu Pump Station or the Water Treatment Plant is off-line. The District presently owns a parcel of land adjacent to the Regulation Station that would be suitable for the construction of a 3 million gallon above ground storage tank. **Figure 5-17** shows the Regulation Station site and the approximate location of the proposed storage tank.

The existing 185,000-gallon tank at the Regulating Station is a flow through tank providing no operational storage. The tank operates over a very narrow range with control valves regulating the flow into the tank to maintain a water surface elevation of 686 to 688 feet above MSL. The elevation of the floor of the existing tank is 675 above MSL.

In order to provide 3 million gallons of usable storage and fit within the existing parcel the new tank will need to be considerably taller than the existing tank. A 32 or 40-foot-tall tank is proposed for the site. The proposed tank would need to be 120 to 140 feet in diameter to provide 3,000,000 gallons of storage.

A pressure reducing station will be required downstream of the tank in order to maintain the same pressures in the Deschutes Pressure Zone as customers in that zone are accustomed to. The proposed tank will be supplied by a new pipeline that ties into the existing 36-inch water main ahead of the Regulation Station. A separate discharge pipeline will be constructed and tie back into the existing 36-inch water main downstream of the Regulation Station Tank. It is not anticipated that the two tanks will operate simultaneously. Rather, all flows will go through the new tank unless it needs to be taken out of service for inspection or repairs; in which case, the Regulation Station would be returned to service and all flows would be through the Regulation Station Tank.

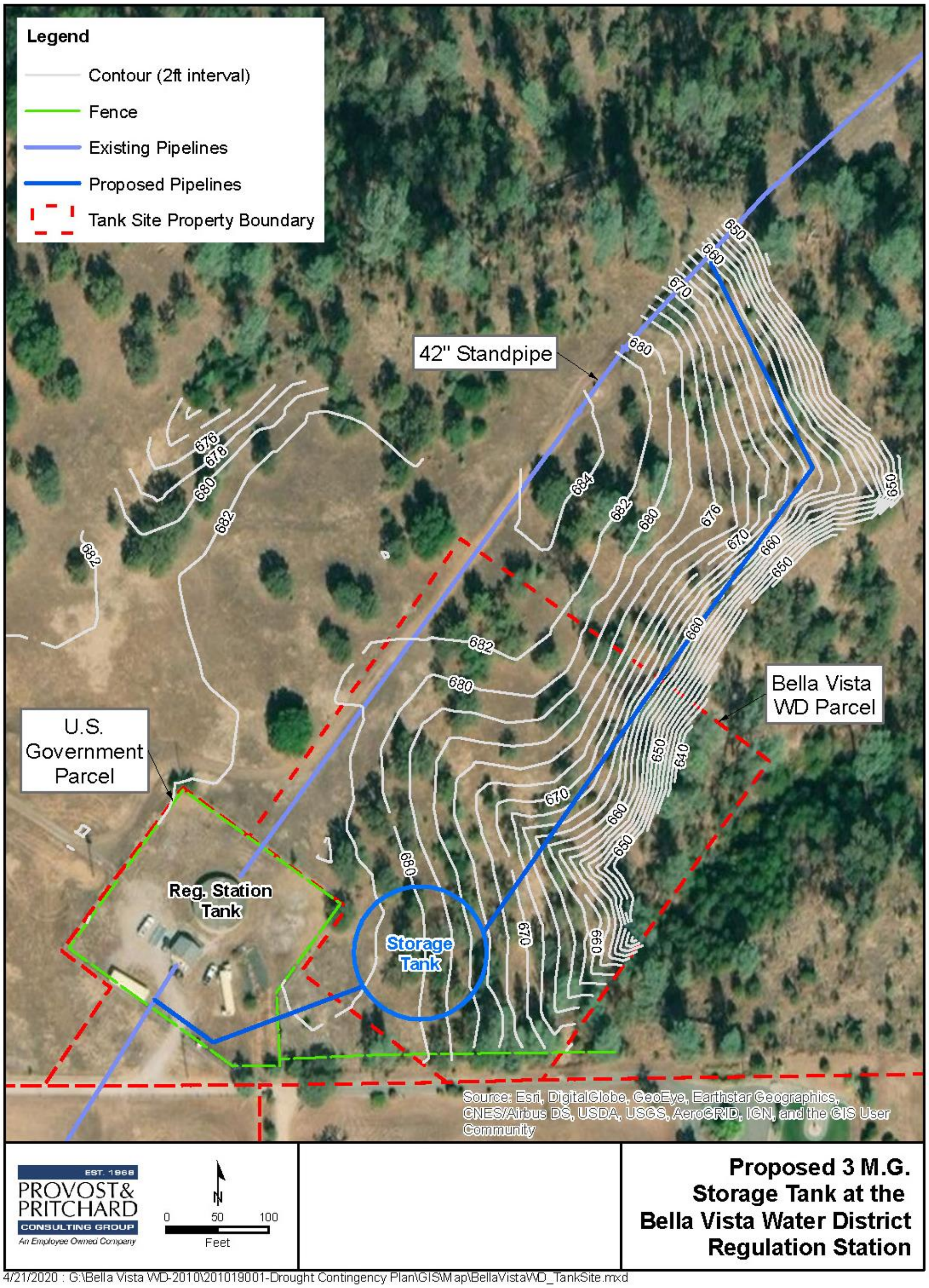



**Figure 5-17 – Proposed 3 M.G. Storage Tank at the BVWD Regulation Station**

**Table 5-10 – Estimated Costs Proposed 3 M.G. Storage Tank**

| | |
|---|---|
| Furnish and Install 3 Million Gallon Tank | $2,500,000 |
| Piping and control valves | $645,000 |
| Earthwork | $270,000 |
| Mobilization, demobilization, bonds, insurance | $90,000 |
| Potholing, miscellaneous facilities and operations | $61,000 |
| Subtotal | $3,566,000 |
| Engineering, Legal and Construction Services @22% | $785,000 |
| Subtotal | $4,351,000 |
| Contingency @ 10% | $435,000 |
| Total Construction Cost | $4,786,000 |

All cost estimates are based on current prices and may vary depending on construction economics at the time of bidding and construction.

## 5.7 References

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# 6 Response Actions

## 6.1 Introduction

A Response Action is defined as a measure, policy, or step taken in response to drought conditions to reduce water demands or mitigate the impacts of drought. Response actions are addressed in the District Water Shortage Contingency Plan (WSCP), included as **Appendix C**. The District first developed a WSCP in 1992. The plan was updated several times including in 2015 as a response to a significant multi-year drought in California. The WSCP is being updated as part of this Drought Contingency Plan.

The District's WSCP covers the following topics:

- Purposes and Principles of the Plan
- Procedures for Conducting Assessment
- Water Shortage Levels
- Shortage Response Actions
- Community Outreach
- Customer Compliance and Enforcement
- Legal Authority of the Plan
- Revenue Reductions and Expense Increases
- Monitoring and Reporting Requirements
- Monitoring and Evaluating the Plan

This chapter describes a review of the previous WSCP, input from local water users, revisions to the WSCP, prioritization of response actions, and a process for implementing the response actions.

## 6.2 Review of Adequacy of Existing Response Actions

The existing response actions have worked well in past years, including during severe droughts, and feedback on them has generally been positive. Nevertheless, some minor refinements were made to the response actions and an additional water shortage stage was added. These changes are discussed in Section 6.4 below.

## 6.3 Input from Water Users

The Draft WSCP was provided to the Drought Task Force for their review and comments. Most of the Task Force members were landowners and/or business owners in the District, and therefore had experience complying with various response actions during previous droughts. Their relevant comments were incorporated into the WSCP.

## 6.4 Revisions to Existing Response Actions

The WSCP plan was revised to include new Water Shortage Stages, and several specific response actions were modified.

Effective January 1, 2019, the State of California made several significant updates to Water Code 10632. This section of Code specifically discusses the requirements for Water Shortage Contingency Plans for urban water suppliers (WC 10632). One of the updates associated with WC 10632 is the introduction of section 10632(3)(A) which requires:

"(3) (A) Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage. Urban water suppliers shall define these shortage levels based on the suppliers' water supply conditions, including percentage reductions in water supply, changes in groundwater levels, changes in surface elevation or level of subsidence, or other changes in hydrological or other local conditions indicative of the water supply available for use. Shortage levels shall also apply to catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other potential emergency events."

The BVWD response actions are divided into six different Water Shortage Levels as seen in **Table 6-6-1**. The previous stages of water shortage are presented in **Table 6-6-2** for comparison.

### Table 6-6-1 – Updated Stages of Water Shortage

| Stage | % Supply Reduction | Water Supply Condition |
|---|---|---|
| 1 | 0%-10% | Normal Water Supply (90% to 100% of Normal Demand) |
| 2 | 10%-20% | Moderate Water Shortage (80% to 90% of Normal Demand) |
| 3 | 20%-30% | Severe Water Shortage (70% to 80% of Normal Demand) |
| 4 | 30%-40% | Extreme Water shortage (60% to 70% of Normal Demand) |
| 5A | 40%-50% | Critical I Water Shortage-Short Term (50% to 60% of Normal Demand) |
| 5B | 40%-50% | Critical I Water Shortage-Long Term (50% to 60% of Normal Demand) |
| 6A | 50+% | Critical II Water Shortage-Short Term (Less than 50% of Normal Demand) |
| 6B | 50+% | Critical II Water Shortage-Long Term (Less than 50% of Normal Demand) |

Notes:
1 - Short term conditions occur for 45 days or less and may be attributed to infrastructure, water quality or power issues, as well as hydrologic conditions. Long-term conditions are greater than 45 days and are typically due to hydrologic conditions.
2 – "Normal Demand" refers to the average water demand over the same time period during last 3 years with unconstrained supplies.
3 - These are effective water shortage stages as of 2020.

The previous water shortage levels are shown below.

Table 6-6-2 – Original Stages of Water Shortage (superseded)

| Stage | % Supply Reduction | Water Supply Condition |
|---|---|---|
| 1 | Up to 15% | Normal Water Supply (85% to 100% of Normal) |
| 2 | 15-30% | Moderate Water Shortage (70% to 85% of Normal) |
| 3 | 30-50% | Severe Water Shortage (50% to 70% of Normal) |
| 4 | 50-70% | Extreme Water Shortage (30% to 50% of Normal)<br>Short-term and Long-term |
| 5 | 70% or more | Critical Water Shortage (less than 30% of Normal)<br>Short-term and Long-term |

Notes: These are previous water shortage stages and included only for comparison purposes

In addition, several response actions were modified to: 1) make them more consistent with neighboring agencies to avoid confusion, 2) address lessons learned during recent droughts, and 3) follow new State guidelines and requirements.

## 6.5 Prioritization of Response Actions

The District's Response Actions are shown below and are contained within the WSCP (**Appendix C**). Response Actions are listed for each of the six drought stages. In addition, two of the stages have categories for short-term and long-term water shortages. The District understands that Response Actions associated with drought need to be applicable for all water users throughout the District, regardless of economic standing. It is also intentional that the earlier stages contain some of the more feasible, economical, and easier to enforce response actions.

