PREPARED FOR
U.S. DEPARTMENT OF
THE INTERIOR, BUREAU
OF RECLAMATION

Public Draft
North American Basin Regional Drought Contingency Plan

JULY 2017

PCWA
water • energy • stewardship

CITY OF FOLSOM
DISTINCTIVE BY NATURE

CITY OF ROSEVILLE
CALIFORNIA

City of SACRAMENTO

SAN JUAN WATER
SINCE 1854

RWA
Regional Water Authority
BUILDING ALLIANCES IN NORTHERN CALIFORNIA

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Abbreviations and Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
ARB	American River Basin
ARBS	American River Basin Study
ARD	American River Division
BiOp	Biological Opinion
C&O	Communications and Outreach
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
DPTF	Drought Planning Task Force
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EDCWA	El Dorado County Water Agency
EID	El Dorado Irrigation District
ESA	Endangered Species Act
FMS	Flow Management Standard
Framework	RDCP Operational and Administrative Framework
GCM	global climate model
GPCD	gallons per capita per day
IRC	interim renewal contract
IRWMP	Integrated Regional Water Management Plan
LAR	Lower American River
LTO	Long-Term Operation
LTWSC	long-term water service contract
M&I	municipal and industrial
NAB	North American Basin
NMFS	National Marine Fisheries Service
O&M	operation and maintenance
PCWA	Placer County Water Agency
RDCP	Regional Drought Contingency Plan
Reclamation	U.S. Department of the Interior, Bureau of Reclamation’s

ROD	Record of Decision
Roseville	City of Roseville
RPA	Reasonable and Prudent Alternative
RWA	Regional Water Authority
SCWA	Sacramento County Water Agency
SJWD	San Juan Water District
SMUD	Sacramento Municipal Utility District
SOR	System Optimization Review
SSJRBS	San Joaquin Rivers Basin Study
State	State of California
SWE	snow water equivalent
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWS	Selective Withdrawal System
TAF	thousand acre feet
TCD	Temperature Control Device
UIFR	unimpaired inflow into Folsom Reservoir
USACE	U.S. Army Corps of Engineers
UWMP	Urban Water Management Plan
WFSE	Water Forum Successor Effort
WSCP	Water Shortage Contingency Plan

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1.0 Introduction

1.1 Background

The dry lakebed of Folsom Reservoir became symbolic of California's recent historic drought. Severe drought conditions precipitated statewide water right curtailments, severely reduced contract allocations, mandatory extraordinary conservation measures, and relaxed regulatory flows and water quality requirements for environmental protection. These measures were in addition to the increased regulatory requirements over the past decades that have further constrained the U.S. Department of the Interior, Bureau of Reclamation's (Reclamation) flexibility in operating Folsom Dam to meet all authorized project purposes of the Central Valley Project (CVP), stressing the already overburdened American River watershed.

Folsom Reservoir reached a record low of 135,000 acre-feet on December 5, 2015, threatening water supplies and ecosystems of the American River Basin and system-wide.

In late 2015, stored water was insufficient for local water right diversions and their CVP contract delivery, threatening water supply to over one million people in the American River Basin, and Reclamation operated Folsom Reservoir under temporary relaxation of the flow and water quality requirements under their water rights and Endangered Species Act[1] (ESA) permits. The system was severely overwhelmed by the persistent drought conditions. However, months later in March of 2016, Reclamation operators were compelled to make flood control releases from Folsom Dam after several moderate El Niño storms. This rapid shift in hydrologic conditions led many water managers to question the adequacy of historical assumptions and regional infrastructure under the "new normal" of changing climate characteristics.

Although drought in California remained, Folsom Reservoir made releases in 2016 to maintain flood space (March 28, 2016).

Reclamation's recently completed Sacramento and San Joaquin Rivers Basin Study (SSJRBS) (March 2016) outlines major impacts from potential climate change on water supply, fish and wildlife protection, and flood management due to reductions in snowpack and

[1] Endangered Species Act of 1973, as Amended.

changes in seasonal runoff. In the American River Basin, the potential effects of a changing climate have introduced significant uncertainty in long-term water supply reliability. Folsom Reservoir has a limited capacity relative to the watershed it serves, partially because seasonal snowpack provides a large portion of the storage necessary to regulate runoff for water supply. Warming conditions and changes in precipitation patterns in the Sierra Nevada mountains threaten the volume of water stored in the snowpack and the timing of runoff entering the reservoir. Further, the superior quality of water in the American River and its close proximity to the Delta give Folsom Reservoir a critical role as the "first responder" in CVP operations to satisfy Delta flow and quality standards and other requirements for protecting endangered fishery species.

1.2 Purpose and Need

Regional Water Authority (RWA) member agencies have been and continue to work on coordinated planning to improve regional water supply reliability. Integrated regional planning has been coordinated under RWA[2] since 2001. The latest products of the regional planning efforts include a 2012 System Optimization Review (SOR), and the 2013 update to the American River Basin Integrated Regional Water Management Plan (IRWMP). In addition, agencies have developed individual Water Shortage Contingency Plans that define water use reduction stages during emergency conditions. The North American Basin (NAB) Regional Drought Contingency Plan (RDCP) builds on these existing regional and agency-specific efforts.

Recent drought conditions (2013-2016) in California have revealed greater potential risks to the public water supply system in the greater Sacramento region than previously anticipated. Despite recent conditions also revealing additional opportunities for regional collaboration and cooperation to enhance regional reliability, these drought conditions have precipitated the need to prepare the RDCP to increase the resiliency of the region's water resources in the face of future climate and drought conditions.

The RDCP was a collaborative planning effort partially funded by Reclamation through its WaterSMART Drought Response Program. The RDCP involved five partner water agencies that hold Reclamation water service contracts to divert CVP supply from the American River and Folsom Reservoir. The five partner agencies were Placer County Water Agency (PCWA), City of Folsom, City of Roseville, City of Sacramento, and the San Juan Water District (SJWD). In addition to the five partner agencies, the RDCP study area also included 12 additional water agencies located in the NAB[3] (**Figure 1-1**).

[2] RWA is a joint powers authority formed in 2001 and consisting of more than 20 water suppliers in the greater Sacramento region for the purpose of protecting and enhancing the sustainability of regional water supplies.

[3] California American Water, Carmichael Water District, Citrus Heights Water District, City of Lincoln, Del Paso Manor Water District, Fair Oaks Water District, Golden State Water Company, Natomas Central Mututal Water Company, Orange Vale Water Company, Rio Linda/Elverta Community Water District, Sacramento County Water Agency, Sacramento Suburban Water District.

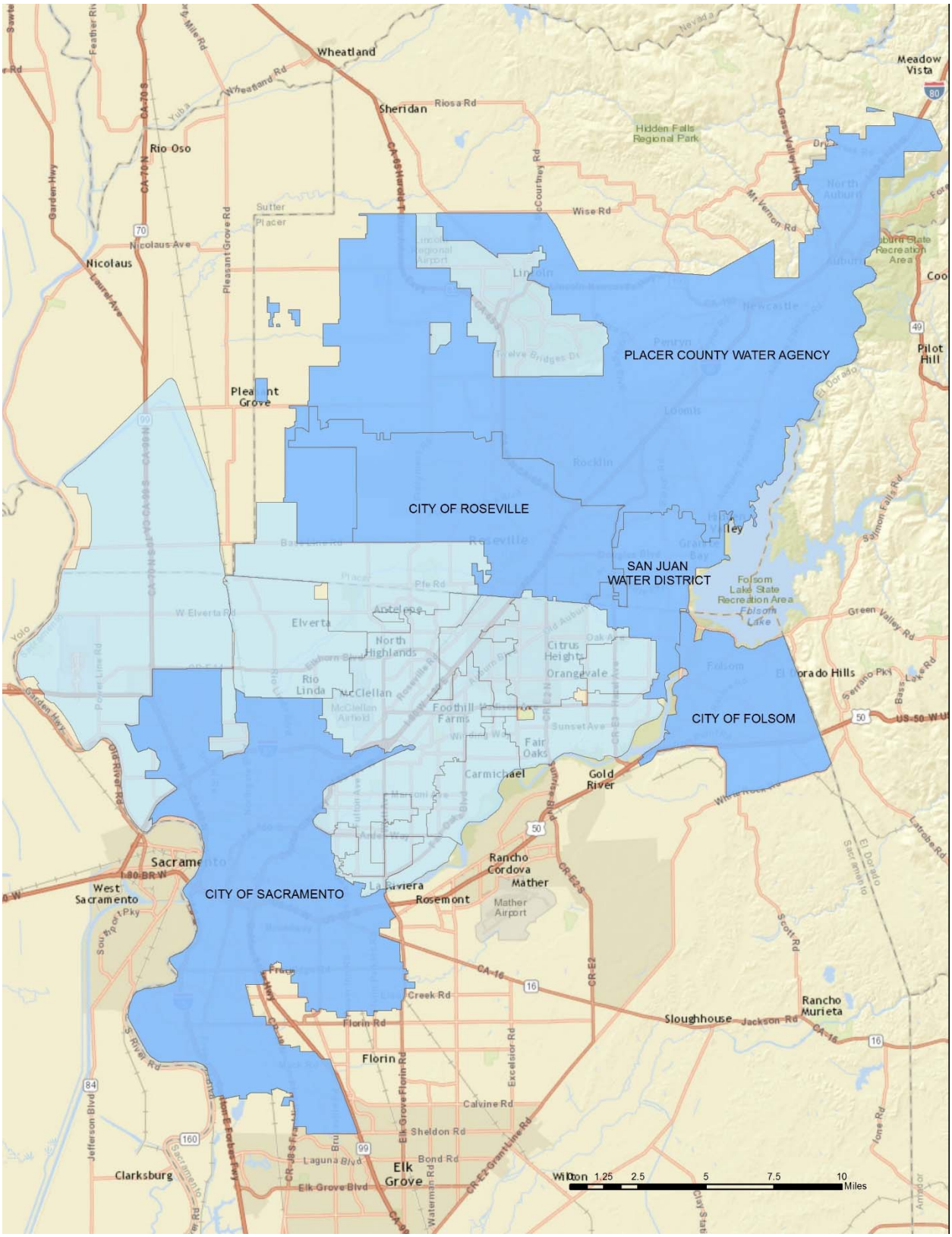

Figure 1-1. Agencies in Regional Drought Contingency Plan Study Area

The RDCP also included participation by RWA, the Water Forum[4], California Department of Water Resources (DWR), Reclamation, and several additional agencies[5] located adjacent to the RDCP study area that were potential partners for drought mitigation measures.

The partner agencies and RWA acted as the Planning Leads for development of the RDCP.

1.3 Pre-RDCP Activities

Prior to starting RDCP development, the Planning Leads completed the following three required activities:

- **Development of Detailed Work Plan.** The Planning Leads developed the RDCP Work Plan to guide the RDCP development process. It described the specific planning tasks and the manner in which each would be completed, the associated budget and schedule, and roles and responsibilities. The Work Plan included four sections:

    - ***Section A: Introduction*** – Description of the scope and purpose of the RDCP, the planning area, and background on past regional planning efforts.

    - ***Section B: Planning Approach*** – Description of the budget and schedule for RDCP development, scope of work to complete the six required RDCP elements, planning oversight structure, decision making process, roles and responsibilities, and coordination.

    - ***Section C: Documentation and Reporting*** – Description of deliverables and documentation requirements, reporting requirements and responsibilities, and review process.

    - ***Section D: Communication and Outreach Plan*** – Overview of anticipated stakeholder and public involvement, and schedule. (The detailed discussion was included in the separate Communications and Outreach Plan, described below.)

    The RDCP work plan was accepted by Reclamation in May 2016. It is available on the RWA website at http://rwah2o.org/regional-water-reliability-and-drought-contingency-plan/.

- **Establishment of Drought Planning Task Force.** The Planning Leads established the Drought Planning Task Force (DPTF) to provide a transparent setting for plan development and serve as the primary venue for collaborative planning. All DPTF meetings were open to the public.

[4] The Sacramento Water Forum, formed through the signing of the Water Forum Agreement in 2000, is a diverse group of business and agricultural leaders, citizen groups, environmentalists, water managers, and local governments working together to (1) provide a reliable and safe water supply for the Sacramento region's long-term growth and economic health; and (2) to preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River.

[5] El Dorado County Water Agency, El Dorado Irrigation District, Elk Grove Water District, Rancho Murieta Community Services District, City of West Sacramento, and Sacramento Regional County Sanitation District.

The DPTF held a formation meeting on May 11, 2016. This meeting served to refine the purpose, goals, and objectives for the RDCP; confirm roles and responsibilities; discuss potential constraints for planning purposes; agree on protocols for communications and interactions with elected officials and other organizations/agencies that may be become involved in this process; and agree on the outlined RDCP schedule and milestones. The Planning Leads invited the 12 water agencies in the NAB (representing M&I and agricultural water suppliers in the region), the Sacramento Water Forum (a key representative of the environmental interest for water), DWR (a key State agency involved in water), and Reclamation (a key interest in the region and beyond).

A discussion of subsequent DPTF meetings is included in the next section.

- **Development of Communication and Outreach Plan.** The RDCP Communications and Outreach (C&O) Plan was developed to help ensure active stakeholder and public engagement in preparation of the RDCP, providing organizational structure, and serving as a general outline for the communication and outreach activities associated with the RDCP. It described how stakeholders and members of the public could be involved in the planning process, their opportunities to provide input on the drafting of the RDCP, and how the DPTF would keep them informed as RDCP development progressed. The C&O Plan included four sections:

  - ***Section A: Introduction –*** Overview of the RDCP and the planning area.

  - ***Section B: Goals for Stakeholder and Public Involvement –*** Description of the goals, measures of success for communications and outreach, roles and responsibilities, and key messages.

  - ***Section C: Communications and Outreach Approach, Activities, and Tools –*** Description of the C&O approach; DPTF and its formation and membership; activities and tools (email, webinar, website updates, presentations, public information and notification, anticipated schedule)

  - ***Section D: Identified Stakeholders –*** Initial list of stakeholders.

  The RDCP C&O Plan was submitted to Reclamation May 2016. It is available on the RWA website at http://rwah2o.org/regional-water-reliability-and-drought-contingency-plan/. A discussion of stakeholder and public outreach efforts is included in the next section.

1.4 RDCP Development Efforts

As described below, the Planning Leads, DPTF, and stakeholder and public outreach efforts continued throughout development of the RDCP.

Planning Leads Efforts. The Planning Leads were responsible for developing the RDCP and fulfilling all Reclamation WaterSMART requirements, including the following:

- Conducting RDCP scope of work activities.

- Providing input and direction on planning progress and deliverables (review comments, policy issues, etc.) and information required for task completion.
- Coordinating and consulting with the other NAB water agencies.
- Addressing review comments.
- Making decisions related to RDCP and resolve issues.
- Preparing for and conducting RDCP-related meetings.
- Acting on next steps/recommendations (as appropriate).
- Periodically updating the RWA Board, its membership, and others in attendance on planning progress and findings.

The Planning Leads used support staff to assist with planning, technical, and outreach efforts, including conduct of scope of work activities, preparation of meeting materials, and meeting facilitation.

DPTF Efforts. Following the formation meeting, the DPTF was convened eight times to discuss and review planning progress, findings, and deliverables. These meetings occurred on:

- June 8, 2016
- July 13, 2016
- October 12, 2016
- February 8, 2017
- April 12, 2017
- May 16, 2017
- July 19, 2017 (scheduled)
- September 2017 (to be scheduled)

Stakeholder and Public Outreach Efforts. During development of the RDCP, several activities were undertaken and tools utilized to encourage stakeholder and public participation, including the following:

- ***DPTF meetings*** – All DPTF meetings were open to the public.
- ***Webcast*** – The July 2017 DPTF meeting was webcast in order to reach broader audience for the rollout of the public draft RDCP and comment period.

- ***Website Updates*** – RWA maintains a webpage with RDCP content so that interested stakeholders could track RDCP progress and see output from meetings (http://rwah2o.org/regional-water-reliability-and-drought-contingency-plan/).

- ***Presentations*** – Sixteen presentations were given to local water agency boards, representatives of environmental groups, representatives of local and state elected officials, and representative of Reclamation, DWR, and the State Water Project Contractors between October 2015 and July 2016.

- ***Public Information and Notification*** – Announcements of the availability of the draft and final RDCPs are being provided via direct e-mails and posting to the RDCP website (http://rwah2o.org/regional-water-reliability-and-drought-contingency-plan/).

1.5 Document Organization

The RDCP is organized into six sections – an introduction (Section 1) and sections that address each required RDCP element (Sections 2 through 6).

- **Section 1 – Introduction.** This section introduces the RDCP by providing background information; describing pre-RDCP development activities; summarizing efforts of the planning leads, DPTF, and stakeholder and public outreach process; and describing document organization.

- **Section 2 –Drought Monitoring.** This section describes a framework for predicting and confirming future droughts by establishing data metrics used to indicate drought conditions in the region.

- **Section 3 –Vulnerability Assessment.** This section describes the process and findings of the vulnerability assessment that was conducted to evaluate the risks and impacts of current and future drought in the region.

- **Section 4 –Mitigation Actions.** This section describes the identification, evaluation, and prioritization of actions and activities to improve the region's resiliency in the face of drought conditions.

- **Section 5 – Response Actions.** This section describes the identification, evaluation, and prioritization of actions and activities that may expeditiously mitigate impacts during an ongoing drought.

- **Section 6 – Operational and Administrative Framework, and Plan Update Process.** This section describes the roles, responsibilities, and procedures for ongoing activities associated with the RDCP including conducting drought monitoring; initiating mitigation and response actions, including communicating with the public about those actions; and evaluating and updating the RDCP. Anticipated frequencies for these activities and potential funding and financing mechanisms are also discussed.

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2.0 Drought Monitoring

2.1 Introduction

The RDCP DPTF met in October 2016 to discuss drought monitoring. At the meeting, the DPTF discussed local sources of indicator data and indices that would be most useful for defining supply conditions. Also discussed at the meeting was whether there were any recommendations for a modified index that could more appropriately reflect local supply conditions. The DPTF believed that the existing indicators and indices were sufficient to define an effective drought monitoring process.

The primary goal of developing a drought monitoring process is to decrease the amount of time needed to recognize when local drought conditions exist or are likely to occur. To help meet the goal, the RDCP partners prioritized the following actions as part of the drought monitoring process: 1) identify the most relevant indices and indicators the help define local supply conditions; 2) identify triggers that help define when local supply conditions might fall below what would be considered a normal range needed to meet the needs of the sectors[6] dependent on available water resources; and 3) develop a process for determining the potential severity of shortage conditions for each of the RDCP partners. Each of these is discussed further below.

2.2 Indicators and Indices

The region has many sources of data to act as indicators and indices for determining water availability, because the region: 1) includes a major Reclamation facility in the form of Folsom Reservoir; 2) is located near the hub of California's water supply infrastructure in the form of the Sacramento-San Joaquin Delta; 3) has a large population; and 4) has critical environmental resources in the lower American River. Experiences during the recent drought (2013-2016) were very helpful in assessing the most relevant indicators and indices for local water resource managers in determining the presence of shortage conditions. Three of these, Folsom Reservoir storage, Central Sierra Nevada snowpack, and the calculated unimpaired inflow to Folsom Reservoir, are described further below.

2.2.1 Folsom Reservoir Storage

Folsom Reservoir storage is a key local indicator because three of the RDCP partners (City of Folsom, City of Roseville, and San Juan Water District) rely on direct diversions from the reservoir for public supply. While there are other factors that influence storage in the reservoir (releases for Central Valley Project deliveries, releases for water quality maintenance in the Delta, maintaining flood storage space), hydrologic conditions are the most significant factor. Since its completion in 1956, releases from Folsom Dam have maintained an average storage in the reservoir to balance water supply needs with flood control needs. Average storage in the reservoir at the beginning of the water year (October 1st) has been approximately 550,000 acre-feet (**Figure 2-1**). Storage typically declines to a low around the beginning of December when

[6] Sectors are described in the Vulnerability Assessment section.

winter season rains in the region begin to increase storage. Storage in the reservoir typically increases to a maximum average of just over 800,000 acre-feet in early June due to the American River watershed's snowpack gradually melting throughout the spring season.

The 2015-2016 water year is a good example of the hydrologic variability that can be seen in the region. At the beginning of the water year, Folsom Reservoir had less than 175,000 acre-feet in storage (**Figure 2-1**). Storage fell below 135,000 acre-feet in December, 2015, which was the lowest ever recorded storage since completion of the dam. Wet conditions starting in late December and continuing through January 2016 quickly raised storage to above the historical average. Local water managers closely monitor these storage levels as an indicator of supply conditions as described in the Drought Triggers section below.

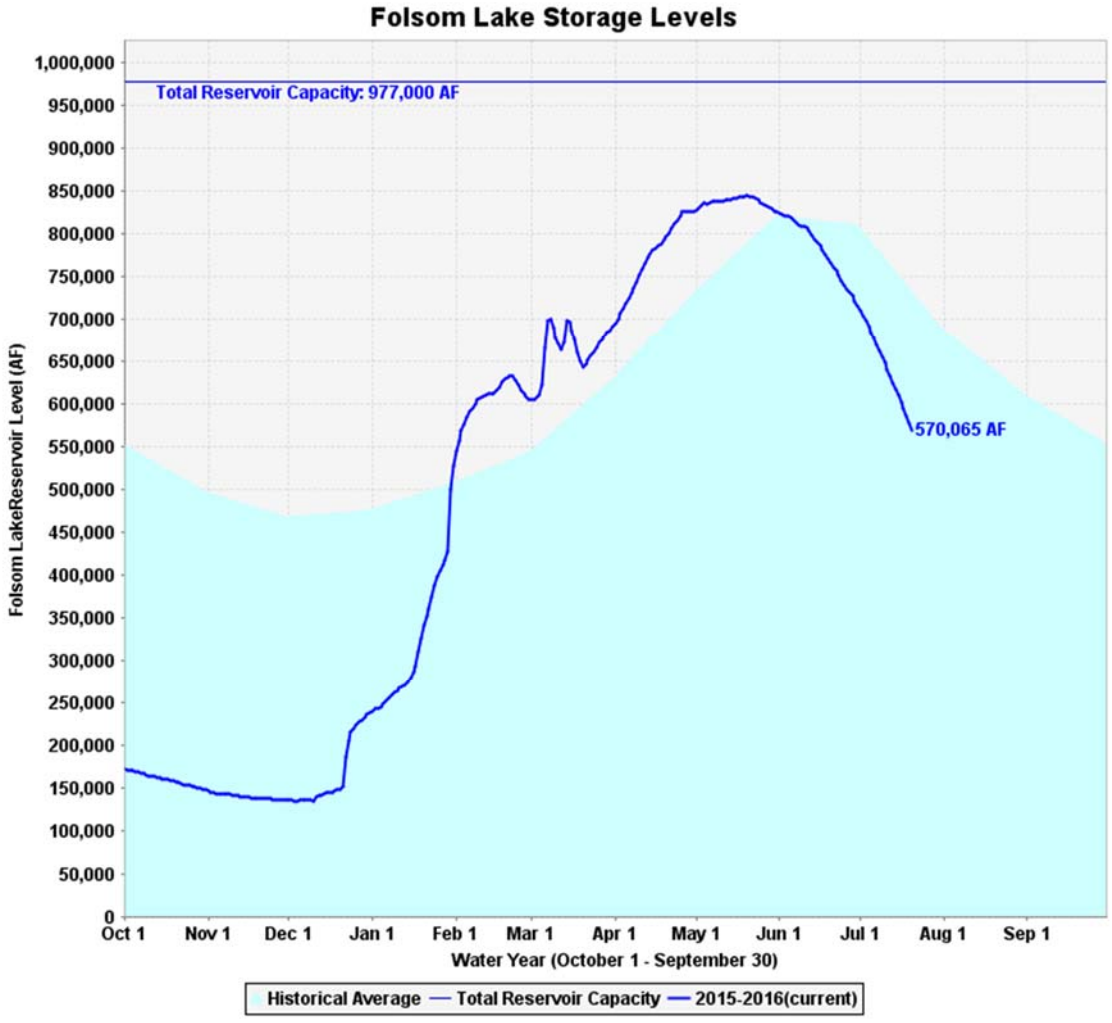

Figure 2-1. Average Folsom Reservoir Storage Levels with 2015-2016 Water Year Storage (source CDEC.water.ca.gov)

2.2.2 Central Sierra Nevada Snowpack

The Sierra Nevada snowpack is the largest contributor to runoff for the State. Locally, the Central Sierra Nevada snowpack feeds local reservoirs, so it is a key indicator for determining water supply conditions. DWR collects monthly measurements from a number of locations on a

water basis to determine the status of the snowpack compared to its historical average on April 1st (**Figure 2-2**). The Central Sierra Nevada measurement is an average of some 40 stations routinely monitored. The 2014-2015 season saw the lowest recorded snowpack for the Central Sierra Nevada with a peak of less than 20 percent of the April 1 average early in the year and nearly unmeasurable amounts by the final survey in May 2015. The 2016-2017 season (shown as the dark blue line on **Figure 2-2**) finally broke the most recent drought period with a snowpack measuring nearly 180 percent of the April 1st average. This year was only exceeded by 1982-1983 for the highest measured snow water content.