***Stage 1. Below Normal Water Supply (90% to 100% of Normal Water Production)***

*Stage 1. Below Normal Water Supply* is categorized with a possible reduction percentage of up to 10%. Response Actions may include:

- Water shall be used for beneficial purposes only; all unnecessary and wasteful uses of water are prohibited (*District Policy Manual Section 143*).
- Water shall not be applied to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures. Care shall be taken not to water past the point of saturation.
- Free-flowing hoses are prohibited for all uses. Automatic shut-off devices shall be attached on any hose or filling apparatus in use.
- Leaking customer pipes or faulty sprinklers shall be repaired within five (5) working days or less if warranted due to the severity of the problem or shall not be utilized until repaired.
- All pools, spas, and ornamental fountains/ponds shall be equipped with a recirculation pump and shall be constructed to be leakproof.
- Swimming pool and spa covers encouraged to prevent evaporative water loss.
- Pool draining and refilling shall be allowed only for health, maintenance, or structural considerations.
- Washing streets, parking lots, driveways, or sidewalks, except as necessary for health, aesthetic, or sanitary purposes, is prohibited.
- To reduce evaporation, between March 1 and October 31 the use of sprinkler irrigation systems for all landscape irrigation systems shall be limited to be between the hours of 7:00 p.m. and 9:00 a.m. Sprinkler irrigation systems may be run outside of these hours for testing, but not for more than 15 minutes per cycle and only long enough to verify proper operation and make sprinkler adjustments.
- Irrigated landscaped areas shall include efficient irrigation systems (e.g., drip irrigation, timed sprinklers, rain sensors, low-flow spray heads, etc.).
- Use of potable water for the irrigation of turf or high-water use plants within public street medians and parkways is prohibited.

***Stage 2. Moderate Water Shortage (80% to 90% of Normal Water Production)***

*Stage 2. Moderate Water Shortage* is categorized with a possible reduction percentage of 10-20%. All Stage 1 Response Actions are required plus the following:

- Reduce water use by the following specified percentages: Residential and Rural by 10-20%, Multi-family and Public/Institutional customers by 10-20%, commercial customers by 5-10%, and Landscape Irrigation by 15-25%.
- Customers with "smart" irrigation timers or controllers are asked to set their controllers to achieve 90 to 95% of the evapotranspiration (ET) rate.
- Eating or drinking establishments, including but not limited to: Restaurants, cafes, cafeterias, bars, or other public places where food or drink are served and/or purchased shall serve water only upon request.
- Operators of hotels and motels shall offer patrons the option of not having their towels and linens washed daily.
- Users of construction meters and fire hydrant meters will be monitored for efficient water use.

Penalties: Any customer in violation of Stage 2 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 2 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

***Stage 3. Severe Water Shortage (70% to 80% of Normal Water Production)***

*Stage 3. Severe Water Shortage* is categorized with a possible reduction percentage of 20-30%. All the Response Actions in Stage 2 are required plus the following new Response Actions:

- Outdoor irrigation of ornamental landscapes and turf with potable water shall be limited to 3 days a week. Customers whose street addresses end with an odd number may water on Wednesday, Friday, and Sunday. Customers whose street addresses end with an even number may water on Tuesday, Thursday, and Saturday.
- The application of potable water to outdoor landscapes during or within 48 hours after measurable rainfall is prohibited.

- Flushing of water mains, sewers, or fire hydrants is prohibited except for emergencies and essential operations.
- Water use exceedance tiered pricing or penalties may be implemented.
- Motor vehicles and equipment shall be washed only with buckets or with hoses equipped with automatic shutoff nozzles.

The following Response Actions replace previous less stringent actions:

- Leaking customer pipes or faulty sprinklers shall be repaired within two (2) working days or less if warranted due to the severity of the problem.
- Reduce water use by the following specified percentages: Residential and Rural by 20-30%, Multi-family and Public/Institutional customers by 20-30%, commercial customers by 20%, and Landscape Irrigation by 25-35%.
- Customers with “smart” irrigation timers or controllers are asked to set their controllers to achieve 75% of the evapotranspiration (ET) rate. Drip irrigation systems are excluded from this requirement.

Penalties: Any customer in violation of Stage 3 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 3 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District’s Policy Manual.

***Stage 4 Extreme Water Shortage (60% to 70% of Normal Water Production)***

*Stage 4. Extreme Water Shortage* is categorized with a possible reduction percentage of 30-40%. All the Response Actions in Stage 3 are required plus the following new Response Actions:

- Water use for ornamental ponds, fountains, or other ornamental water feature for aesthetic purposes is prohibited except where necessary to support aquatic life.
- The application of potable water to driveways and sidewalks is prohibited.
- The installation of new turf or landscaping is prohibited.
- Irrigation of ornamental turf with potable water on public street medians is prohibited.

- New connections to the District's water distribution system will be allowed but their water use shall be restricted to the minimum requirements for personal health and safety.

The following Response Actions replace previous less stringent actions:

- Leaking customer pipes or faulty sprinklers shall be repaired within 24 hours or less if warranted due to the severity of the problem.
- Reduce water use by the following specified percentages: Residential and Rural by 30-40%, Multi-family and Public/Institutional customers by 30-40%, commercial customers by 30%, and Landscape Irrigation by 35-50%.

Penalties: Any customer in violation of Stage 4 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 4 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

***Stage 5A Critical I Water Shortage Short-Term (50% to 60% of Normal Water Production)***

*Stage 5A Critical I Water Shortage* is categorized with a possible reduction percentage of 40-50%. A short-term declaration is for water shortage conditions expected for a duration of 45 days or less. All the Response Actions in Stage 4 are required plus the following new Response Actions:

- Water use for ornamental ponds and fountains is prohibited.
- No potable water from the District's system shall be used for construction purposes including but not limited to dust control, compaction, or trench jetting.

The following Response Actions replace previous less stringent actions:

- Leaking customer pipes or faulty sprinklers shall be repaired within 24 hours. Water service will be suspended until repairs are made.
- Reduce water use by the following specified percentages: Residential and Rural 40% to 50% or more, Multi-family and Public/Institutional customers reduce water use by 40% to 50% or more, commercial customers by 30%, and Landscape Irrigation by 50%.
- Water for flow testing and construction purposes from water agency fire hydrants and blow- offs is prohibited.

- Water use exceedance tiered pricing and/or excessive water use fines will be implemented.

Penalties: Any customer in violation of Stage 5 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 5 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

***Stage 5B Critical I Water Shortage Long-Term (50%-60% of Normal Water Production)***

*Stage 5B Critical II Water Shortage* is categorized with a possible reduction percentage of 40-50%. A long-term declaration is for water shortage conditions expected for a duration of 45 days or more. All the Response Actions in Stage 5A are required plus the following that replace previous less stringent actions:

- Motor vehicles and equipment shall be washed only at commercial establishments that use recycled or reclaimed water.

Penalties: Any customer in violation of Stage 5 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 5 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

***Stage 6A Critical II Water Shortage Short-Term (less than 50% of Normal Water Production)***

*Stage 6A Critical II Water Shortage* is categorized with a possible reduction percentage of 50+%. A short-term declaration is for water shortage conditions expected for a duration of 45 days or less. All the Response Actions in Stage 5B are required plus the following new Response Actions:

- Landscape irrigation is prohibited.

The following Response Actions replace previous less stringent actions:

- Leaking customer pipes or faulty sprinklers shall be repaired immediately. Water service will be suspended until repairs are made.

- Reduce water use by the following specified percentages: Residential and Rural by 50% or more, Multi-family and Public/Institutional customers by 50% or more, commercial customers by 30% or more, and Landscape Irrigation by 100%.

Penalties: Any customer in violation of Stage 6 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 6 requirements after notice and warning is provided shall be punishable by an administrative fine of $500.00 per day or per occurrence.

***Stage 6B Critical II Water Shortage Long-Term (less than 50% of Normal Water Production)***

*Stage 6B Critical II Water Shortage* is categorized with a possible reduction percentage of 50+%. A long-term declaration is for water shortage conditions expected for a duration of 45 days or more. All the Response Actions in Stage 6A are required plus the following new Response Actions:

- No commitments ("will serves") will be made to provide service for new water service connections.

Penalties: Any customer in violation of Stage 6 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 6 requirements after notice and warning is provided shall be punishable by an administrative fine of $500.00 per day or per occurrence.

## 6.6 Process for Implementing Response Actions

The process for implementing the response actions is found in the updated Water Shortage Contingency Plan (**Appendix C**) and is briefly summarized below.

### Roles and Responsibilities

The District Engineer is responsible for collecting and analyzing data from the various sources. The District Manager will be kept updated on a regular basis, and the District Board of Directors will be updated at monthly Board meetings. Once a trigger is observed meeting a threshold value, the District will perform an assessment of their supplies to determine if hydrologic conditions will affect its current and future CVP water allocations. Due to the water-year used by the Reclamation (March 1$^{st}$ through the last day of February) and the low water demands during the winter and early spring, no changes to the water shortage stages are generally implemented prior to March 1$^{st}$. However, due to public notice requirements and the District's 2-month billing cycle, the District needs to be prepared to implement water demand reduction actions immediately following Reclamation's CVP 's announcement of initial water allocations for BVWD.

### Communication Protocols

If Response Actions must be implemented, the general public encompassing the BVWD service area will be noticed through the District website and with billing inserts or notices on each bill.

### Monitoring Plan

The Monitoring Plan is outlined in detail in Chapter 3 - Drought Monitoring of this Plan. Water demands will be regularly monitored during emergency water shortages so the District can manage the balance between supply and demand. Below are monitoring protocols for different water shortage stages:

- In normal water supply conditions (Stage 1), production and pumping amounts are reported monthly to the District Engineer.
- During Stages 2, 3, and 4 water shortage conditions, weekly production and pumping amounts are reported to the District Engineer for comparison to weekly targets and goals.
- During stages 5 and 6, a daily production and pumping report will be provided to the District Engineer to verify that reduction goals are being met.

# 7 Operational and Administrative Framework

This section discusses the operational and administrative framework for implementing this Drought Contingency Plan. Following are discussions on roles and responsibilities, procedures for declaring a water shortage and implementing the appropriate response actions, and a list of practical drought related resources. This framework is important to help ensure that responses to droughts are organized, timely, and efficient.

## 7.1 Roles and Responsibilities

Roles and responsibilities during droughts are summarized below:

District Engineer

- Monitor drought conditions (refer to Section 3 – Drought Monitoring Plan)
- Prepare and disseminate public outreach information on water supply conditions, declaration of a water shortage, changes in drought stages, and implementing response actions
- Monitor the effectiveness of the response actions and mitigation actions
- Meet regularly with the District Manager to share information and assist with decision making

District Manager

- Meet regularly with the District Engineer to discuss drought conditions, response actions, and mitigation actions
- With input from the District Engineer, make recommendations to the Board of Directors for responding to droughts and implementing response actions (see Section 6 – Response Actions) and mitigation actions (see Section 5 – Mitigation Actions)
- Declare an emergency water shortage (e.g., water main break, equipment failure, etc.) and notify the Board of Directors as soon as possible afterwards.

Board of Directors

- Make decisions regarding initiating a drought, implementing response actions, and funding of mitigation actions

Drought Task Force

- Assist in updating the Drought Contingency Plan. This is discussed in Section 6 – Plan Update Process.

## 7.2 Drought Response Procedures

Scope: This subtask includes identifying specific procedures and protocols for initiating, announcing, and implementing response actions. Topics addressed will include timing, communication methods, public notification, and triggers for implementing response actions.