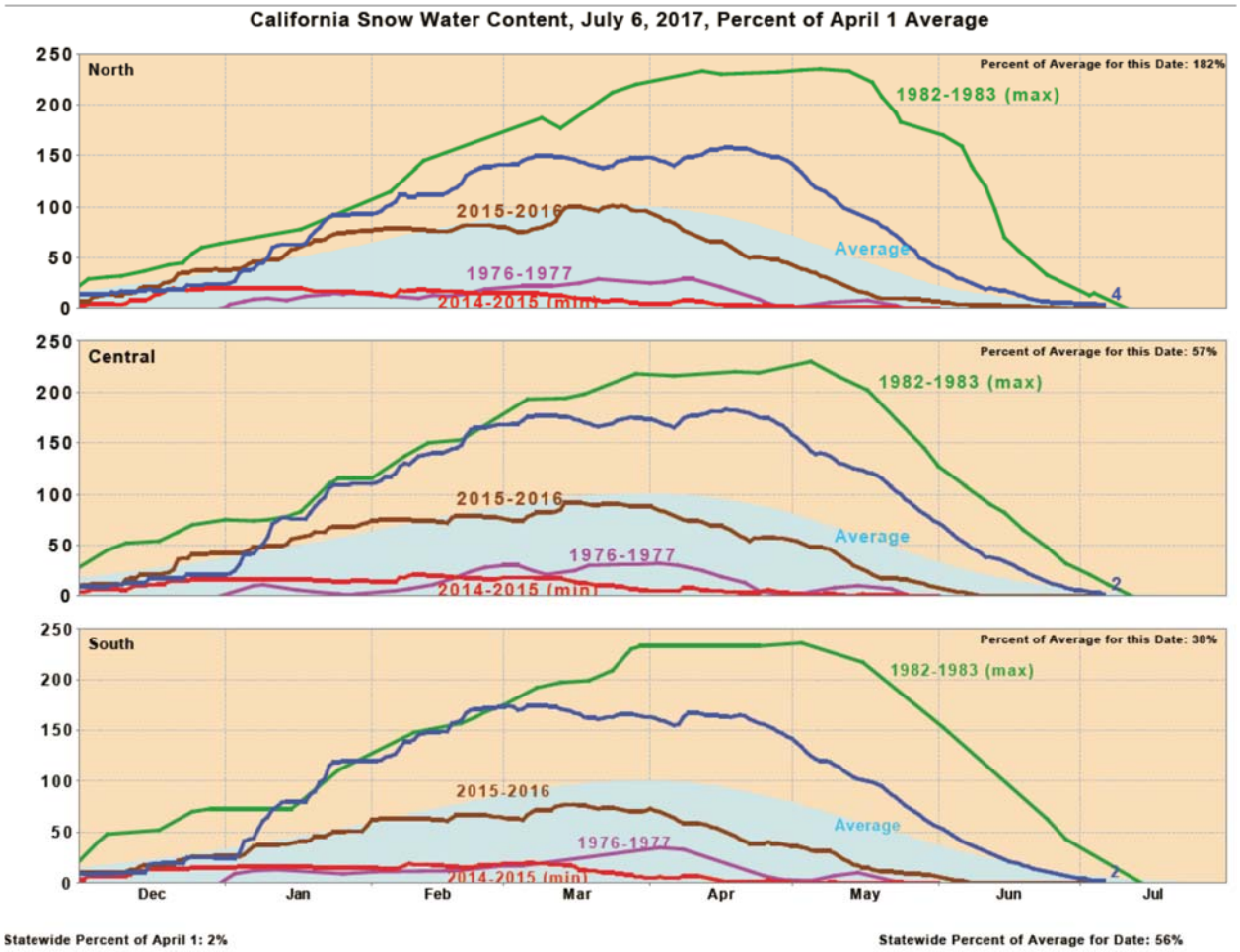

Figure 2-2. Example of Snow Water Content Measurements for the North, Central, and South Sierra Nevada Regions (source CDEC.water.ca.gov)

2.2.3 Unimpaired Inflow into Folsom Reservoir

The unimpaired inflow into Folsom Reservoir (UIFR) is a calculated index that represents the volume of water that would flow past Folsom Dam from American River watershed assuming no water development projects had been constructed (Water Forum Successor Effort [WFSE] 2007). The unimpaired runoff for the American River is calculated by DWR in its Bulletin 120, which is issued and updated four times each year (February, March, April, and May). Locally, the

UIFR[7] is an important hydrologic index in that it is used to determine the water year type as part of the historic Water Forum Agreement. **Table 2-1** shows the defined values that classify the water year type.

Table 2-1. Water Year Types as Defined by Water Forum Agreement

Year Type	Unimpaired Inflow to Folsom Lake, March Through November (acre-feet)
Wet (No Restrictions)	Greater than 1,600,000
Average (Hodge Year)	Greater than 950,000 and less than 1,600,000
Drier (Wedge Year)	Greater than 400,000 and less than 950,000
Driest (Conference Year)	Less than 400,000

The UIFR is used to define actions to be taken by specific water agencies to limit the impacts of dry conditions. A range of options include increased customer conservation, switching to groundwater as a supply, switching to an alternative surface water source (e.g., the Sacramento River), or reoperation of reservoirs further up the watershed in the Middle Fork of the American River.

Since execution of the Water Forum Agreement, one-third of years (6 out of 18) have been classified as dry or driest (**Figure 2-2**). Although 2001 and 2004 were dry, local conditions were not considered to be in a stage of drought. It was not until consecutive dry years (2007-2008 and 2013-2014) were experienced that drought conditions were declared by the Governor in 2008 and 2014, respectively.

To further evaluate the appropriateness of the UIFR as an index for drought conditions, the classification of the Water Forum Year Type was compared to CVP water supply allocations for municipal and industrial (M&I) contractors north of the Delta since 2000. **Table 2-2** shows a positive relationship between the UIFR index and CVP allocations. In the six years classified as either dry or driest by the UIFR index, five of those saw reduced CVP allocations. There were no CVP allocation reductions in the 12 years classified as either average or wet by the UIFR index.

[7] The calculation of the UIFR is described in detail in a WFSE technical memorandum available at http://www.waterforum.org/wp-content/uploads/2016/05/DryYearProceduresTM1-Computing-March-Nov-UIFR-5-17-07.pdf.

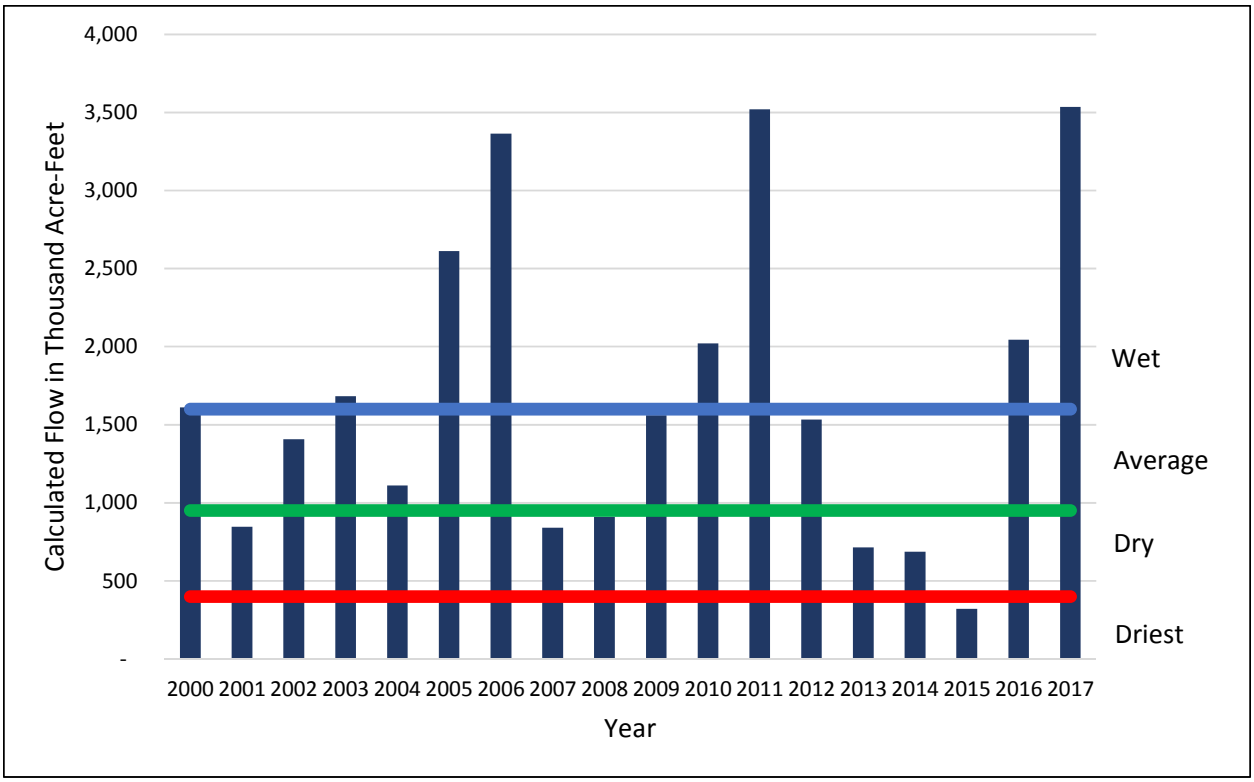

Figure 2-3. Calculated Unimpaired Inflow into Folsom Reservoir, March-November

Table 2-2. Comparison of UIFR Index and CVP Allocations to M&I Purveyors North of Delta Since 2000

Year	Water Forum Year Type Classification	CVP Water Supply Allocation to M&I Contractors North of Delta
2000	Wet	100
2001	Dry	85
2002	Average	100
2003	Wet	100
2004	Average	100
2005	Wet	100
2006	Wet	100
2007	Dry	100
2008	Dry	75
2009	Average	100
2010	Wet	100
2011	Wet	100
2012	Average	100
2013	Dry	75
2014	Dry	50
2015	Driest	25
2016	Wet	100
2017	Wet	100

Key:
CVP = Central Valley Project
M&I = municipal and industrial
UIFR = unimpaired inflow into Folsom Reservoir

2.3 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. Due to the unique water supply characteristics of each of the local water agencies, the RDCP partners are focused on using triggers to define a process that would lead to agency-specific response actions or to regional responses rather than on defining stages of drought. The monitoring of triggers for each of the indicators and indices described above will be conducted by the RWA. When triggers are exceeded, RWA will disseminate the information to all of its members for each agency to consider agency-specific response actions. RWA staff will also use regular monthly meetings of its Executive Committee or Board to discuss potential recommended regional response actions.

Experiences during the recent drought (2013-2016) are very helpful in defining the values and timing of when to evaluate triggers for determining the presence or likelihood of potential shortage conditions. **Table 2-2** summarizes the priority RDCP indicators/indices, timing of monitoring, and trigger threshold values that would lead to consideration of response actions. The proposed monitoring schedule is fairly conservative in that it would be implemented in all years, regardless of the conditions from the previous year (e.g., if the previous year was wet). As discussed above, it has been more typical in California that consecutive dry years would be experienced prior to triggering consideration of response actions.

Table 2-3. Summary of RDCP Triggers

Indicator/Index	Timing of Reporting	Threshold Value
Folsom Reservoir Storage	October 1 December 1	<300,000 acre-feet <200,000 acre-feet
Central Sierra Nevada Snowpack	February 1 March 1 April 1 May 1	<50% of average for February 1 <50% of average for March 1 <50% of average for April 1 <50% of average for May 1
Unimpaired Inflow into Folsom Reservoir	February 15 March 15 April 15 May 15	<950,000 acre-feet <950,000 acre-feet <950,000 acre-feet <950,000 acre-feet

Key:
RDCP = Regional Drought Contingency Plan

2.4 Process for Determining Shortage Conditions

Once a regional trigger is observed below any of the above threshold values, local water agencies will perform an assessment of their supplies. The purpose is to evaluate if the hydrologic conditions will affect current and future local deliveries. This local assessment is a water supply and demand balance similar to the "stress test" methodology adopted by the State Water Resources Control Board in May 2016.[8] Each water agency will calculate potential future water supply based on an additional assumed two years of drought (as defined by the agency's average drought year supply) and then will compare it to anticipated demand levels (as defined by the

[8] http://www.waterboards.ca.gov/water_issues/programs/conservation_portal/docs/emergency_reg/fs81616_stress_test.pdf

agency's average demand from the previous five years) for the same two-year period. If supply projections do not equal or exceed demand projections, the agency could activate its local Water Shortage Contingency Plan (WSCP)[9] to decrease demand until it matches supply projections. For example, if a water agency performs an assessment and projects a 20 percent shortage in supply compared to anticipated demand, the agency could call for a 20 percent reduction in demand through enacting a 20 percent reduction stage in its WSCP.

RWA will serve in a coordination role to ensure that water agencies in the region are aware of individual agency actions being taken. If conditions warrant, RWA would facilitate coordination of a regional response to emerging drought conditions. For example, the RWA Board adopted a resolution strongly recommending to all agencies in the region to urge a water use reduction of 20 percent or more on January 9, 2014. This occurred in advance of the Governor's declaration of statewide drought conditions on January 17, 2014.

[9] More detailed descriptions of Water Shortage Contingency Plans are provided in the Response Actions section of the RDCP.

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3.0 Vulnerability Assessment

The purpose of this section is to summarize the process and findings from the vulnerability assessment performed in support of the RDCP.

3.1 Vulnerability Assessment Approach

Following a review of regional characteristics and water agency experiences during the recent (2013 – 2016) drought period, the RDCP partners elected to limit the scope of vulnerability assessments to the water supply (municipal/industrial and agricultural) and environmental (in-stream natural resources) sectors. While the energy, recreation, and economic sectors are important, the impacts experienced during the recent drought to water supply and the environment were substantially greater. Additionally, it is believed that in addressing the water supply and environmental sector vulnerabilities many of the other sectors will also be addressed. For example, maintaining water supply availability during dry conditions supports healthy economic conditions. It should be noted that energy production was significantly impacted during drought conditions, but much of the production occurs at facilities that are outside the geographic extent of this RDCP.

The vulnerability assessment required developing extensive information for each agency in the region to assess water supply sector vulnerabilities, while environmental sectors vulnerabilities were identified previously during the Water Forum process.[10] Each of these vulnerability assessments is described further below.

3.1.1 Water Supply Sector Vulnerability Assessment Methodology

To address current and future water supply reliability issues, vulnerabilities need to be assessed. Vulnerabilities are features of the water system that are susceptible to droughts, climate change, and other uncontrollable factors, resulting in an agency not being able to meet water supply demands at levels determined to be acceptable by governing boards (referred to in this document as “desired level of service”). Vulnerabilities could be physical, operational, or institutional in nature.

Because of the interrelated water resources and infrastructure in the basin, information on water supply vulnerabilities were collected for the participating RDCP agencies. Additionally, seven other agencies[3] were consulted to identify potential opportunities for collaboration to improve regional reliability. This allowed for a more complete assessment to best leverage regional collaboration and coordinated actions.

In order to assess vulnerabilities, a complete picture of each agencies’ water supplies, demands, and production capacities during different hydrologic conditions was imperative. These analyses provided the basis for identifying potential needs and opportunities for collaboration with other

[10] The Water Forum process began in 1993 and concluded in 2000 with the Water Forum Agreement. Implementation of the Agreement has been coordinated since that time through the Water Forum Successor Effort.

agencies. Vulnerabilities identified through this process form the basis for developing mitigation and response actions.

At the outset of the study, the intent was to develop a survey capable of capturing all of the vulnerability information relative to water supply for each agency. In attempting to develop the survey, it became apparent that it was difficult to design questions to appropriately capture the information. Instead, an approach was developed to build a template of information to be collected from each agency that would serve to both identify vulnerabilities and to begin identifying mitigation measures. This template eventually became known as the "Water Supply Portfolio" for each agency. The core of the vulnerability assessment subsequently focused on developing agency-specific Water Supply Portfolios, which involved four steps (**Figure 3-1**). These four steps included the following activities:

1. **Summarizing available information** regarding available water supplies (surface water, groundwater, and recycled water), production capacities, water demands, reliability targets, regional interties, and cost of water by source. Information sources included regional, State, and federal studies and datasets, local agency information, and existing modeling datasets (such as the American River Basin IRWMP 2013 Update and agency-specific 2015 Urban Water Management Plans (UWMP), updated Master Plans, Capital Improvement Plans related to water production capacity and interties, and recent water supply studies).

2. **Developing initial water budget and vulnerability analysis** for each agency to highlight the demand variability throughout the course of year, and variability of supplies across different hydrological conditions per the Water Forum Agreement water year types. This information was compiled into water supply portfolios, which were sent to each agency for review.

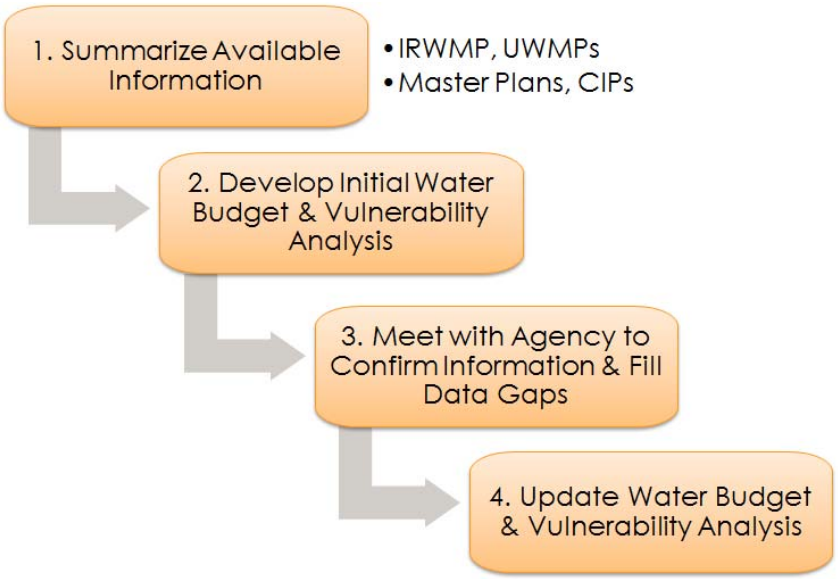


Figure 3-1. Vulnerability Assessment Process

1. **Meeting with each agency** to confirm accuracy and completeness of information presented in the water supply portfolios, fill data gaps, and identify vulnerabilities and opportunities. These agency interviews took place in December 2016 and January 2017.

2. **Updating water budget and vulnerability analysis** in each agency's water supply portfolio using the information learned during the agency interviews. A summary of potential vulnerabilities is presented in Section 3 below.

The breadth and content of information for each agency is extensive. Each agency has their own separate water supply portfolio. These water supply portfolios will remain as working drafts as updated data and information may become available. For agencies with multiple service areas, data and analyses within each portfolio are further broken down to account for operational and geographic differences.

3.1.2 Environmental Sector Vulnerability Assessment Approach

Key vulnerabilities to environmental sector resources were identified during the Water Forum process between 1993 and 2000. The priority asset in the RDCP area is the fishery of the lower American River. To ensure the vulnerabilities of this sector were included in the RDCP, the Water Forum Successor Effort was included in the DPTF.

3.2 Vulnerability Assessment Outcomes

Through the vulnerability assessment process, a comprehensive list of vulnerabilities was compiled. Of those, there were five broad drought-specific water supply vulnerability areas described by the M&I sector.

3.2.1 Overall Water Supply Sector Vulnerabilities

A major outcome through this assessment is a list of key vulnerabilities that would prevent water supply agencies from meeting their desired level of service. These vulnerabilities, if not addressed, could have wide a range of effects from localized impacts, to severe disruptions in services region-wide.

The identified vulnerabilities are grouped into seven major vulnerability themes:

1. Institutional threats to surface water availability
2. Physical threats to surface water availability
3. Institutional threats to groundwater availability
4. Physical threats to groundwater availability
5. Institutional limitations on sharing supplies
6. Physical limitations on sharing supplies
7. Threats to infrastructure integrity

These vulnerabilities range from being influenced by external factors to internal factors and from being physical (structural deficiencies or improvement needs), operational, and institutional (contractual, policy, and/or administrative issues) (see **Figure 3-2**). Vulnerabilities that are affected by external factors are those that individual agencies and the region have less control

over, such as the climate, State-mandated water supply curtailments, or changing Federal and State regulations and policies. Agencies have more control or influence on local factors. In general, institutional and physical threats to surface water availability are influenced by external factors, whereas limitations on the ability to share water supplies are more influenced by local factors. Threats to groundwater availability are a mix of external and local influences.

Under these seven major vulnerability themes are approximately 30 vulnerability categories (see **Table 3-1**). These vulnerabilities were identified during the agency interviews and encompass the vulnerabilities that agency staff identified. Since the RDCP focus is on drought resiliency, the focus of this analysis was on vulnerabilities that may limit the ability to provide water at desired level of service during drought conditions.

Figure 3-2. Summary of Identified Vulnerability

Table 3-1. Identified Vulnerability Themes and Examples

Vulnerability Theme	Vulnerability Examples
1. **Institutional threats to surface water availability**	• CVP/Folsom Reservoir Operations • Evolving State and Federal Regulations • Agency Specific Water Rights/Contract Limitations
2. **Physical threats to surface water availability**	• Climate Change/Hydrologic Variability • Inability to Divert during Low Storage/Flow Conditions • Source Contamination
3. **Institutional threats to groundwater availability**	• New Drinking Water Standards • New State Water Quality Regulations • Future constraints related to SGMA
4. **Physical threats to groundwater availability**	• Groundwater Contamination • Groundwater Production Capacity Limitations • Groundwater Injection Limitations
5. **Institutional limitations on sharing supplies**	• Existing POU/Service Area Limitations • Disparity in Cost of Water • Diverse Agency Goals & Interests
6. **Physical limitations on sharing supplies**	• Inconsistent Fluoridation Practices • Limited Intertie Capacities • Incompatible Pressure Zones • Inconsistent water quality • Lack of metering on interties
7. **Threats to infrastructure integrity**	• Aging Infrastructure • Lack of redundancy for critical facilities • Geologic Hazards • Flooding Hazards
Other Challenges	• Reliance on single supply source • Unrealized recycled water potential • Limited capacity to serve growth • Lack of Real-time Data Sharing

Key:
CVP = Central Valley Project
POU = place of use
SGMA = Sustainable Groundwater Management Act

3.2.2 Drought-Specific Water Supply Sector Vulnerabilities

Of the wide range of vulnerabilities identified by the agencies, four vulnerabilities within the **institutional** and **physical threats to surface water availability** themes surfaced as having the most significant impacts to drought resiliency. Additionally, fluoridation was identified as a potential vulnerability in that it could represent a limitation to sharing supplies. These specific vulnerabilities are discussed below.

Low Reservoir Storage

This vulnerability could occur when reservoir levels drop to a point that intake structures for diverting water would be impacted; or when low storage or runoff projections result in reduction of deliveries. The primary vulnerability in the region is with storage at Folsom Reservoir as it reduces overall water supply reliability. Regional water suppliers are very concerned when storage in Folsom drops below 200,000 acre-feet.[11] In the ten-year period from 2007 through 2016, Folsom reservoir dropped below 200,000 acre-feet three times, with its lowest ever

[11] This prompted the City of Folsom to be the first agency to call for mandatory customer conservation of 20% in December 2013.

recorded storage of under 135,000 acre-feet in December 2015. While emergency pumps and barges provide water at lower storage volumes, it is believed that when storage volumes fall below 90,000 acre-feet, water supply diversions would be substantially impacted. While these storage levels have never occurred, the occurrence of low storage in Folsom appears to be increasing in frequency during droughts. The magnitude of impacts should this occur would be high. Another example is when PG&E water supplied through Drum Spaulding to PCWA is reduced due to low storage projections. This would not only result in PCWA having lower supplies, but could also impact deliveries to its wholesalers and availability of supplies for temporary transfers. This has occurred with moderate frequency, but the relative impact to PCWA has been low.

Low Flows in Rivers

Low flows in rivers potentially reduce the amount of surface water, to agencies diverting directly from the American or Sacramento Rivers. If river flows are sufficiently low, surface water diversions could even be cut off. Agencies relying predominantly on these supplies would have to rely on transfers from other agencies, all or in part, to meet demands. For example, the City of Sacramento identified this vulnerability as an ongoing concern. This is because the City of Sacramento's lower American River diversion experiences impacts on its ability to divert water when flows are at about 500 cubic feet per second. Flows below this have occurred during the recent drought. This vulnerability is moderately likely to occur again, and would have a moderate impact on their supply.