The District defines a water supply shortage as the difference between demand and the sum of the reduced CVP allocation and additional secure sources of supply (groundwater, Anderson - Cottonwood ID long-term transfer agreement, and other water transfers). The District's CVP supply is their primary water supply, and the announcement of CVP allocation is usually not made until March of each year. As a result, no changes to the water shortage stages are generally implemented prior to March 1st. However, due to public notice requirements and the District's 2-month billing cycle, the District needs to be prepared to implement water demand reduction actions immediately following Reclamation's announcement of the initial CVP water allocations for BVWD.

When assessing current demands, BVWD typically looks at the average of the last three years of unconstrained demand due to the requirements of the CVP M&I Water Shortage Policy. A "Normal Supply" is also defined as the average M&I water usage during the last three years of unconstrained supplies. As a result, years with water restrictions are not included in the average. When necessary, other considerations such as new growth, weather, etc. will be considered in estimating demand. Based on a comparison of supplies versus demands, a drought stage and its associated response actions are recommended to the Board of Directors for approval. A new drought stage can be implemented fairly quickly by calling a special Board Meeting.

The District has adopted six different drought stages (see Section 6 – Response Actions). The declaration of a Stage is made by the District's General Manager or his/her designee and subject to ratification by the District's Board of Directors, in a regular or special session. Typically, all the Response Actions are enacted when a stage is declared, but the District may elect to exclude certain Response Actions if they are deemed unnecessary.

Numerous technical details on this process are not discussed here but can be found in Section 6 – Response Actions and **Appendix C - Water Shortage Contingency Plan**.

Should a potential shortage be anticipated, or if one is declared, the public and BVWD customers will be notified via public notices, announcements on the District's web page (www.bvwd.org), announcements at Board of Directors meetings, and in their bimonthly billings.

## 7.3 Drought Response Resources

Following are useful resources related to drought monitoring, assessment, and response:

- California Water Science Center (https://ca.water.usgs.gov/california-drought/index.html) (includes webpages on droughts, runoff, surface water, groundwater and other drought publications)
- Central Valley Project and State Water Project Drought Contingency Plan for Water Project Operations (Reclamation and California Department of Water Resources, updated annually)
- Drought Response Program Framework: WATER Smart Program (Reclamation, 2016)
- Maven's Notebook (https://mavensnotebook.com/) (water news including drought conditions)
- Record of Decision – Central Valley Project Municipal and Industrial Water Shortage Policy (Reclamation, 2015)
- Sacramento and San Joaquin River Basin Study (Reclamation, 2016)
- West-wide Climate Risk Assessment – Sacramento and San Joaquin Basin Climate Impact Assessments (Reclamation, 2014)

In addition, Chapter 2 – Drought Monitoring Plan provides numerous references for hydrologic and drought monitoring data.

# 8 Plan Update Process

This chapter discusses the processes for developing the DCP, measuring its effectiveness during implementation, triggers for updating the plan, and incorporation of the plan into other Bella Vista Water District (BVWD) planning documents.

## 8.1 Process for Developing a Drought Contingency Plan

The following general process was used for developing the DCP.

**Drought Task Force**

A Drought Task Force (Task Force) was formed to help discuss District issues and drought management strategies. The Task Force included ten members comprised of District staff and District board members, as well as representatives from other local agencies, local businesses, residential water users, rural water users, and agricultural water users.

Two Workshops were held with Task Force members. The first was held at the commencement of the project to explain the contents and purpose of the DCP, review past drought impacts, and educate all interested parties on water supply issues in the District. The second workshop included a presentation on the Draft DCP and provide an opportunity for detailed discussions and comments.

**Review of Draft DCP Documents**

The following process was followed for reviewing and commenting on the Draft DCP:

1. Draft chapters were emailed to Task Force members for review and comment.
2. The full Draft DCP was sent to the Task Force and discussed at a special workshop.
3. The Draft DCP was placed on the District website for public review and comments.
4. The Final DCP will be posted on the District website for public awareness and education.

**Public Outreach**

The general public was educated on the DCP using several outreach methods. These are documented in a project Communication and Outreach Plan (see **Appendix A**) and include: a press release, two District newsletter articles, website postings, a list of Frequently Asked Questions (FAQ) to inform the public about drought conditions in the District, and discussion on DCP progress at regular Board Meetings, which are open to the public. These outreach methods were aimed at educating the District customers on the DCP and soliciting input.

## 8.2 Process for Monitoring Plan Effectiveness

Evaluation of the DCP will primarily be performed during post-drought conditions after the plan has been implemented. Consequently, the plan's effectiveness will be re-evaluated after each drought. The post-drought evaluation will analyze the following:

- Effectiveness of response actions and mitigation actions
- Customer comments and suggestions
- Revenue impacts to the District
- Overall water reliability during droughts

This will provide a mechanism for improving the system. The evaluation will look at where drought planning was both successful and where it failed or needs improvement. The mitigation actions and response actions are the main components of the drought plan; however, all six components of the DCP will be evaluated.

The evaluation will be performed by District staff as well as the District Board of Directors, and, when deemed necessary, the Drought Task Force will be reconvened, or a new Drought Task Force will be formed to assist with the evaluation. This evaluation will be important in assessing whether a DCP update is needed, which is discussed in the following section.

## 8.3 Criteria for Periodic Updates

**Triggers for Plan Updates**

This Drought Contingency Plan will be updated as deemed necessary by the Bella Vista Water District. District staff will review this Plan at a minimum every 5 years and evaluate the need for an update. An update could be triggered by one of more of the following scenarios:

1. **Drought Contingency Plan Requirements.** Reclamation modifies the required content for their Drought Contingency Plans.
2. **Multi-year Drought.** A multi-year drought occurs, especially if the District's response and mitigation actions are not adequate.
3. **New Facilities.** Significant changes in facilities that could either help mitigate or inhibit

drought response.

4. **Changes in Water Supplies.** Changes in the availability and timing of surface or groundwater supplies.
5. **Changes in Water Demands.** A significant change in water demands (annual, seasonal, or diurnal) or demand changes in different water use sectors (urban, agricultural, commercial, etc.).
6. **New Water regulations.** Changes in State or Federal water regulations that impact water supplies, water demands, water conservation requirements, or water reliability.
7. **New District Water Policies.** The adoption of new internal water policies for BVWD.

**Incorporations into Other Planning Documents**

The relevant content of this Drought Contingency Plan will be incorporated into other District planning documents, including their Federal Water Management Plan, Urban Water Management Plan, and Water System Master Plan.

**Federal Water Management Plan**

Federal Water Management Plans are due every five years, usually at the end of the year. The District will be updating their Water Management Plan for submission by December 31, 2021. The relevant contents of this plan will be incorporated into the 2021 Water Management Plan, and into future plans, as necessary.

**California Urban Water Management Plan**

California Urban Water Management Plans are also due every even five years, and the District tries to prepare then concurrently with the Federal Water Management Plan updates. The District will be updating their Urban Water Management Plan for submission by July 1, 2021. The relevant contents of this plan will be incorporated into the 2020 Urban Water Management Plan, and into future plans, as necessary.

**Water System Master Plan**

The District last updated their Water System Master Plan in 2005. The plan includes an evaluation of water demands using peaking factors, a hydraulic analysis of their distribution system, and an infrastructure plan. The District would like to update the plan within the next few years, pending available funding. The relevant water supply analyses and mitigation actions in this Drought Contingency Plan will be incorporated into the Water System Master Plan update.

When feasible, future updates will be performed to coincide with the schedule for updating these other plans.

**Plan Update Process**

The process for updating the DCP will depend on the nature and extent of revisions needed. Minor revisions would likely be made by District staff and submitted to the District Board of Directors for approval. If major changes are required, the District will consider using a Drought Task Force and following the steps outlined in Section 8.1. In both cases, notification of any changes to the DCP will be posted on the District's website.

## BELLA VISTA WATER DISTRICT

## DROUGHT CONTINGENCY PLAN

# *APPENDIX A – COMMUNICATION AND OUTREACH PLAN*

Bella Vista Water District

# Communication & Outreach Plan

## for the Drought Contingency Plan

**Shasta County, California**

November 2019

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# Abbreviations

BVWD ........ Bella Vista Water District
DCP ........ Drought Contingency Plan
FAQ ........ Frequently Asked Questions
Task Force ........ Drought Task Force
USBR ........ United States Bureau of Reclamation

# 1. Overview & Communication Goals

This section of the Communication & Outreach Plan provides a description of the Bella Vista Water District (**BVWD**), an overview of the Drought Contingency Plan (**DCP**) and the goals of this outreach plan.

## A. Overview of the Bella Vista Water District

Bella Vista Water District was formed on June 5, 1957 to provide agricultural and domestic water to the area northeast of the City of Redding. Located in western Shasta County, BVWD includes 34,360 acres (54 square miles), and is a California water District pursuant to the California Water Code, operating under governance of an elected board of directors. The District supplies agricultural, municipal, commercial, and public/institutional water, and owns and operates the water treatment, water storage tanks and most of the distribution system.

Approximately one-fifth of the BVWD boundary is located within the northeastern portion of the City of Redding, encompassing over half of the District's customer accounts within those city limits. Redding has a population of over 91,000, and is the county seat of Shasta County, serving as the center of trade and commerce, and regional hub for retail, education, professional services and government for the region.

## B. Drought Contingency Plan Overview

The BVWD has significant water supply issues during droughts, primarily related to uncertainty in their USBR surface water supply. The District also lacks sufficient diversity in water supplies. The 2013-2016 drought resulted in surface water cutbacks that required extreme water conservation measures. These deficit conditions have led the BVWD staff to develop a long-term Drought Contingency Plan (**DCP**). During the development phase of the DCP, BVWD will gather input from a wide range of stakeholders to identify important vulnerabilities and potential solutions, such as improved water conservation programs, additional groundwater extraction capacity, water transfer agreements, and installation of smart meters.

## C. Goals/Desired Outcomes of Outreach Plan

The Communication & Outreach Plan outlines the proposed methods for informing, engaging and soliciting input from stakeholders on the DCP. The Bella Vista Water District will give their customers opportunities to engage in the DCP development process and provide educational outreach opportunities for those stakeholders by reaching out through specific communication avenues (discussed in **Section 4**). As primary stakeholders, members of the Board of Directors and Drought Task Force are direct representatives of their communities and water use sectors, and it is important for them to continually gather feedback/input, and concerns/needs of their constituents and report back to their respective meetings. Any primary or secondary stakeholder input received will be reviewed and taken into consideration during DCP development.