CVP Allocation Shortages

Reclamation annually provides water supply allocations to its water contractors. In drought years, when water supplies are constrained, Reclamation can implement their M&I Shortage Policy which reduces the amount of CVP supplies a CVP contractor receives that year. When CVP allocations are reduced, Reclamation uses an average of the three previous unconstrained (100 percent allocation) years of use by each CVP contractor to determine each CVP contractor's baseline demand, and then applies the allocation reduction (e.g., 25 percent reduction to CVP contractors) . According to Reclamation's CVP M&I Shortage Policy, this historical use calculation may be adjusted on request of the CVP contractor to assist in meeting basic public health and safety needs, or to account for population growth, extraordinary water conservation measures, use of non-CVP water or other unique or unusual circumstances. However, even with such adjustments, CVP supply may still be insufficient to meet contractors' critical needs depending upon the severity of shortage conditions. Reclamation has reduced allocations for M&I contractors in recent years. For the period 2002 to 2016 total CVP allocations to the 8 CVP American River diverters Water Service Contractors was generally 57.5 percent of allocations, and 41 percent of total deliveries from all other surface water supplies (e.g., water rights, Middle Fork Project supply, Section 215) were conveyed to them by Reclamation through Folsom Reservoir. This vulnerability is likely to occur more frequently in the future, as Reclamation is increasingly challenged to meet competing demands system-wide. The impact on supply ranges from low to high depending on the each agency's reliance on their CVP contract supply.

Water Right Curtailments

The State Water Resources Control Board (SWRCB) uses curtailments as a tool to help with the overall administration of the state's water rights system. When there is insufficient water available to meet all the demand in a watershed, water right holders, starting with the most junior, are ordered to cease diverting surface water to protect the rights of more senior right

holders. Upon notice of curtailment, the water rights holder must immediately reduce or stop taking water according to the terms of the curtailment. This vulnerability generally has a low frequency of occurrence within the RDCP due to the seniority of water rights in the region. However, during the recent drought, curtailments were issued on rights with seniority dating back to 1903, which was unprecedented in terms of seniority of the rights curtailed. Notably, Carmichael Water District, which has a 1915 date on its water right, was curtailed in both 2014 and 2015. The impact of curtailments is highly variable ranging from low to high.

Inconsistent Fluoridation Practices

Inconsistent fluoridation practices was also identified as a potential limitation to sharing supplies as about half of the agencies fluoridate their water and the other half do not. As part of the RDCP development, a map of which systems are or are not fluoridated was created (**Figure 3-3)**.

While this is an issue in the short-term (e.g., following a single dry year), it is expected that in the long-term (e.g., consecutive dry years) this will not limit supply sharing. For example, during the recent drought, the SWRCB Division of Drinking Water was willing to consider requests to waive the requirement for optimal fluoridation is fluoridated systems.

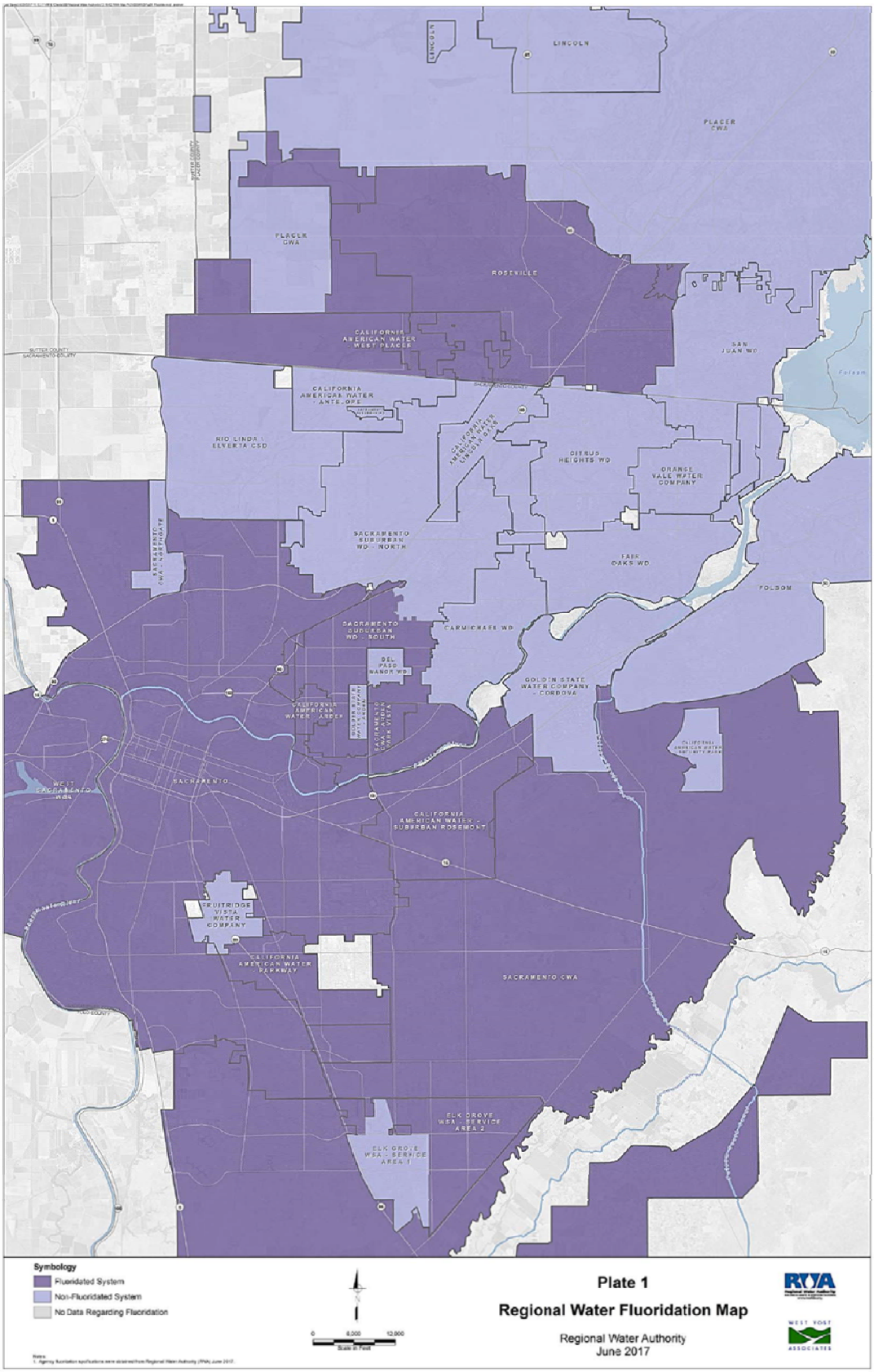


Figure 3-3. Regional Water Fluoridation Map

Table 3-2 summarizes which of the drought-specific water supply vulnerabilities that each of the participating RDCP agencies are vulnerable to. The following general definitions were used to define the likelihood of the impact occurring and the magnitude of the impact:

- **Likelihood to Occur**
  - Low (**yellow**) – Very unlikely to occur (estimated frequency of less than 1 year in 10 years).
  - Moderate (**orange**) – Occurs infrequently (estimated frequency of 1 or 2 years in 10 years).
  - High (**red**) – Likely to occur (estimated frequency of 3 or more years in 10 years).
- **Magnitude of Impact**
  - Low (**yellow**) – Limited impact on ability to meet demands. No projected deficit if customers respond with demand reductions similar to those seen in 2015.
  - Moderate (**orange**) – Impacts water supply that could result in an estimated additional conservation requirement of up to about 25 percent over that of the "low" impact. This essentially equates to up to 50 percent of total supply.
  - High (**red**) – Impacts water supply that could result in an estimated additional conservation requirement of greater than 25 percent over that of the "low" impact. This essentially equates to more than 50 percent of total supply. This is typically above the highest stage of a water shortage contingency plan.

It should be noted that as shown in **Table 3-2**, there are several agencies with service areas in the RDCP area that can fully meet demands through already developed groundwater supplies. These agencies are not projected to experience any supply vulnerabilities during drought as long as the groundwater basin remains sustainable in terms of volume. The regional groundwater basin has been sustainably managed over the past two decades as a result of improved conjunctive use operations.[12] During the most recent drought, groundwater elevations remained relatively stable as customers reduced demands. Therefore, the groundwater basin is not considered vulnerable with respect to drought conditions. Because of the reliability of the groundwater supply from a hydrologic perspective, many of these agencies will be key contributors to mitigation actions for those agencies with drought vulnerabilities.

[12] Currently, groundwater in the North American Subbasin is being managed by the Sacramento Groundwater Authority (SGA), Sutter County, South Sutter Water District, Placer County, and the Western Placer County Groundwater Management Partners (City of Roseville, City of Lincoln, Placer County Water Agency, California American Water). These entities have a history of coordinated data collection and groundwater management efforts for over 20 years. SGA has submitted a notice to California Department of Water Resources (DWR) to become a Groundwater Sustainability Agency (GSA) for the Sacramento County portion of the North American Subbasin.

Table 3-2. RDCP M&I Agencies Relative Impacts Associated with Drought-Specific Water Supply Vulnerabilities

Agency	Low Reservoir Storage	Low Flows in Rivers	CVP Allocation Shortages	Water Right Curtailments
RDCP Partners				
Placer County Water Agency	● ■		● ■	● ■
City of Folsom	● ■		● ■	● ■
City of Roseville	● ■		● ■	
City of Sacramento		● ■		● ■
San Juan Water District (Retail)	● ■		● ■	● ■
Other Agencies in RDCP Area				
California American Water – Placer County+	● ■		● ■	● ■
California American Water – Sacramento County				
Carmichael Water District				● ■
Citrus Heights Water District+	● ■		● ■	● ■
City of Lincoln+	● ■		● ■	● ■
Del Paso Manor Water District*+				
Fair Oaks Water District+	● ■		● ■	● ■
Golden State Water Company – Arden*				
Orange Vale Water Company+	● ■		● ■	● ■
Rio Linda/Elverta Community Water District*				
Sacramento County Water Agency*				
Sacramento Suburban Water District	● ■			● ■

Key:
* = only uses groundwater in RDCP area
+ = not CVP contractors, but may be impacted indirectly through shortage allocations from the wholesaling agency
CVP = Central Valley Project
M&I = municipal and industrial
RDCP = Regional Drought Contingency Plan
Likelihood to Occur: <blank> = Unlikely or Not Applicable ● = Low ● = Moderate ● = High
Magnitude of Impact: <blank> = No Impact or Not Applicable ■ = Low ■ = Moderate ■ = High

Potential Water Supply Deficits During Highly Restricted Supply Scenario

The consequences of drought-specific water supply vulnerabilities are more severe as hydrologic conditions become more restricted. For the purposes of this vulnerability assessment, the Highly Restricted Supply scenario reflects a severe supply disruption situation, where one or more of an agency's primary water supply(ies) becomes unavailable for an extended duration. This scenario is beyond the requirements of Urban Water Management Plans, and varies for each agency depending on their portfolio of water supplies. Each agency identified which parts of their supply were most vulnerable and which were most reliable for purposes of determining the potential deficit. For example, under current conditions, the City of Roseville (shown in **Figure 3-4**) has

access to groundwater and recycled water that are considered highly reliable during drought conditions. However, as also shown below, additional customer conservation ("Extraordinary Conservation") is required to close a supply and demand gap in August through September under this supply scenario. This three-month deficit period is also shown graphically in **Figure 3-5** for the City of Roseville. This same approach was used to determine and depict potential water supply deficits for each agency under current water demand conditions and is shown in **Figure 3-5**.

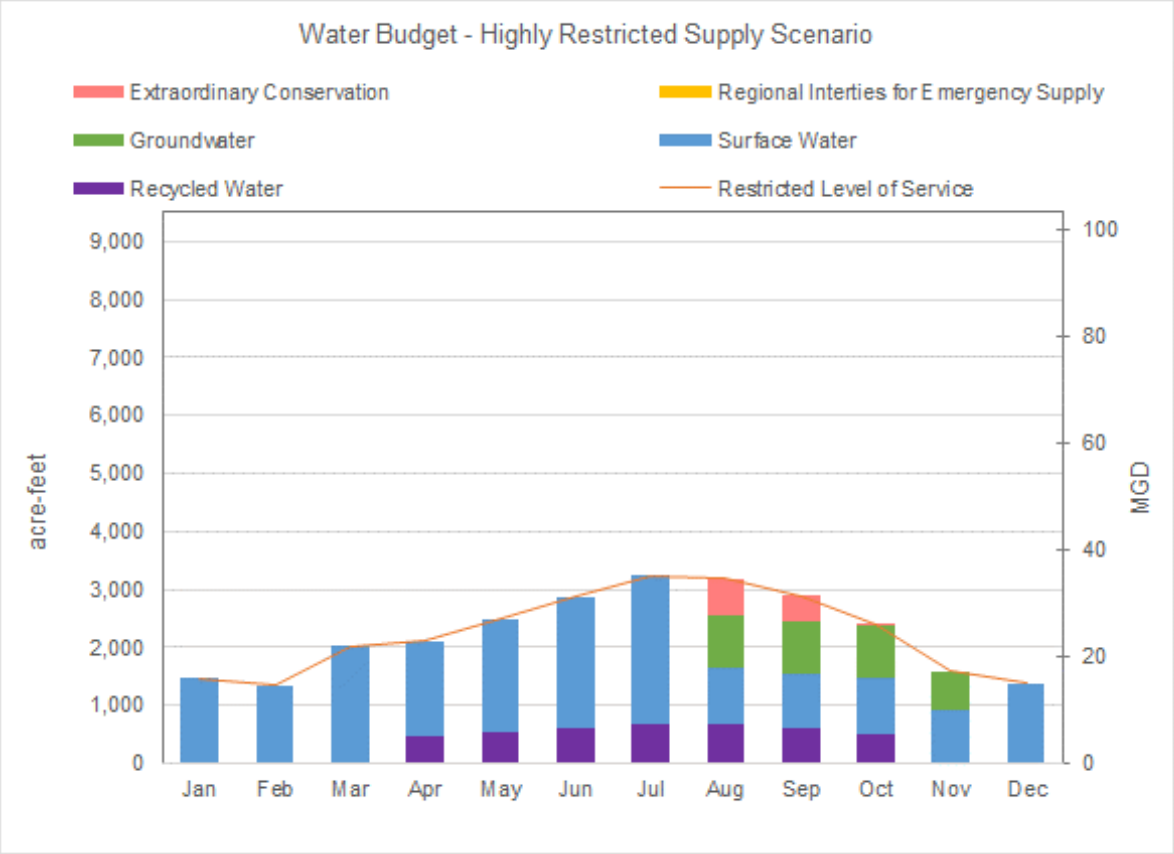


Figure 3-4. Example Monthly Supply and Demand Curve Under a Highly Restricted Supply Scenario for Current Conditions – City of Roseville

As shown in **Figure 3-5**, 12 agencies may experience deficits during their Highly Restricted Supply scenario under current conditions. Of those water agencies, five agencies would have low impacts that can be managed by customer conservation on par with reductions in 2014 and 2015. The remaining seven agencies could experience deficits that would require significant additional customer conservation to achieve desired service levels and reliability of service going forward. Consistent with demand patterns throughout the year, the greatest deficits tend to occur during summer months when demand is highest.

To estimate future potential deficits, a "buildout conditions" scenario was developed by working with each agency to estimate its demand and supply at some future time. For most agencies this assumed supply and demand for 2035, which is the information available in the latest 2015 update to their respective Urban Water Management Plans. **Figure 3-6** depicts graphically when and to what degree monthly deficits could occur at buildout under a highly restricted supply

scenario. At buildout, two additional water agencies may experience a deficit, and others may experience a longer period of deficit than under current conditions (shown in **Figure 3-5**). Fair Oaks Water District projects deficits during current conditions, but not at buildout primarily due to projected increases in groundwater production capacity.

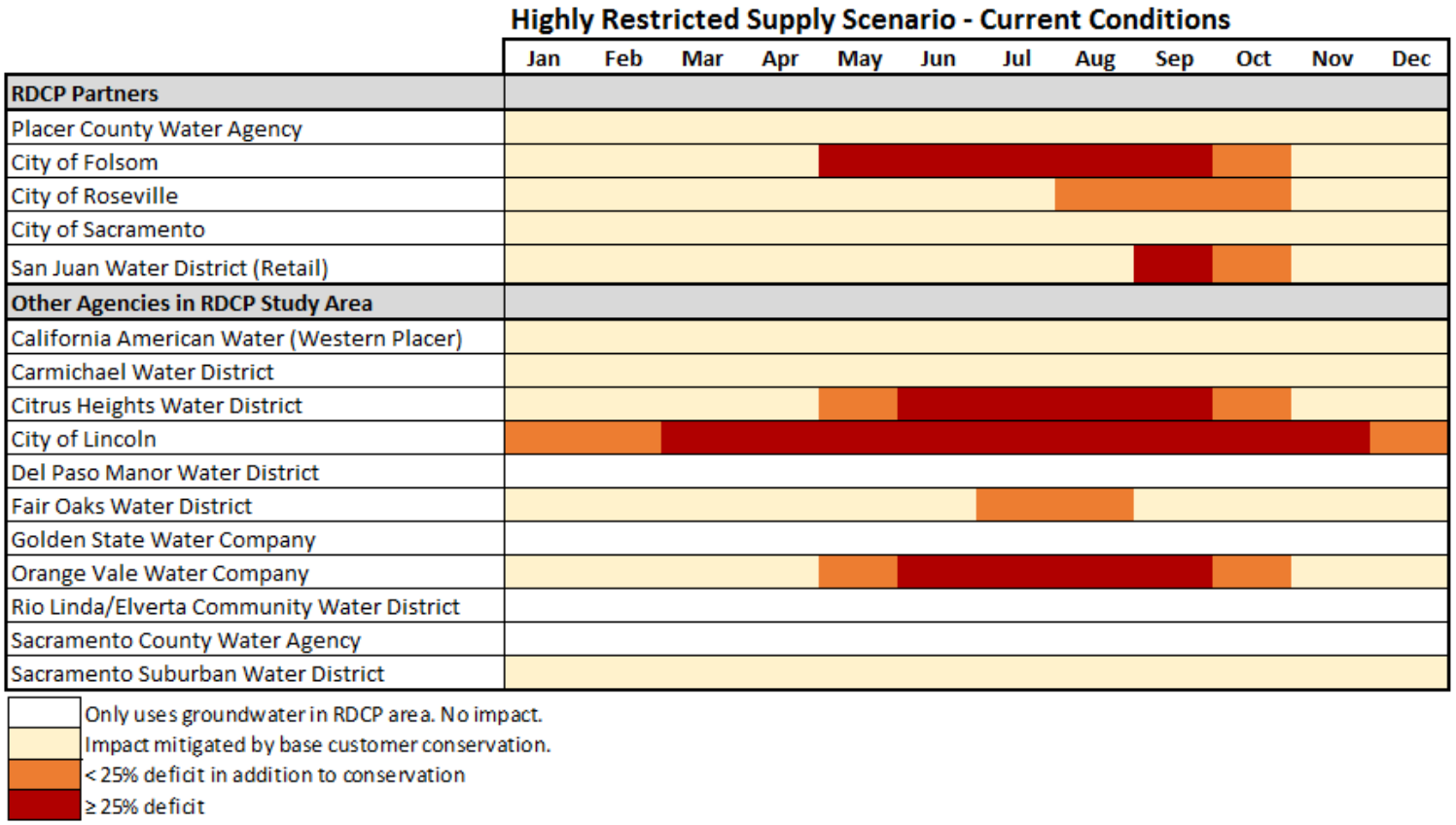


Figure 3-5. Monthly Deficits During Highly Restricted Supply Scenario by Agency for Current Conditions

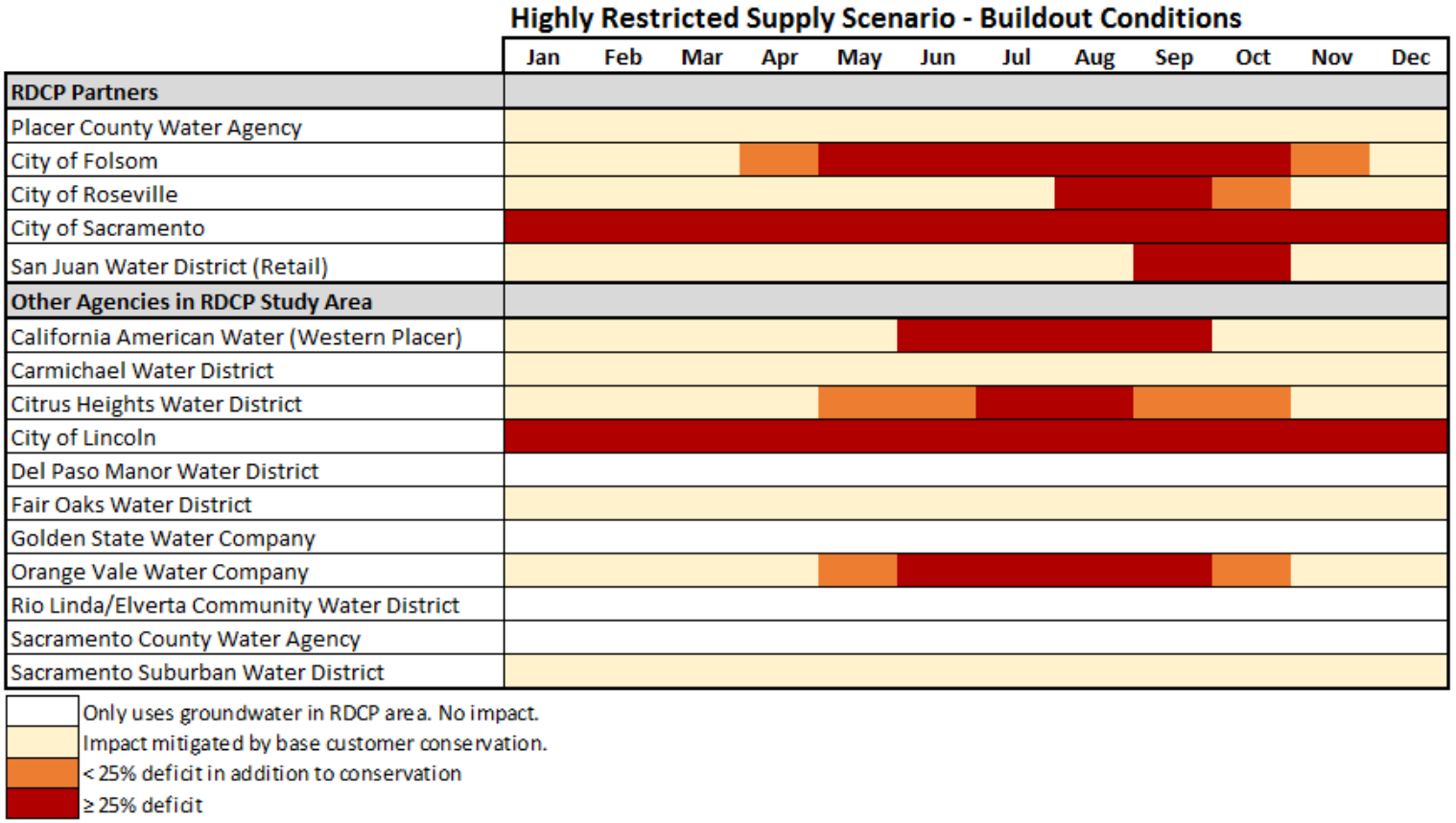


Figure 3-6. Monthly Deficits During Highly Restricted Supply Scenario by Agency for Build-Out Condition

3.2.3 Drought-Specific Environmental Sector Vulnerabilities

With completion of the Water Forum Agreement in April 2000, the region committed to a management regime to contribute to the protection of fisheries in the Lower American River (LAR). The LAR provides critical habitat to more than 40 species of native and nonnative fish, including fall-run Chinook salmon and Central Valley steelhead trout. Critical to the support of these species is a pattern of releases of water from Folsom Reservoir that is of both appropriate quantity and temperature to support the life cycles of these species. Drought conditions can result in the reduction of flows and an increase of temperature in the LAR, which results in a substantial vulnerability to the fishery.

LAR's resident salmonid species (Central Valley Steelhead and Fall-run Chinook Salmon) are sensitive to water temperatures and often experience thermal stress. Temperature monitoring data show that water temperature is hotter – and less healthy for salmon – during dry years. This is due to reduced coldwater pool in Folsom Reservoir and due to lower river flows during dry years. This can be seen in daily water temperature measurements from 2015 taken at the Watt Avenue Bridge (see **Figure 3-7**).

Dry years also result in reduced fish habitat quality and quantity. During the drought in 2015, river flows were as low as 500 cubic feet per second for several months (see **Figure 3-8**). Fish biologists observed fish stranding and salmon egg dewatering associated with the low flow conditions.