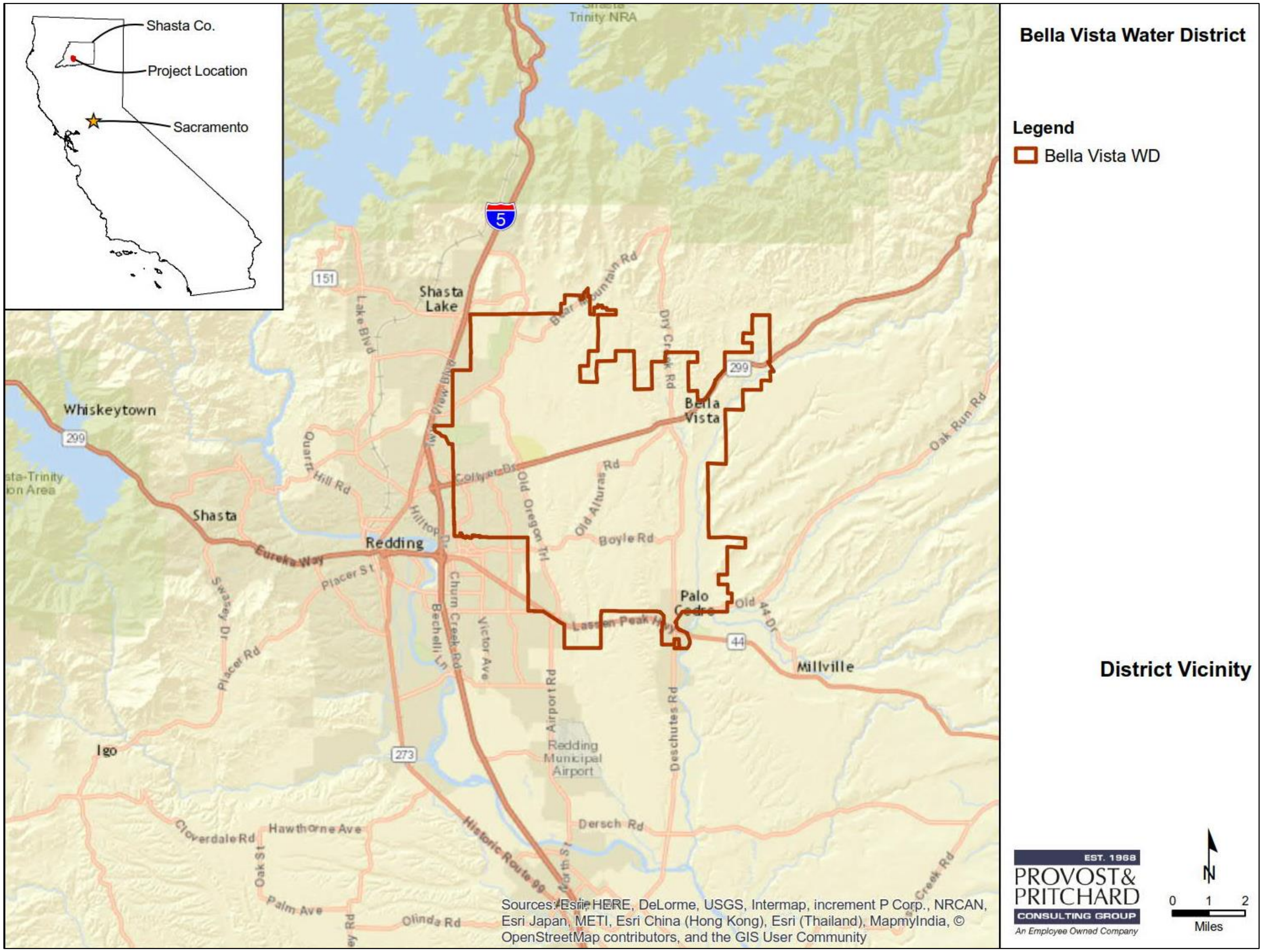


**Figure 1-1. Bella Vista Water District Boundary Map**

# 2. Stakeholder Identification

## A. Primary Stakeholders

The primary stakeholder groups of the Bella Vista Water District are members of the Board of Directors, and members of the Drought Task Force Committee. Their specific roles in the communication and outreach process are discussed in this section.

### 2.A.1 Board of Directors

The Bella Vista Water District's Board of Directors consists of five members, each elected to serve four-year terms that are staggered. Board members also serve on various standing and ad hoc committees, including an Engineering and Planning Committee, Finance and Personnel Committee, and Policy and Legislation Committee

The Board of Directors meetings are held at 5:30 p.m. on the fourth Monday of each month at the Bella Vista Water District's office, located at 11368 East Stillwater Way in Redding, California. These meetings are open to the public.

### 2.A.2 Drought Task Force

A Drought Task Force (**Task Force**) was developed to include a diverse group of stakeholders within the BVWD boundary. The purpose of the Task Force is to identify District issues provide new ideas, and critique existing policies. Task Force members were initially contacted by BVWD staff to identify those who were interested in becoming a part of the effort, as this group is an integral part of developing the DCP.

Task Force members who were contacted by staff and expressed interest in participating are listed in **Table 2-1**. These members represent a comprehensive spectrum of agriculture, rural and residential stakeholders.

**Table 2-1. Drought Task Force Members**

| Task Force Member | BVWD Affiliation |
|---|---|
| Wayne Ohlin | District Engineer |
| David Coxey | General Manager |
| Bob Nash | Agricultural Business Owner, BVWD Board Member |
| Leimone Waite | Agricultural Professor, BVWD Board Member |
| Charlene Beard | Shasta County Public Works |
| Gerald Hagmeyer | Rural BVWD Customer |
| Jordan Taylor | Residential BVWD Customer |
| Synthia Penn | Agricultural and Commercial BVWD Customer |
| Linda Samuels | Residential BVWD Customer |
| Liz Elwood | Agricultural BVWD Customer, Shasta County Farm Bureau Board Member |

## B. Secondary Stakeholders

Secondary stakeholders are the customers of the BVWD, which includes agricultural landowners, residents and business owners (commercial and industrial) within the BVWD boundary. These stakeholders are direct beneficiaries of BVWD water and will be engaged through communication and outreach efforts during DCP development, public review and implementation phases. Secondary stakeholder groups will be engaged through the preparation of a press release on the DCP, preparation of two District newsletter articles on the DCP, including information regarding the grant and DCP on the District Website or at (www.bvwd.org/drought-contingency), and preparing a list of Frequently Asked Questions (FAQ). In addition, they can be informed through DCP progress reports and updates provided and announced at regular Board Meetings, provided in Board Meeting agendas and minutes, and made available on the District Website.

# 3. Messages and Talking Points

Key messages and talking points will be broken down by phases and stakeholder groups, as different factors and issues will affect different groundwater interests. These messages and talking points are also prone to evolve as the DCP is developed, leaving this section open to be amended and finetuned as communication and outreach efforts move forward.

Newsletters, presentations, and other literature reflecting key messages will be developed and tailored for the specific DCP development, public review and implementation phases, and made available for public education efforts.

## 3.A.1 Key Messages & Talking Points

### 3.A.1.1 Universal Key Messages

Universal key messages will be a consistent part of a list of FAQs and talking points throughout all phases of DCP development, public review and implementation.

- What is the Drought Contingency Plan
- What is the Role of a BVWD and Drought Task Force
- Purpose of the DCP within the BVWD boundary
- How is the BVWD impacted by Droughts

### 3.A.1.2 Development Phase

The newsletter articles, PowerPoint presentation, and Frequently Asked Questions (FAQ) will be developed and made available on the District's website, and distributed at project meetings. In addition to the universal key messages, the communication outlets for the DCP development phase will include:

- Timeline of the DCP process
- Direction on providing input/voicing concerns (outreach meetings)

### 3.A.1.3 Public Review Phase

Once the draft of the BVWD's DCP is completed, a second newsletter will be developed, and the DCP presentation and FAQs will be updated. Like in the development stage, these modes of communication will be distributed at project meetings and posted on the website. These communication and outreach efforts will consist of the universal key messages, while the rest of the content will be focused on:

- Updated timeline of the DCP process
- Main points/overview of the DCP
- Process for public review of DCP draft and providing comments to the BVWD District on the DCP
- Additional key messages may be added for this phase.

### 3.A.1.4 Implementation Phase

Once the BVWD's DCP has been completed, the implementation phase will begin, and outreach will be performed to primary and secondary stakeholder groups. As with the previous phases, universal key messages will be included. Outreach is expected to increase during dry years when the DCP will be implemented.

# 4. Methods of Outreach

There are a variety of opportunities, venues and methods for the District to connect with and engage stakeholders throughout implementation of the Drought Contingency Plan. Stakeholders identified in **Section 2** will be engaged in communication efforts as detailed below.

## A. Stakeholder Meetings

### 4.A.1 Board of Directors Meetings – Primary Stakeholders

As detailed in **Section 2.A**, regular meetings with primary stakeholder groups will be held during their regularly scheduled times. Members of the public and representatives are encouraged to attend Board of Directors meetings to voice their thoughts and concerns about addressing drought issues within the BVWD. Meeting notices and agendas are routinely posted on www.bvwd.org.

- **Board of Directors Meetings –** Fourth Monday of each month at 5:30 p.m., held at the Bella Vista Water District's office, located at 11368 East Stillwater Way in Redding, California.

### 4.A.2 Drought Task Force Workshops & Meetings – Primary Stakeholders

As discussed in **Section 2.A.2**, workshops will be held with the Task Force members, one near the beginning of plan development, and one near the end in conjunction with the release of the Draft DCP for public review.

- **Task Force Workshop #1 –** This workshop was held in June 2019. The agenda consisted of reviewing past drought impacts and water supply vulnerabilities, identifying roles and responsibilities, providing input on the proposed elements of the DCP, and determining needs of future Task Force progress meetings.
- **Task Force Workshop #2 –** The agenda for the second workshop will include a presentation of the Draft DCP, with an opportunity for Task Force members to provide comments and hold a detailed discussion prior to the release of the plan for public review.
- **Task Force Meetings –** Additional meetings of the Task Force may be set at the discretion of BVWD staff members, with the focus of discussing DCP progress.

## B. Printed Communications

Printed materials will be developed for the educational and outreach efforts:

- **FAQ-** A list of Frequently Asked Questions will be prepared that addresses commonly asked questions about the cause of drought in BVWD, and existing and potential future mitigation measures. The FAQs will be placed on the BVWD website and presented to the Task Force for comments.
- **Presentation Materials –** Power Point presentations will be utilized for the Task Force and Board of Directors meetings. In addition, display boards printed at 24-inch x 36-inch or larger in size may be used and set up on easels. Handouts of presentations and smaller versions of display boards can

be distributed to stakeholders in attendance and can also be posted on www.bvwd.org/drought-contingency for access by stakeholders as a recap of the meeting.

- **Newsletter –** The BVWD will incorporate two articles regarding the DCP into their newsletters, or alternatively post the articles on the District website. These articles will be utilized to inform stakeholders of the USBR grant, DCP effort and opportunities for comments.
- **Other Printed Materials –** Other printed materials may be developed as needed to educate stakeholders and implement the DCP.

## C. Digital Communications

Digital communication outlets will be a significant mode of communication.

- **Website –** Public meeting notices, agendas and minutes of the BVWD's Board of Directors meetings are posted on the District's website, www.bvwd.org. This website already serves as an information portal for stakeholders within the Bella Vista Water District boundary. Educational resources related to the DCP will be posted on the Drought Contingency page on the District's website.
- **Email Distribution –** The BVWD maintains email contact lists for the Task Force and Board of Directors. Emails will be used to inform members of meetings, draft chapters for review and other project related information.

A press release will be written and distributed to local media. A list of potential media outlets is presented in **Table 4-1**. The press release will provide a summary for the public, covering DCP development as well as indicating the project's completion.