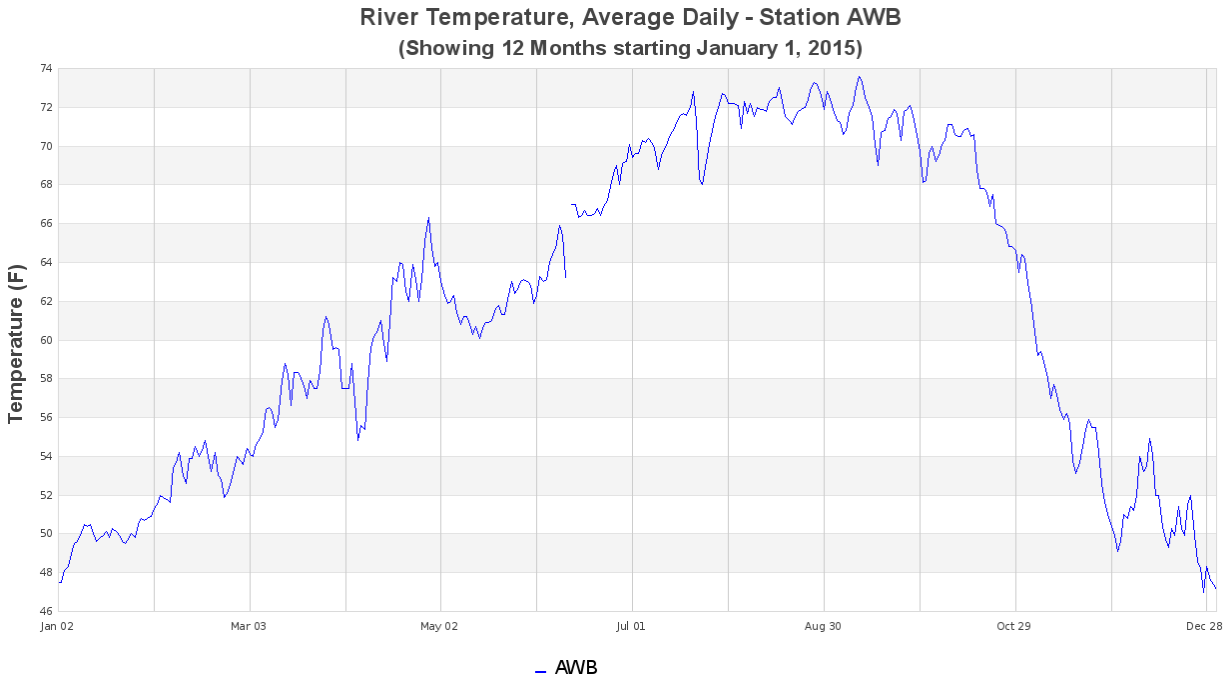


Figure 3-7. Daily Water Temperature in 2015 in the American River at the Watt Avenue Bridge

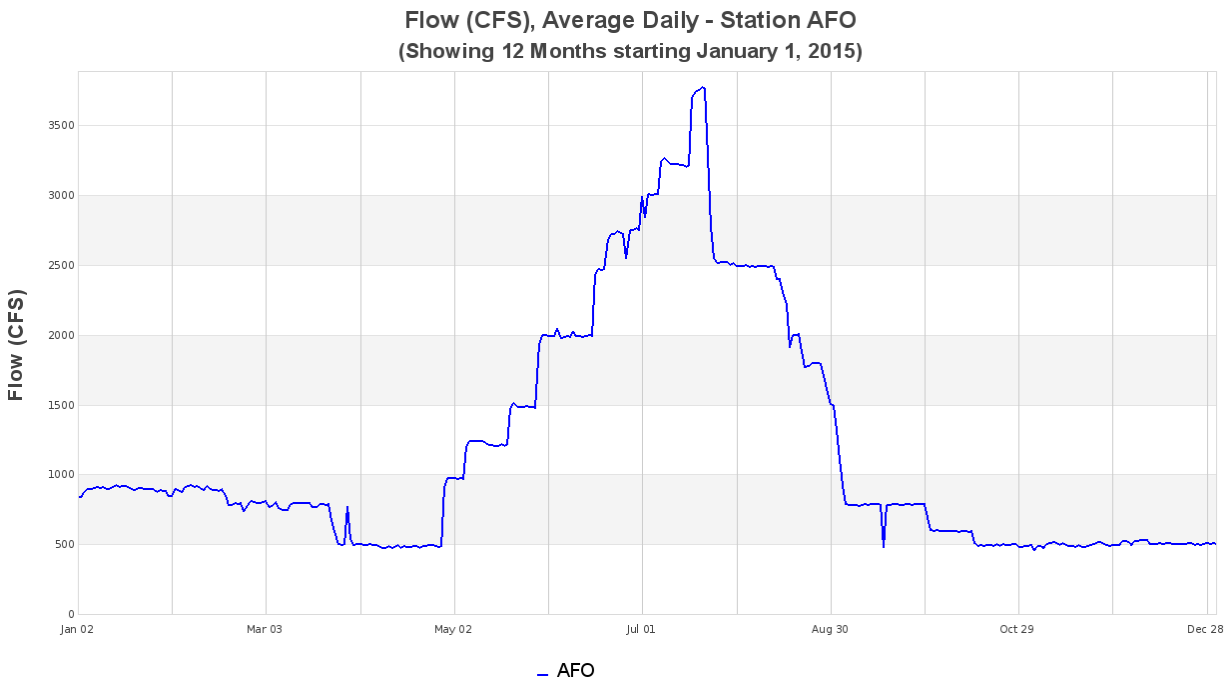


Figure 3-8. Daily Flows in 2015 in the American River in Fair Oaks

3.2.4 Consideration of Other Factors that Could Influence Vulnerabilities Under Current or Future Conditions

Climate Change

The Sacramento and San Joaquin Basins Climate Impact Assessment (Reclamation, 2014) and the recently completed Sacramento and San Joaquin Basin Study (Reclamation, 2016) outline the following major effects of climate change on temperature, precipitation, and runoff:

- Temperatures are projected to increase steadily during this century, with generally greater changes occurring farther inland. In the Sacramento region, warming increases by about 1 degree Celsius (°C) to 3°C (1.8 degrees Fahrenheit (°F) to 5.4°F) at mid-21st century (2055) and about 2°C to 5°C (3.6°F to 9°F) at end-of-century (2084) (Reclamation, 2014).

- 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, 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.[13] The greatest changes will occur in the lower elevations of the basins. By 2025, the Sacramento Valley watershed is projected to experience decreases in the April 1st SWE in the range from 10 percent in the higher

[13] Managing an Uncertain Future (California Department of Water Resources, 2008)

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).

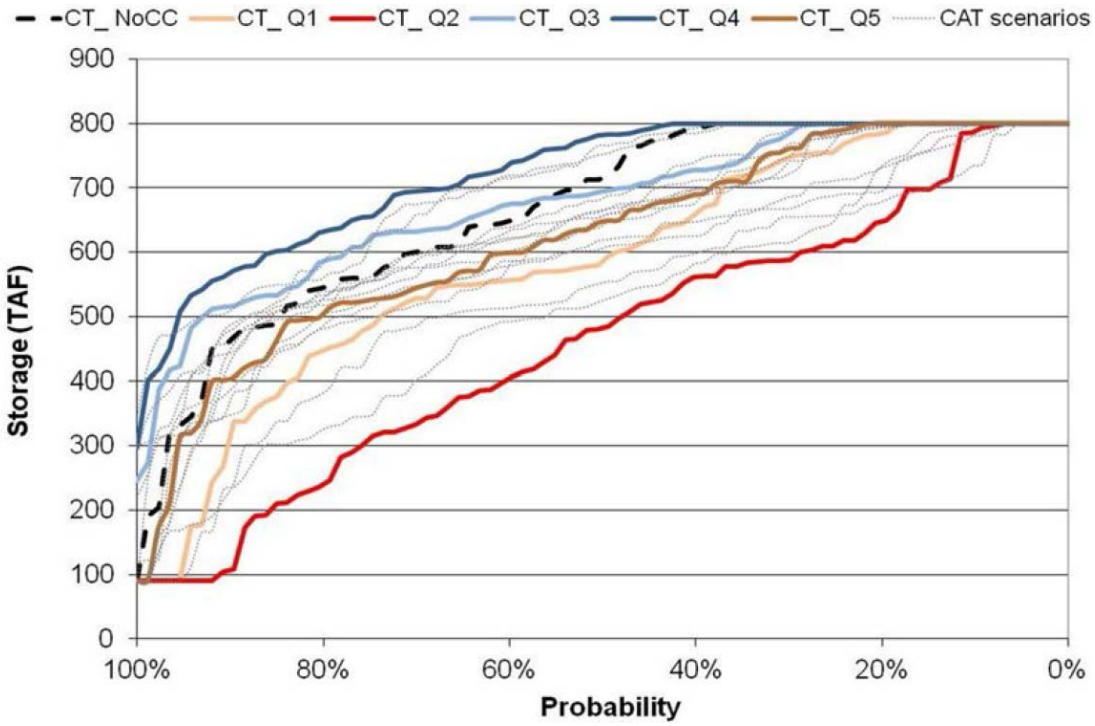
- Evapotranspiration is projected to increase continuously during the 21st century due to warmer temperatures. This would result in longer growing season lengths, thus increasing the amount of water needed for the irrigation of many crops, urban landscaping, and environmental water (Reclamation, 2016).

- Projected runoff in the Sacramento Region varies by climate scenario. Under the no climate change scenario, average annual runoff was about 22,739 thousand acre feet (TAF)/year in the Sacramento Region. Across the range of all climate scenarios, average annual runoff ranged from 17,993 to 31,899 TAF/year for 2012-2040; 16,989 to 29,129 TAF/year for 2041-2070; and 18,372 to 28,695 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.

- 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).

- Mean sea level is expected to rise by approximately 4.8 to 23.9 inches by the year 2050 at the Golden Gate Bridge (NRC 2012). The lower Sacramento River in the southern portion of the American River Basin region is tidally influenced, and will be affected by rising sea levels.

In the American River Basin, the potential effects of a changing climate cause significant uncertainty in long-term water supply reliability. Folsom Reservoir, the main water supply source for much of the region, has a limited capacity relative to the watershed it serves, in part because seasonal snowpack is relied upon to provide a large portion of the storage necessary to regulate runoff for water supply. Changing climate conditions in the Sierra Nevada mountains threaten the volume of water stored in the snowpack and the timing of runoff entering the reservoir. Further, the superior quality of water in the American River and its close proximity to the Delta give Folsom Reservoir a critical role in the operations of the CVP to satisfy Delta flow and quality standards and other requirements for protecting endangered fishery species. The net effects of these factors are that Folsom Reservoir is projected to have lower storage and more frequent dead pool under most future climate scenarios (see **Figure 3-9**).



(Sacramento and San Joaquin Basin Climate Impact Assessment, Reclamation, 2012)

CAT Scenarios = California Climate Action Team Scenarios[14]
CT_NoCC = Current Trends, No Climate Change
CT_Q1 = Current Trends, Drier and Less Warming
CT_Q2 = Current Trends, Drier and More Warming
CT_Q3 = Current Trends, Wetter and More Warming
CT_Q4 = Current Trends, Wetter and Less Warming
CT_Q5 = Current Trends, Central Tending Climate Scenario
TAF = thousand acre-feet

Figure 3-9. Exceedence Plot of Folsom Reservoir end-of-September Storage under Future Climate Change

Population Growth

Population growth will also be a factor that influences future water reliability of the RDCP agencies that project a substantial increase in population. The Sacramento region as a whole is expected to grow by one million people, or nearly 50 percent, over the next 20 years.[15] Currently the majority of the region's water demand is from the residential sector (single family and multifamily households). While the average amount of water used per person (expressed as gallons per capita per day or GPCD) has steadily declined over the last decade and half, the sheer number of new residents has the potential to slightly increase water use in this sector overall (**Figure 3-10**). GPCD includes both residential indoor and outdoor water use and it is estimated that between 50-65 percent of residential water use is used outdoors.

The impact on water demand and reliability will largely depend on how and where these future residents settle into the region. For example, if the region grows with more compact, denser development patterns (transit-orientated, multifamily units), there will be fewer, smaller individual household landscape areas, meaning decreased outdoor water use comparatively. However if the majority of the future residents choose to settle in more traditional, larger single

[14] Eighteen climate projected were used. 5 ensemble-informed scenarios were developed by the Central Valley Project Integrated Resource Plan based on downscaled global climate model (GCM) projections (Q1 through Q5). 12 specific GCM projections were identified by the State of California's Climate Action Team for use in climate studies performed by the California Department of Water Resources for the California Water Plan Update 2009 (CAT scenarios).

[15] http://www.sacog.org/sites/main/files/file-attachments/sacog_handbook_2016.pdf Page17, Overview of ITS.

family lots, outdoor water use and, therefore, GPCD could remain the same or increase. Most likely, future residential development will be a mixture of both compact, denser and traditional, larger lot households. As for residential indoor use, existing efficiency gains from fixtures such as toilets and showerheads will wane over time (unless new more efficient fixture standards are adopted) as older fixtures are steadily exchanged for efficient fixtures. In addition to residential water use, new residents will also need schools, government services and commercial services such as restaurants and grocery stores, which will also impact future water demand and therefore future water reliability.