**Table 4-1. Media Outlets**

| Media Source | Submission Information |
|---|---|
| KRCR TV 7 | Submit: news@krcrtv.com<br>Website: www.krcrtv.com<br>Telephone: (530) 232-5702 |
| Record Searchlight | Submit: rrsedit@redding.com (Newsroom email)<br>Website: www.redding.com<br>Telephone: (530) 225-8211 |
| East Valley Times | Submit: Judy@eastvalleytmes.com<br>Website: http://evalleytimes.com/news/<br>Telephone: (530) 515-3809 |
| KFPR – North State Public Radio | Submit: kmfrost@csuchico.edu<br>Website: www.mynspr.org |
| KGEC TV 26 | Submit: engineer@kgectv.com<br>Website: www.kgectv.com<br>Telephone: (530) 941-7879 |
| KIXE TV 9 | Submit: channel9@kixe.org<br>Website: www.kixe.org<br>Telephone: (530) 243-5493 |
| KQMS 1670 AM | Submit: Steve.Gibson@smgnational.com<br>Website: www.kqms.com<br>Telephone: (530) 221-1400 |
| Shasta County Farm Bureau | Submit: shastacountyfarm@frontiernet.net<br>Website: www.shastafarmbureau.com<br>Telephone: (530) 547-7170 |

# 5. Implementation Timeline

The timeline for implementing this Communication & Outreach Plan will be broken down by phase:

- Development Phase
- Public Review Phase
- Implementation Phase

The timeline is tentative and subject to change with the progression of the DCP development, public review and implementation phases.

**Table 5-1. DCP Communication & Outreach Plan Tentative Timeline**

| Outreach Opportunity | Date/Timeframe |
|---|---|
| **Development Phase** | |
| Drought Task Force Recruitment | April-May 2019 |
| Updates at monthly BVWD Board of Directors Meetings | Monthly |
| Drought Task Force Workshop #1 | June 2019 |
| DCP Newsletter Article #1 | Summer 2019 |
| Digital Communications (website and emails) | Ongoing |
| Printed Communications, including Frequently Asked Questions on the DCP developed, posted online, and distributed to stakeholders | January 2020 |
| **Public Review Phase** | |
| Drought Task Force Workshop #2 – Final Draft Review | April 2020 |
| Updates at monthly BVWD Board of Directors Meetings | Monthly |
| DCP Newsletter Article #2 | May 2020 |
| Press Release distributed on DCP and Public Review process | May 2020 |
| Digital Communications (website updates and email blasts) | Ongoing |
| **Implementation Phase** | |
| Updates at monthly BVWD Board of Directors Meetings | Monthly |
| Digital Communications (website updates and email blasts) | Ongoing |

**BELLA VISTA WATER DISTRICT**

**DROUGHT CONTINGENCY PLAN**

# *APPENDIX B – FREQUENTLY ASKED QUESTIONS REGARDING DROUGHTS AND WATER RESTRICTIONS*

# BELLA VISTA WATER DISTRICT
# FREQUENTLY ASKED QUESTIONS REGARDING DROUGHTS AND WATER RESTRICTIONS

1. *What is the Drought Contingency Plan?*

   The District's Drought Contingency Plan (DCP) addresses drought related vulnerabilities through consideration of drought response actions and mitigation measures. The primary focus of the DCP is drought mitigation and response; however, the strategies considered in this plan may provide ancillary benefits for emergency response, replacement, and/or alternative supplies. The DCP is not a water supply master plan to accommodate growth. Future supply planning is addressed separately by the District's Urban Water Management Plans (UWMP) and other efforts.

   Contained within the DCP is the District's Water Shortage Contingency Plan (WSCP) that can be implemented in the case of a water shortage caused by a drought or other interruptions to the District's water supplies. The Water Shortage Contingency Plan identifies six conservation levels, or Stages, along with suggested voluntary or mandatory conservation measures and activities that can be implemented to help preserve the District's water supply during a water shortage.

   A link to the Drought Contingency Plan can be found on the following webpage:

   https://www.bvwd.org/drought-contingency

   A link to the Water Shortage Contingency Plan can be found on the following webpage:

   https://www.bvwd.org/drought-contingency

2. *Purpose of the DCP?*

   The BVWD DCP addresses drought related vulnerabilities through consideration of drought response actions and mitigation measures. The DCP is not a water supply master plan to accommodate growth. Future supply planning is addressed separately by the District's Urban Water Management Plans (UWMP) and other efforts. The primary focus of the DCP is drought mitigation and response; however, the strategies considered in this plan may provide ancillary benefits for emergency response, replacement, and/or alternative supplies.

3. *What is the Role of the BVWD Drought Task Force?*

   The District established a Drought Task Force in 2019 representing a broad range of stakeholder interests in order to solicit their input on interim Water Shortage Contingency Plan work products through written comments and two workshops.

4. *How is the BVWD impacted by Droughts?*

   The District's primary water supply is a Central Valley Project (CVP) Water Service Contract with the Bureau of Reclamation. In a normal year, the District could receive up to 24,578 acre-feet (approximately 8 billion gallons) of water. However, during a drought the District's allocation can be severely cut. In 2015, the District's allocation was cut to 25% of Historical

Municipal & Industrial (M&I) usage and 0% for Agricultural water. M&I usage includes the District's Residential, Rural, Commercial, Public/Institutional and Landscape customer classes. Based on recent M&I usage of approximately 7,000 acre-feet per year, a 25% allocation would result in the District receiving only 1,750 acre-feet under its CVP Water Service Contract.

Fortunately, the District has a contract with the Anderson-Cottonwood Irrigation District (ACID) to provide up to 1,536 acre-feet of M&I water. Additionally, the District has five groundwater wells that it can use to offset most of the impact on its M&I customers.

5. *How will we recognize the next drought in the early stages?*

The District will monitor various sources of information on water supplies and drought including:

- California Department of Water Resources data on stream flows and reservoir levels (http://cdec.water.ca.gov/index.html).
- The U.S. Drought Monitor for California (https://droughtmonitor.unl.edu/data/pdf/current/current_ca_trd.pdf)
- United States Bureau of Reclamation announcements regarding water supplies and drought allocations (https://www.usbr.gov/mp/cvp-water/allocations.html)

6. *How will drought affect me?*

It will depend on the severity of the drought and the allocations that the District receives from the Bureau of Reclamation. The Water Shortage Contingency Plan includes six shortage stages ranging from a reduction of up to 10% of historical water production, to a reduction of more than 50% of historical water production. Each shortage stage contains restrictions on water usage. The Water Shortage Contingency Plan restrictions (required "Customer Actions") can be found at the link below. [Note: This link will need to be updated and we should probably have a link to the stages without any particular stage being highlighted.]

7. *How can we protect ourselves from the next drought?*

The District will continue to investigate potential projects and opportunities to increase the reliability of its water supplies in preparation for future droughts. Individual customers are encouraged to actively manage their water usage by monitoring their water usage on a regular basis, fixing leaks when they are discovered and by utilizing drought tolerant landscaping options.

8. *What is the status of our water supplies?*

Currently (in 2020), the District received an allocation of its CVP Water Service Contract of 75% of historical use for M&I usage, and 50% of the contract remainder for a total CVP Water Service Contact Supply of 13,963 AF. In a normal water year usage by the District is approximately 10,000 AF. So, for the 2020-2021 water year the District's supplies are more than 100% of its normal water production/usage. This translates to being at Stage 0 of the Water Shortage Contingency Plan.

9. *What potential mitigation measures are the District considering?*

Throughout its development, the Drought Contingency Plan investigated a number of potential mitigation actions for the District to consider. These included:

- Water transfers and exchanges
- Intra-basin groundwater substitution transfers
- Aquifer storage recovery
- Installation of new groundwater wells
- Additional treated water storage
- Surface water storage
- Recycled water
- Pipeline leakage reduction
- Advanced Metering Infrastructure (smart meters)

The top ranked mitigation measures were the installation of new groundwater wells and additional treated water storage.

10. *Why is the District updating its Water Shortage Contingency Plan?*

California had three straight dry years from 2013 through 2015, with 2013 being the state's driest year on recorded history. With the continuing uncertainty regarding the District's Central Valley Project water supplies, the District is updating its Water Shortage Contingency Plan to reflect lessons learned during the latest drought.

11. *What are the drought stages based on?*

The drought stages are based on the total quantity of water available to the District from its CVP Contract, its long-term water transfer from ACID, potential water production from its wells, and any water transfers that the District is able to arrange.

The drought stages are as follows:

- Stage 0 – M&I Water supplies exceed 100% of historical water production
- Stage 1 – M&I Water supplies are between 90% and 100% of historical water production
- Stage 2 – M&I Water supplies are between 80% and 90% of historical water production
- Stage 3 – M&I Water supplies are between 70% and 80% of historical water production
- Stage 4 – M&I Water supplies are between 60% and 70% of historical water production
- Stage 5 – M&I Water supplies are between 50% and 60% of historical water production

- Stage 6 – M&I Water supplies are less than 50% of historical water production

A link to the Water Shortage Contingency Plan restrictions (required "Customer Actions") can be found at the following webpage:

https://www.bvwd.org/drought-contingency

12. *By how much will I need to reduce my water use in a drought?*

The amount that you will need to reduce your water usage varies depending what drought stage is in effect. The percentages are shown in item no. X of the Water Shortage Contingency Plan restrictions (required "Customer Actions") which can be found at the following webpage:

https://www.bvwd.org/drought-contingency

13. *Does the District currently have a target for customers to reduce water use?*

The target for water use reduction depends on the drought stage that the District has declared. When no drought has been declared the District just asks water users to voluntarily conserve water and prevent water waste. The following webpage includes a link to the current status on drought declarations and target water use reductions: https://bvwd.org/drought-contingency

14. *Are there restrictions on how water can be used?*

A link to restrictions on how water can be used for each Drought Stage can be found at the following webpage:

https://www.bvwd.org/drought-contingency

15. *Can't we just pump more local groundwater to make up for reduced allocations from the Central Valley Project?*

The District has five groundwater wells that are capable of producing up to 3,000 acre-feet per year. So, the District can make up for CVP allocation cutbacks that result in water supply shortfalls of up to 3,000 acre-feet. In order to make sure that the District has sufficient supplies to meet customer demands it will implement staged reductions in customer water usage in accordance with the Water Shortage Contingency Plan.

16. *How can I obtain more information, and get other questions answered?*

Additional information regarding the District's water supply and drought conditions can be found by clicking on the "Drought Contingency" link on the District's web page at https://bvwd.org/.

17. *What if I am already practicing conservation and am using water efficiently, will I be asked to conserve more?*

    During a drought, the water supply allotments for each customer are based on their historical water usage (their water usage during the last three 100% allocation years).

18. *What if my property has no "historical usage" what then?*

    Depending on the severity of the drought here are 2 options;

    <u>Option 1-</u>

    All District Rural and Residential customers shall receive a minimum of 24 HCF (which is equal to approximately 600 gallons per day) for each location and each billing period.

    <u>Option 2 -</u>

    All new Residential and Rural Customers shall be granted the following water allotments:

    - 24 HCF (customers billed March 16 - May 15)
    - 34 HCF (customers billed May 16 - July 15)
    - 58 HCF (customers billed July 16 - September 15)
    - 52 HCF (customers billed September 16 - November 15)
    - 25 HCF (customers billed November 16 - January 15)
    - 24 HCF (customers billed January 16 - March 15)
    - (applicable to all new meter installations after the date of the drought declaration and may be granted to accounts with less than 3 years of representative water usage history).

**BELLA VISTA WATER DISTRICT**

**DROUGHT CONTINGENCY PLAN**

# *APPENDIX C – WATER SHORTAGE CONTINGENCY PLAN*

# WATER SHORTAGE CONTINGENCY PLAN

# FOR

# BELLA VISTA WATER DISTRICT

*Revised April 2020*

Prepared for:

Bella Vista Water District

Prepared By:

Provost & Pritchard Consulting Group

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# 1 - PURPOSES AND PRINCIPLES OF PLAN

The purpose of the Bella Vista Water District (BVWD or District) Water Shortage Contingency Plan (WSCP) is to provide a methodology for analyzing water supply reliability, establishing water shortage stages, identifying appropriate response actions, and documenting protocols for enforcing the WSCP. This WSCP was prepared according to requirements in Sections 10632 & 10635 of the California Water Code. **Table 1** below shows the required components of a WSCP, the relevant water code section, and where they are found in this document.

### Table 1: Water Shortage Contingency Plan Requirements

| Topic | CA Water Code Section | WSCP Section |
|---|---|---|
| Water Supply Reliability Analysis | WC 10632 (a.1) | Section 2 |
| Annual Assessment Procedures | WC 10632 (a.2) | Section 2 |
| Water Shortage Stages | WC 10632 (a.3) | Section 3<br>Table 2 |
| Shortage Response Actions | WC 10632 (a.4)<br>WC 10632 (b) | Section 4 |
| Communication Protocols | WC 10632 (a.5) | Section 5 |
| Compliance and Enforcement | WC 10632 (a.6) | Section 6 |
| Legal Authorities | WC 10632 (a.7) | Section 7 |
| Financial Consequences of WSCP | WC 10632 (a.8) | Section 8 |
| Monitoring and Reporting | WC 10632 (a.9) | Section 9 |
| WSCP Refinement Procedures | WC 10632 (a.10) | Section 10 |

The District first adopted a WSCP in 1992 and has updated it several times since then. This updated WSCP includes changes from the 2015 WSCP to meet new State requirements and better serve the District and its water users. All the water uses that are regulated or prohibited under this Plan are considered to be non-essential. Therefore, the continuation of such uses during times of water shortage or other emergency water supply conditions is deemed to constitute a waste of water, which subjects the offender(s) to penalties, as set forth in the WSCP.

# 2 - PROCEDURES FOR CONDUCTING ASSESSMENT

## 2.1 Decision Making Process

**Regulatory Requirement**

| |
|---|
| **§10632(a.2.A)** The written decision-making process that an urban water supplier will use each year to determine its water supply reliability.<br>**§10632 (a.2.B) (iv)** A defined set of locally applicable evaluation criteria that are consistently relied upon for each annual water supply and demand assessment. |

In 2005, BVWD entered a long-term (25-year) renewal contract with the United States Bureau of Reclamation (USBR, Reclamation) (*Contract No. 14-06-200-851A-LTR1*) that authorizes the District to divert up to 24,578 AF annually, subject to shortage provisions, from the Sacramento River via the Central Valley Project (CVP). This is the primary water source for the District. However, Reclamation is often unable to deliver the full contract quantities due to hydrological conditions and environmental regulations. Therefore, the CVP allocations would serve as the primary determinant as to whether the District would expect to see a supply shortage. Traditionally March 1st marks the commencement of the water year for CVP supplies and is also the tentative date for the District to first consider implementing water shortage stages.

Additionally, several hydrologic datasets act as early predictors of the allocation the District can expect from Reclamation. These include the following:

1. Lake Shasta Reservoir Storage
2. Northern Sierra Precipitation and Snowpack
3. Sacramento Valley 40-30-30 Water Year Index
4. Shasta Lake Unimpaired Inflow
5. Regional and national drought indices (lower priority due to the general nature of their predictions)

Refer to the District's 2020 Drought Contingency Plan (Chapter 3 – Drought Monitoring Plan) for additional details on these data sources.

The District Engineer is responsible for collecting and analyzing various hydrologic datasets and assessing water demands versus anticipated supplies. The District Manager will be updated regularly, and the District Board of Directors will also be provided informative briefings at monthly Board meetings.

## 2.2 Data Inputs and Assessment Methodology

Current Year Demand

**Regulatory Requirement**

| |
|---|
| **§10632 (a.2.B) (i)** Current year unconstrained demand, considering weather, growth, and other influencing factors, such as policies to manage current supplies to meet demand objectives in future years, as applicable. |

When assessing current demands, BVWD typically looks at the average of the last three years of unconstrained demand due to the requirements of the USBR M&I Water Shortage Policy. A "Normal Supply" is also defined as the average supply during the last three years of unconstrained supplies. As a result, years with water restrictions are not included in the average. When necessary, other considerations such as new growth, weather, etc. will be considered in estimating demand.

Quantification of Water Supply

**Regulatory Requirement**

**§10632 (a.2.B)** The key data inputs and assessment methodology used to evaluate the urban water supplier's water supply reliability for the current year and one dry year.
**§10632 (a.2.B) (iii)** Current year available supply, considering hydrological and regulatory conditions in the current year and one dry year. The annual supply and demand assessment may consider more than one dry year solely at the discretion of the urban water supplier.
**§10632 (a.2.B) (v)** A description and quantification of each source of water supply.

BVWD maintains a Federal Water Contract with surface water diverted from the Sacramento River. In 2005, the District entered a long-term (25-year) Water Service renewal contract with the USBR (*Contract No. 14-06-200-851A-LTR1*) that authorizes the District to divert up to 24,578 AF from the Sacramento River supply via the Central Valley Project (CVP). USBR typically announces the initial allocation in February and may refine it over the next several months. The BVWD, also maintains a long-term transfer agreement with the Anderson-Cottonwood Irrigation District (ACID) for 1,536 AF/Y of CVP water, but this is reduced by 25% to 1,152 in Shasta Critical Years[1]. Lastly, the District relies on groundwater pumping from 5 wells for a combined production of approximately 12 acre-feet/day but runs its wells on a limited basis producing less than 300 AF in a normal year.

In order to augment supply on behalf of agricultural customers that would otherwise be subjected to significant shortages, the District adopted a Supplemental Water Program in April of 2009. This program was prompted from frequent, unreliable water supplies as a result of the evolving regulatory environment. The goal of the Program is to acquire additional water supplies in shortage years on behalf of the District's agricultural customers. Participation is on a voluntary basis, and therefore does not obligate the entire customer class. For example, those customers that have permanent crops may choose to participate, while others with pasture irrigation or annual row crops may choose to idle or fallow during shortages.

In the winter months and early spring, District staff reviews the CVP supply forecast, estimates demands, and determines the interest for additional water supplies in the upcoming water year. Once the Supplemental Water Program is activated, District staff then identifies, negotiates, and acquires needed supplies based on the applications received. The most likely source of supplemental water is from willing sellers that are also Central Valley Project contractors. Once a supply of water is obtained, the District then works with the appropriate agencies to obtain necessary approvals, schedule delivery, and transfer the water into the District.

[1] Shasta Critical Year is a term defined in specific water contracts. In general, a Shasta Critical Year occurs when the forecasted inflow to Shasta Lake for a particular water year is equal to or below 3.2 million acre-feet.

Existing Infrastructure Constraints

**Regulatory Requirement**

| **§10632 (a.2.B) (iii)** Existing infrastructure capabilities and plausible constraints. |
|---|

The District has a water system that consists of three treated water storage tanks, nine pumping plants, a main treatment plant, five wells, and over 200 miles of pipeline ranging from 4-inch in diameter to 54-inches. All the water is pumped for delivery within the District's local service area. Additionally, surface water is pumped from the Sacramento River at the Wintu Pumping Plant, which is located outside of the District's boundary. From the Wintu Pumping Plant, water is sent to a Surge Tank and then to the Water Treatment Plant (WTP). All water previously described is used for domestic or agricultural purposes.

Plausible constraints could include the following:

1. Distribution System. As additional wells are added at the southern ends of the distribution system, there may be locally high head losses and limited conveyance capacity until the well water reaches larger transmission lines.

2. Water Storage. Water storage is currently limited. During certain times of the year the District only has several hours' worth of storage. Storage could also be problematic if the District is relying solely on its wells and day-to-day flows vary widely due to varying irrigation demands (i.e., large irrigators using water once or twice a week) or if a widespread power outage occurs (see the discussion under Power below). Storage could also become inadequate if the District installs more well capacity.

3. Power. Power outages due to downed power lines or Public Safety Power Shutoff (PSPS) events are a significant problem. The District does not have excess storage to meet demands during an outage if only well water is available. Nor does the District have backup generators at any of its wells. The District only has one portable generator; thus, it could only be used to run one well at a time. In addition, only three District wells have transfer switches for the connection of a portable generator.

   Without additional storage, a power outage affecting multiple wells would require switching the District to surface water use until power could be restored. If the Water Treatment Plant has been off-line for more than a few days, it would require four to six hours to bring the plant back online and begin delivery of treated surface water into the distribution system. Depending on water demands and storage volumes at the time that the outage occurs, the District could quickly exhaust its operational storage and some customers could experience reduced pressures or water outages.

4. Transfers of non-federal (non-project) water. Water transferred to the District from a source other than from another Central Valley Project contractor requires a Warren Act contract that is negotiated with Reclamation in order to utilize federal facilities for the conveyance of non-project water. Additionally, Reclamation requires a separate power contract for conveyance pumping of non-project water through federal facilities (i.e., the Wintu Pumping Plant) since it is not eligible for project use energy.

# 3 - WATER SHORTAGE STAGES

**Regulatory Requirement**

**§10632 (a.3.A)** Six standard water shortage levels corresponding to progressive ranges of up to 10, 20, 30, 40, and 50 percent shortages and greater than 50 percent shortage. Urban water suppliers shall define these shortage levels based on the suppliers' water supply conditions, including percentage reductions in water supply, changes in groundwater levels, changes in surface elevation or level of subsidence, or other changes in hydrological or other local conditions indicative of the water supply available for use. Shortage levels shall also apply to catastrophic interruption of water supplies, including, but not limited to, a regional power outage, an earthquake, and other potential emergency events.

As outlined in the new Water Code requirements (10632 a & b.), Water Shortage Contingency Plans must include or be adapted to the six standard water shortage levels, which correspond to the progressive ranges of <10%, 10-20%, 20-30%, 30-40%, 40-50%, and 50+%. These six stages are described in **Table 2.** Stages 5 and 6 can be declared for a short-term (<45 days) or long-term (>45 days) shortage. The various Response Actions that correspond with these stages are addressed in **Section 4** of this plan.

### Table 2: Updated Stages of Water Shortage

| Stage | Supply Reduction | Water Supply Condition |
|---|---|---|
| 1 | 0%-10% | Normal Water Supply (90% to 100% of Normal Water Production) |
| 2 | 10%-20% | Moderate Water Shortage (80% to 90% of Normal Water Production) |
| 3 | 20%-30% | Severe Water Shortage (70% to 80% of Normal Water Production) |
| 4 | 30%-40% | Extreme Water Shortage (60% to 70% of Normal Water Production) |
| 5A | 40%-50% | Critical I Water Shortage-Short Term (50% to 60% of Normal Water Production) |
| 5B | 40%-50% | Critical I Water Shortage-Long Term (50% to 60% of Normal Water Production) |
| 6A | 50+% | Critical II Water Shortage-Short Term (Less than 50% of Normal Water Production) |
| 6B | 50+% | Critical II Water Shortage-Long Term (Less than 50% of Normal Water Production) |

Notes:
1 – Short term conditions occur for 45 days or less and may be attributed to infrastructure, water quality, or power issues, as well as hydrologic conditions. Long-term conditions are greater than 45 days and are typically due to hydrologic conditions.
2 – "Normal Water Production" refers to the average water production during the last 3 years with unconstrained supplies.

# 4 - SHORTAGE RESPONSE ACTIONS

## 4.1 Response Actions by Water Shortage Stage

**Regulatory Requirement**

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| **§10632 (a.4)** Shortage response actions that align with the defined shortage levels |

The existing response actions have been reviewed and updated for thoroughness, compliance with existing regulations, and applicability during potential times of drought, most recently observed in 2015. The declaration of a Stage is made by the District's General Manager or his/her designee and subject to ratification by the District's Board of Directors in a regular or special session. Typically, all the Response Actions are enacted when a stage is declared, but the District may elect to exclude certain Response Actions if they are deemed unnecessary. Following are the standard Response Actions for each water shortage stage.

### *Stage 1. Below Normal Water Supply (90% to 100% of Normal Water Production)*

*Stage 1. Below Normal Water Supply* is categorized with a possible reduction percentage of up to 10%. Response Actions may include:

- Water shall be used for beneficial purposes only; all unnecessary and wasteful uses of water are prohibited (*District Policy Manual Section 143*).
- Water shall not be applied to outdoor landscapes in a manner that causes runoff such that water flows onto adjacent property, non-irrigated areas, private and public walkways, roadways, parking lots, or structures. Care shall be taken not to water past the point of saturation.
- Free-flowing hoses are prohibited for all uses. Automatic shut-off devices shall be attached on any hose or filling apparatus in use.
- Leaking customer pipes or faulty sprinklers shall be repaired within five (5) working days or less if warranted due to the severity of the problem or shall not be utilized until repaired.
- All pools, spas, and ornamental fountains/ponds shall be equipped with a recirculation pump and shall be constructed to be leakproof.
- Swimming pool and spa covers encouraged to prevent evaporative water loss.
- Pool draining and refilling shall be allowed only for health, maintenance, or structural considerations.
- Washing streets, parking lots, driveways, or sidewalks, except as necessary for health, aesthetic, or sanitary purposes, is prohibited.
- To reduce evaporation, between March 1 and October 31 the use of sprinkler irrigation systems for all landscape irrigation systems shall be limited to be between the hours of 7:00 p.m. and 9:00 a.m. Sprinkler irrigation systems may be run outside of these hours for testing, but not for more than 15 minutes per cycle and only long enough to verify proper operation and make sprinkler adjustments.
- Irrigated landscaped areas shall include efficient irrigation systems (e.g., drip irrigation, timed sprinklers, rain sensors, low-flow spray heads, etc.).
- Use of potable water for the irrigation of turf or high-water use plants within public street medians and parkways is prohibited.

### *Stage 2. Moderate Water Shortage (80% to 90% of Normal Water Production)*

*Stage 2. Moderate Water Shortage* is categorized with a possible reduction percentage of 10-20%. All Stage 1 Response Actions are required plus the following:

- Reduce water use by the following specified percentages: Residential and Rural by 10-20%, Multi-family and Public/Institutional customers by 10-20%, commercial customers by 5-10%, and Landscape Irrigation by 15-25%.
- Customers with "smart" irrigation timers or controllers are asked to set their controllers to achieve 90 to 95% of the evapotranspiration (ET) rate.
- Eating or drinking establishments, including but not limited to: Restaurants, cafes, cafeterias, bars, or other public places where food or drink are served and/or purchased shall serve water only upon request.
- Operators of hotels and motels shall offer patrons the option of not having their towels and linens washed daily.
- Users of construction meters and fire hydrant meters will be monitored for efficient water use.

Penalties: Any customer in violation of Stage 2 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 2 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

### *Stage 3. Severe Water Shortage (70% to 80% of Normal Water Production)*

*Stage 3. Severe Water Shortage* is categorized with a possible reduction percentage of 20-30%. All the Response Actions in Stage 2 are required plus the following new Response Actions:

- Outdoor irrigation of ornamental landscapes and turf with potable water shall be limited to 3 days a week. Customers whose street addresses end with an odd number may water on Wednesday, Friday, and Sunday. Customers whose street addresses end with an even number may water on Tuesday, Thursday, and Saturday.
- The application of potable water to outdoor landscapes during or within 48 hours after measurable rainfall is prohibited.
- Flushing of water mains, sewers, or fire hydrants is prohibited except for emergencies and essential operations.
- Water use exceedance tiered pricing or penalties may be implemented.
- Motor vehicles and equipment shall be washed only with buckets or with hoses equipped with automatic shutoff nozzles.

The following Response Actions replace previous less stringent actions:

- Leaking customer pipes or faulty sprinklers shall be repaired within two (2) working days or less if warranted due to the severity of the problem.
- Reduce water use by the following specified percentages: Residential and Rural by 20-30%, Multi-family and Public/Institutional customers by 20-30%, commercial customers by 20%, and Landscape Irrigation by 25-35%.
- Customers with "smart" irrigation timers or controllers are asked to set their controllers to achieve 75% of the evapotranspiration (ET) rate. Drip irrigation systems are excluded from

this requirement.

Penalties: Any customer in violation of Stage 3 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 3 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

### Stage 4 Extreme Water Shortage (60% to 70% of Normal Water Production)

*Stage 4. Extreme Water Shortage* is categorized with a possible reduction percentage of 30-40%. All the Response Actions in Stage 3 are required plus the following new Response Actions:

- Water use for ornamental ponds, fountains, or other ornamental water feature for aesthetic purposes is prohibited except where necessary to support aquatic life.
- The application of potable water to driveways and sidewalks is prohibited.
- The installation of new turf or landscaping is prohibited.
- Irrigation of ornamental turf with potable water on public street medians is prohibited.
- New connections to the District's water distribution system will be allowed but their water use shall be restricted to the minimum requirements for personal health and safety.

The following Response Actions replace previous less stringent actions:

- Leaking customer pipes or faulty sprinklers shall be repaired within 24 hours or less if warranted due to the severity of the problem.
- Reduce water use by the following specified percentages: Residential and Rural by 30-40%, Multi-family and Public/Institutional customers by 30-40%, commercial customers by 30%, and Landscape Irrigation by 35-50%.

Penalties: Any customer in violation of Stage 4 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 4 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

### Stage 5A Critical I Water Shortage Short-Term (50% to 60% of Normal Water Production)

*Stage 5A Critical I Water Shortage* is categorized with a possible reduction percentage of 40-50%. A short-term declaration is for water shortage conditions expected for a duration of 45 days or less. All the Response Actions in Stage 4 are required plus the following new Response Actions:

- Water use for ornamental ponds and fountains is prohibited.
- No potable water from the District's system shall be used for construction purposes including but not limited to dust control, compaction, or trench jetting.

The following Response Actions replace previous less stringent actions:

- Leaking customer pipes or faulty sprinklers shall be repaired within 24 hours. Water service will be suspended until repairs are made.

- Reduce water use by the following specified percentages: Residential and Rural 40% to 50% or more, Multi-family and Public/Institutional customers reduce water use by 40% to 50% or more, commercial customers by 30%, and Landscape Irrigation by 50%.
- Water for flow testing and construction purposes from water agency fire hydrants and blow-offs is prohibited.
- Water use exceedance tiered pricing and/or excessive water use fines will be implemented.

Penalties: Any customer in violation of Stage 5 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 5 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

### Stage 5B Critical I Water Shortage Long-Term (50%-60% of Normal Water Production)

*Stage 5B Critical II Water Shortage* is categorized with a possible reduction percentage of 40-50%. A long-term declaration is for water shortage conditions expected for a duration of 45 days or more. All the Response Actions in Stage 5A are required plus the following that replace previous less stringent actions:

- Motor vehicles and equipment shall be washed only at commercial establishments that use recycled or reclaimed water.

Penalties: Any customer in violation of Stage 5 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 5 requirements after notice and warning is provided shall be punishable by an administrative fine per day or per occurrence as set in Appendix A of the District's Policy Manual.

### Stage 6A Critical II Water Shortage Short-Term (less than 50% of Normal Water Production)

*Stage 6A Critical II Water Shortage* is categorized with a possible reduction percentage of 50+%. A short-term declaration is for water shortage conditions expected for a duration of 45 days or less. All the Response Actions in Stage 5B are required plus the following new Response Actions:

- Landscape irrigation is prohibited.

The following Response Actions replace previous less stringent actions:

- Leaking customer pipes or faulty sprinklers shall be repaired immediately. Water service will be suspended until repairs are made.
- Reduce water use by the following specified percentages: Residential and Rural by 50% or more, Multi-family and Public/Institutional customers by 50% or more, commercial customers by 30% or more, and Landscape Irrigation by 100%.

Penalties: Any customer in violation of Stage 6 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 6 requirements after notice and warning is provided shall be punishable by an administrative fine of $500.00 per day or per occurrence.

### *Stage 6B Critical II Water Shortage Long-Term (less than 50% of Normal Water Production)*

*Stage 6B Critical II Water Shortage* is categorized with a possible reduction percentage of 50+%. A long-term declaration is for water shortage conditions expected for a duration of 45 days or more. All the Response Actions in Stage 6A are required plus the following new Response Actions:

- No commitments ("will serves") will be made to provide service for new water service connections.

Penalties: Any customer in violation of Stage 6 requirements shall be first notified of the regulations and warned of the penalty associated with continued violation. If the violation is not corrected in a timely manner, any continued violation of mandatory Stage 6 requirements after notice and warning is provided shall be punishable by an administrative fine of $500.00 per day or per occurrence.

## 4.2 Artificial Water Features

**Regulatory Requirement**

**§10632 (a.10)** For purposes of developing the water shortage contingency plan pursuant to subdivision (a), an urban water supplier shall analyze and define water features that are artificially supplied with water, including ponds, lakes, waterfalls, and fountains, separately from swimming pools and spas, as defined in subdivision (a) of Section 115921 of the Health and Safety Code.

Artificial water features, herein defined as ponds, lakes, waterfalls, fountains, and other water features for aesthetic purposes, are treated separately from swimming pools and spas in the Response Actions. Evaporation losses from swimming pools and spas can be reduced through the use of covers, yet this is generally not feasible with other artificial water features. Swimming pools can also provide an important source of cooling in the hot local climate.

## 4.3 Locally Appropriate Supply Augmentation Actions

**Regulatory Requirement**

**§10632 (a.4.A)** Locally appropriate supply augmentation actions.

The BVWD has a Water Service Contract with Reclamation for Central Valley Project water; however, it should be noted that while the District's water service contract with the Reclamation provides for rescheduling of water, the Reclamation has denied all of the District's requests to carry-over water from year to year, thus eliminating any safety net possible from storing wet year water for use in future dry years.

Additionally, the District maintains its long-term agreement with Anderson-Cottonwood Irrigation District (ACID); however, these allocations have the potential to be reduced by 25% under ACID's Water Settlement Contract with the Reclamation. As previously addressed, the BVWD has a sufficient water supply during normal and wet years; however, it is considerably disadvantaged during dry years as it relies almost exclusively on its CVP supply.

Groundwater pumping can account for a significant amount of the local supply as the five District wells may produce upwards of 12 acre-feet/day. This has the potential to decrease during particularly dry years. Use of groundwater in droughts is an important supply augmentation measure. Lastly, the District has relied on and participated in short-term water transfers; however, these opportunities are limited, particularly in dry years.

## 4.4 Locally Appropriate Demand Reductions

**Regulatory Requirement**

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| **§10632 (a.4.B)** Locally appropriate demand reduction actions to adequately respond to shortages. |

The District has taken into consideration specific social and geographical aspects of Shasta County in developing the Response Actions. For instance, the District is comprised mostly of large rural residential parcels, and consequently, the vast majority of water is used outdoors, much more so than in other urban agencies. As a result, most of the Response Actions focus on outdoor water use. In addition, due to the very high summer temperatures in the region, restrictions are placed on daytime irrigation.

## 4.5 Locally Appropriate Operational Changes

**Regulatory Requirement**

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| **§10632 (a.4.C)** Locally appropriate operational changes. |

During normal water years, demands are primarily met with surface water and supplemented with well water, as needed. During a critical drought, this would switch to providing water primarily from wells that are supplemented with surface water. This would be a major operational change and require daily visits to the wells for O&M versus once or twice weekly during a normal year. All the wells also have iron and manganese removal systems that require filter backwashing on a regular basis and periodic removal of settled sludge. Thus, with higher groundwater use in a drought, wellhead treatment operations will require substantially more labor.

## 4.6 Mandatory State Restrictions

**Regulatory Requirement**

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| **§10632 (a.4.D)** Additional, mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions and appropriate to the local conditions. |

In 2015 the State Water Resources Control Board released mandatory water restrictions during the drought that included the following:

- No irrigation with potable water of ornamental turf on public street medians
- No irrigation with potable water outside of newly constructed homes and buildings not in accordance with emergency regulations or other requirements established by the Building Standards Commission and the Department of Housing and Community Development
- No washing of sidewalks and driveways with potable water
- No runoff allowed when irrigating with potable water
- Hoses must have an automatic shutoff nozzle when washing cars
- No use of potable water in decorative water features that do not recirculate the water
- No outdoor irrigation during and within 48 hours following measurable rainfall

- Restaurants may not serve water to customers unless they request it
- Hotels and motels must offer guests the option to not have their linens and towels laundered daily and prominently display this option in each room

The District's response actions include all these measures, and go beyond them with other measures related to: beneficial water use, timely leak repair, swimming pools and spas, smart irrigation systems, dedicated irrigation days, construction water, water system flushing, penalties and water tiers, and new water connections.

## 4.7 Gap Between Supply and Demand

**Regulatory Requirement**

**§10632 (a.4.E)** For each action, an estimate of the extent to which the gap between supplies and demand will be reduced by implementation of the action.

Each water shortage stage includes response actions that are estimated to provide the needed water savings required. These response actions have also been refined over time and proven to generally provide the reductions needed. If prohibitions at any stage do not result in the required water savings, the District can simply go to the next stage. The District also has flexibility to enforce only some of the response actions in a stage, providing the opportunity to make small adjustments when needed.

# 5 - COMMUNITY OUTREACH

## 5.1 Current and Predicted Shortages

**Regulatory Requirement**

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| **§10632 (a.5)** Communication protocols and procedures to inform customers, the public, interested parties, and local, regional, and state governments, regarding, at a minimum, all the following:<br>(A) Any current or predicted shortages as determined by the annual water supply and demand assessment described pursuant to Section 10632.1. |

The BVWD has identified the four following categories as significant points of discussion, regarding current and predicted drought shortages.

- Various causes of drought in the area
- Regulatory impacts on water supplies
- Drought impacts on water supplies
- Constraints on water transfers and exchanges

Additionally, the District will utilize the drought indices and hydrologic datasets outlined **Section 2**. Should a potential shortage be anticipated, the public and BVWD customers will be notified via public notices, announcements on the District's web page (www.bvwd.org), and in their bimonthly billings and warned of the potential for a drought declaration and water conservation measures.

## 5.2 Shortage Response Actions

**Regulatory Requirement**

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| **§10632 (a.5.B)** Any shortage Response Actions triggered or anticipated to be triggered by the annual water supply and demand assessment described pursuant to Section 10632.1.<br>Any other relevant communications. |

The District's Board of Directors will be kept informed of water shortage conditions to enable them to make timely and appropriate decisions on the following actions:

- Coordination with customers on the development and implementation of plans
- Frequent assessment of water shortage status
- Adoption of resolutions to change water storage stages
- Declaration of a water shortage emergency
- Adoption of an Emergency Water Reduction Plan

These actions are communicated to District customers by way of billing inserts, newspaper advertising, on the District's webpage (www.bvwd.org), and by verbal communication as District staff and personnel interact with the customers.

# 6 - CUSTOMER COMPLIANCE AND ENFORCEMENT

**Regulatory Requirement**

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| **§10632 (a.6)** For an urban retail water supplier, customer compliance, enforcement, appeal, and exemption procedures for triggered shortage Response Actions as determined pursuant to Section 10632.2. |

The BVWD Board of Directors, and more specifically the District Engineer, will be responsible for evaluating available data on a consistent basis and adequately determining/implementing the appropriate Response Actions, dependent of the Water Shortage Stage in place.

**Section 4** – Shortage Response Actions outlines the various water conservation measures during each water shortage stage, as well as the various enforcements. The penalties for each stage are also outlined in this section and in Appendix A of the District Policy Manual and can vary significantly depending on the activated Water Shortage Stage.

Customers may request an exemption or variance or may appeal enforcement with the General Manager in accordance with the District's Policy Manual. The District's specific policies are outlined below.

Exception and/or Variance Process. Designated staff may, in writing, grant temporary variances for prospective uses of water after determining that, due to unusual circumstances, to fail to grant such variance would cause an emergency or hardship condition affecting health, sanitation, or fire protection of the applicant or the public. The Board of Directors shall ratify or revoke any such variance or adjustment at its next scheduled meeting. Any such variance or adjustment so ratified may be revoked by later action of the Board of Directors. No such variance shall be retroactive or otherwise justify any violation of the water use restrictions occurring prior to issuance of temporary variance. It must be recognized that due to a declared water shortage emergency, the District has limited ability to grant exceptions and/or variances to the Water Shortage Contingency Plan.

# 7 - LEGAL AUTHORITY OF THE PLAN

**Regulatory Requirement**

**§10632 (a.7.A)** A description of the legal authorities that empower the urban water supplier to implement and enforce its shortage Response Actions specified in paragraph (4) that may include, but are not limited to, statutory authorities, ordinances, resolutions, and contract provisions.

This WSCP adheres with the California Water Code 10632. This document is also required by State law as outlined in the Water Code, which states that, "Every urban water supplier shall prepare and adopt a water shortage contingency plan as part of its urban water management plan…" (WC 10632). As an established California Water District, BVWD has the authority to implement the WSCP, declare water shortages, and implement shortage response actions including statutory authorities, ordinances, resolutions, and contract provisions.

## 7.1 Declaring a Water Shortage Emergency

**Regulatory Requirement**

**§10632 (a.7.B)** A statement that an urban water supplier shall declare a water shortage emergency in accordance with Chapter 3 (commencing with Section 350) of Division 1.

The BVWD will follow the protocols outlined in this Plan should it become necessary to declare a water shortage emergency. The process will follow the pertinent sections of the California Water Code and be noticed for a public hearing, typically at a Board of Directors meeting.

## 7.2 Supplier Coordination

**Regulatory Requirement**

**§10632 (a.7.C)** A statement that an urban water supplier shall coordinate with any city or county within which it provides water supply services for the possible proclamation of a local emergency, as defined in Section 8558 of the Government Code.

The District Manager or designated staff will be available and responsible for coordinating with City and County officials within the District's service area should there be a necessary proclamation for a local water emergency.

# 8 - REVENUE REDUCTIONS AND EXPENSE INCREASES

The various revenue sources available to the District during droughts include, but are not limited to water sales, system connection fees, interest income, special assessments, reserves, and other non-operating revenues, such as grant funding when available. In addition, there may be special outside funding sources made available to water agencies during a water emergency (e.g., Stages 4 through 6).

## 8.1 Potential Revenue Reductions and Expense Increases

**Regulatory Requirement**

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| **§10632 (a.8)** A description of the financial consequences of, and responses for, drought conditions, including, but not limited to, all of the following:<br>(A) A description of potential revenue reductions and expense increases associated with activated shortage Response Action described in paragraph (4) |

Potential revenue reductions may include, but are not limited to:

- Decreased water sales to residential, rural, commercial, and public/institutional users
- Decreased water sales to agricultural water users

Potential expense increases may include, but are not limited to:

- Higher CVP water costs due to reduced water deliveries
- Higher costs for increased groundwater production and treatment
- Higher costs for pumping groundwater from greater depths
- Purchases of higher priced transfer water

## 8.2 Mitigation Actions

**Regulatory Requirement**

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| **§10632 (a.8.B)** A description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage Response Actions described in paragraph (4). |

Several mitigation actions are specifically tailored to offset or soften the financial impact of drought to the District including the following:

1. M&I Rate Stabilization Fund. The District currently maintains a specific M&I Rate Stabilization Fund to help mitigate the revenue impacts of a prolonged drought. This fund has been built up by placing a small portion of urban water user fees into this fund during normal supply years to help offset higher costs during droughts.

2. Supplemental Water Program. This voluntary program allows agricultural water users to purchase supplemental water supplies secured by the District on behalf of participants. This program is only offered during water shortages and the water costs are always higher than typical District costs. This water is sold at cost to participating Agricultural customers ensuring that the District does not lose money on the transaction.

## 8.3 Cost Compliance

**Regulatory Requirement**

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| **§10632 (a.8.C)** A description of the cost of compliance with Chapter 3.3 (commencing with Section 365) of Division 1. |

The District has its standard policies that address penalties for wasteful use of water. They also have a model drought ordinance that they will revise as necessary depending on specific circumstances. Declaring a water shortage and enforcing response actions can be performed by existing staff with no significant increases in operating cost.

# 9 - MONITORING AND REPORTING REQUIREMENTS

**Regulatory Requirement**

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| **§10632 (a.9)** For an urban retail water supplier, monitoring and reporting requirements and procedures that ensure appropriate data is collected, tracked, and analyzed for purposes of monitoring customer compliance and to meet state reporting requirements. |

The BVWD currently, and historically, has always been in compliance with the state reporting requirements. The District uses meters to monitor all of the District's water deliveries, which assists in assuring customer compliance. Additionally, the District maintains a protocol for receiving and addressing complaints of non-compliance and misuse.

The procedures for monitoring reductions throughout the six different water shortage stages are outlined below:

1. In normal water supply conditions (Stage 1) production and pumping totals are reported monthly to the District Engineer.
2. During Stage 2, 3, or 4 water shortage conditions, weekly production and pumping amounts are reported to the District Engineer to compare the weekly data to the targets to verify that reduction goals are being met.
3. During Stage 5a, 5b, 6a, or 6b water shortage, a daily production and pumping report is provided to the District Engineer to verify that goals are being met.

# 10 - MONITORING AND EVALUATING THE PLAN

**Regulatory Requirement**

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| **§10632 (a.10)** Reevaluation and improvement procedures for systematically monitoring and evaluating the functionality of the water shortage contingency plan in order to ensure shortage risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented as needed. |

The District first adopted its WSCP in 1992 and has revised and re-adopted it several times to incorporate refinements and improvements. In addition, this WSCP incorporates important lessons learned during the historic drought of 2013-2015. The WSCP will be re-evaluated at least every five years and at the end of each drought period to assess its performance. If deemed necessary, it will be modified and improved based on lessons learned. The Plan may also be updated in the middle of a drought year if needed.