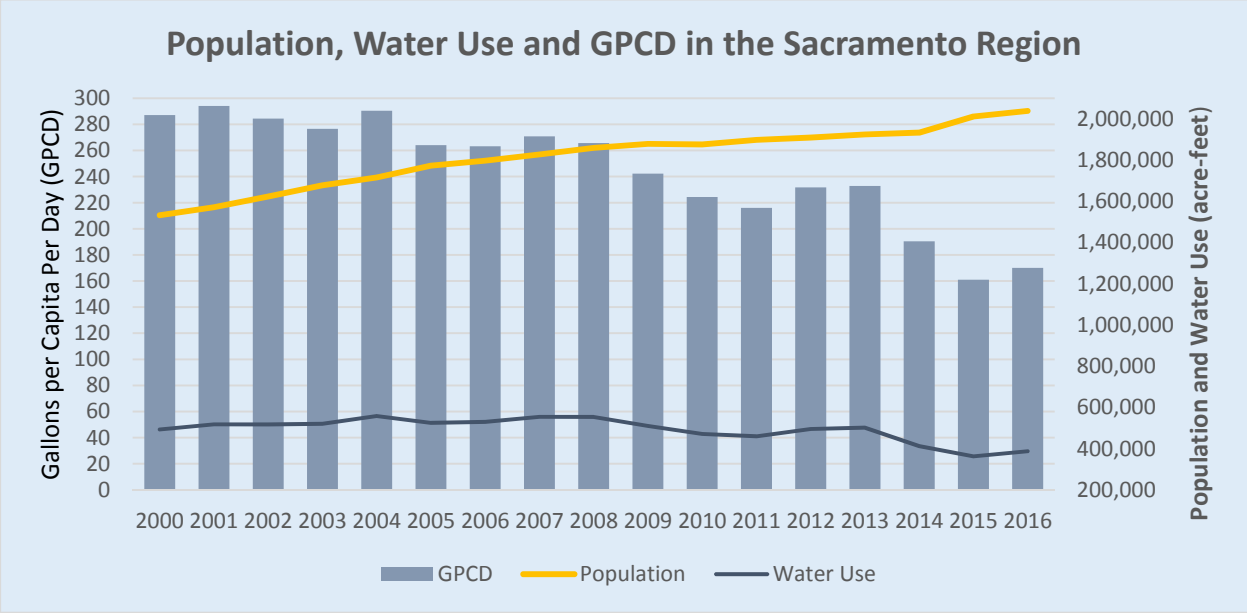


Figure 3-10. Population, Water Use and GPCD in the Sacramento Region

Other Factors

Long-term Water Service Contracts with Reclamation

Uncertainty in renewal by Reclamation of CVP long-term water service contracts was a potential vulnerability expressed by some of the RDCP participants. Between the mid-1960s and early 1970s, Reclamation executed long-term (40-year) water service contracts (LTWSC) with seven municipalities and water agencies for delivery of CVP water supply from Folsom Dam and Reservoir. All LTWSCs were executed in accordance with State Water Resources Control Board (State Board) Decision 893 (D-893)[16] and specific federal statutes collectively referred to as Reclamation Law. The seven CVP American River Division (ARD) contractors are:

- El Dorado Irrigation District (EID)
- SJWD
- City of Roseville (Roseville)
- PCWA

[16] http://www.waterboards.ca.gov/waterrights/board_decisions/adopted_orders/decisions/d0850_d0899/wrd893.pdf

- Sacramento County Water Agency (SCWA)
- Sacramento Municipal Utility District (SMUD)
- East Bay Municipal Utility District (EBMUD)

All seven CVP ARD LTWSCs incorporated a right of renewal for up to 40-years pursuant to Public Law 88-44, June 21, 1963 (1963 Act),[17] and Public Law 102-575, Title XXXIV, Central Valley Project Improvement Act (CVPIA) Section 3404(c). [18] Reclamation renewed the EID, SJWD and EBMUD contracts in 2006. Between 2007 and 2008, Reclamation was precluded by Court Order from executing additional CVP LTWSCs. As a practical matter, Reclamation elected not to execute any additional LTWSCs between 2008 and January 2016 when Reclamation signed the Record of Decision (ROD) for Long-Term Operation (LTO) of the CVP in Coordination with the State Water Project (SWP). The LTO ROD was the last court-ordered action related to extended litigation on long-term CVP operations.

The original LTWSCs for PCWA, Roseville, SCWA and SMUD all expired in the 2010 – 2012 timeframe. Since that time, Reclamation has executed successive two-year interim renewal contracts (IRC) with these contractors under authority of CVPIA Section 3404(c)(1). Immediately, upon release of the LTO ROD in January 2016, PCWA and Roseville requested renewal of their LTWSCs as provided by their IRCs. Reclamation initially elected to defer renewal for evolving reasons, most recently re-initiation of ESA Section 7 consultation on long term CVP/SWP operations.

Roseville, PCWA, SCWA and SMUD are four of the very few remaining CVP contractors still in IRC status. More than 90 percent (251 of 277) of all CVP water contractors, including approximately 85 percent of all CVP M&I contract water supply, are already under long-term or indefinite term contracts. IRCs issued under Section 3404 of the CVPIA have four significant limitations: (1) they are limited to a maximum two year term; (2) Reclamation is not required by law to award new IRCs; (3) where Reclamation does elect to proceed with an IRC, it must consider a reduction in contract quantities; and (4) IRC contractors are subject to new Reclamation policies with each IRC cycle. These factors introduce a significant degree of uncertainty in Roseville and PCWA's CVP water supply. In addition, the uncertainty in CVP water supply denoted by two-year discretionary IRCs affects planning and financing for local capital investment and commercial development projects and, potentially, the financial standing of the contractors.

[17] http://uscode.house.gov/statutes/pl/88/44.pdf
[18] https://www.usbr.gov/mp/cvpia/docs/public-law-102-575.pdf

4.0 Mitigation Actions

The purpose of this section is to summarize the process of identifying and evaluating mitigation actions performed in support of the RDCP.

4.1 Mitigation Actions Development Approach

After a list of vulnerabilities were identified during the vulnerability assessment, the participating agencies began to develop mitigation actions to address those vulnerabilities. The steps for developing mitigation actions included the following activities:

1. **Identification of Mitigation Actions –** A potential range of mitigation actions and opportunities were identified from existing regional plans and studies (e.g., the ARB IRWMP, UWMPs) and through the agency interviews conducted as part of the Vulnerability Assessment (see Section 2. Vulnerability Assessment).

2. **Screening of Identified Mitigation Actions –** The purpose of this high-level screening was to eliminate, for further consideration, any redundant mitigation actions or completed actions, or those outside of the scope of the RDCP.

3. **Evaluation of Retained Mitigation Actions –** The screened mitigation actions were further evaluated to assess contributions to drought resiliency and implementation complexity. For structural mitigation actions, additional evaluation on project status, project schedule, implementation requirements, costs, and potential yield were assessed.

4.1.1 Identification of Mitigation Actions

Mitigation actions are intended to address the drought-specific vulnerabilities identified by participating agencies. In addition, these mitigation actions considered:

- Achieving and maintaining the reliability of each agency's desired level of service under various hydrologic conditions.

- Meeting both short-term and long-term growth needs, and providing flexibility to accommodate timing of uncertainty from the dynamic urban growth.

- Protecting the sustainability of the groundwater basin.

- Maintaining compatibility with existing and planned water supply infrastructure.

- Leveraging regional solutions to achieve resiliency goals for multiple agencies in a cost-efficient matter.

As part of the Vulnerability Assessment process, an initial list of mitigation actions were compiled using information provided during each agency's individual interview conducted between December 2016 and January 2017. These initial mitigation actions were generally agency-specific and are included in the each agency's water supply portfolio. Approximately 130

initial mitigation actions were developed that addressed a wide range of identified water supply vulnerabilities, including both drought- and non-drought-related vulnerabilities. They included physical/structural, operational, and institutional actions.

This list of initial mitigation actions was used as a starting point for sub-regional work group meetings. Four sub-regional work group meetings (north, central, east, and south) were held during the week of March 6, 2017. During these meetings, participating water agencies discussed their vulnerabilities and potential mitigation actions using the information generated during the individual agencies interviews. Through this process, several additional actions were identified and a list of 138 mitigation actions/opportunities was compiled.

Water agencies provided further oral and written comments on the list of mitigation actions during the April 12, 2017 Drought Planning Task Force meeting, and during review of this section. The resulting list included a total of 162 identified mitigation actions.

4.1.2 Screening of Identified Mitigation Actions

The purpose of this screening step was to identify a retained set of mitigation actions for further evaluation. As shown in **Figure 4-1**, the identified mitigation actions were preliminarily screened based on the following:

- **Implementation Status:** Actions identified as already implemented or in process of being implemented were not moved forward. Of the 162 initial mitigation actions, 12 have been implemented or are in process of being implemented.

- **Duplicate/Redundant:** Actions that were similar in scope were combined. About half, or 76, of the mitigation actions were redundant actions (e.g., participating in a regional groundwater bank was proposed separately by eight agencies).

- **Beyond scope of RDCP:** Mitigation actions that were beyond the scope or outside of the Study Area of the RDCP were not moved forward (e.g., security threats, earthquakes, actions addressing non-drought related vulnerabilities).

The screening effort resulted in the retention of 62 of the 162 original mitigation actions.

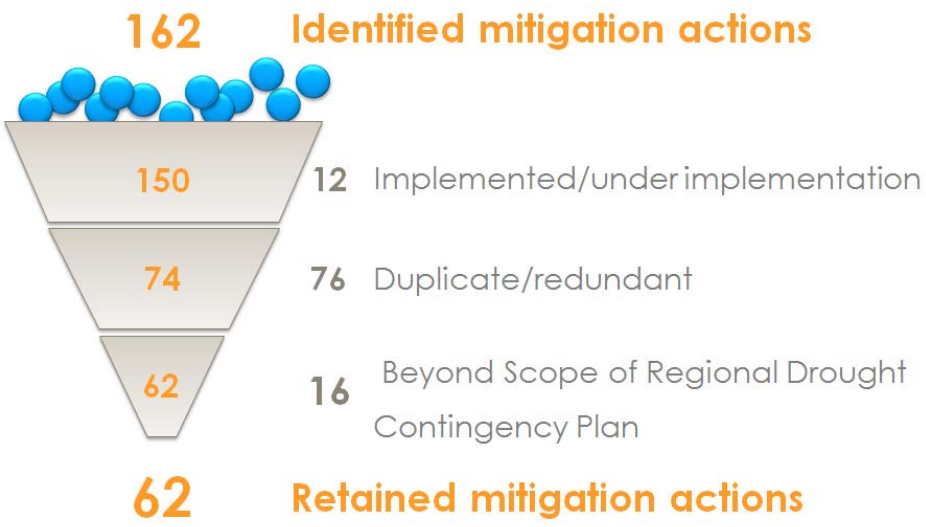


Figure 4-1. Screening of Identified Mitigation Actions

4.1.3 Evaluation of Retained Mitigation Actions

The 62 retained mitigation actions were further evaluated using both quantitative and qualitative criteria to inform which actions could (1) provide the greatest benefit to drought resiliency, and (2) the expected level of implementation requirements. For physical/structural actions, additional evaluation criteria was used to assess (1) project capital costs, and (2) project schedule, and (3) whether these actions could be implemented by individual agencies or are part of a broader regional actions (e.g., federally recognized groundwater bank). Quantitative and qualitative data was solicited from the participating agencies for each of the retained mitigation. This data was used as the basis for applying the evaluation criteria.

Evaluation Criteria

The following six evaluation criteria provided a consistent framework for evaluating and comparing the mitigation actions (**Table 4-1**):

- **Contribution to Improving Drought Resiliency** – Qualitatively assesses the contribution to improving ability to reliably meet water demands during dry or emergency conditions (rated low, moderate, or high).
- **Potential Costs**[19] (structural actions only) – Quantitatively assesses the potential capital cost to implement the mitigation action.
- **Potential Yield**[19] (structural actions only) – Quantitatively assesses the potential yield (in acre-feet/year or million gallons per day) expected upon implementation of the mitigation action.

[19] Estimates for project costs and yield are preliminary estimates provided for planning purposes, and in some cases ranges of costs and/or yields are provided reflecting uncertainty in formulation of projects.

- **Project Status** (structural actions only) – Qualitatively assesses the readiness of the project for implementation based on level of detail available on project facilities and operations of the mitigation action.
- **Implementation Timeframe** (structural actions only) – Quantitatively assesses the timeframe in which a mitigation action could be implemented and begin realizing its potential benefits.
- **Implementation Complexity** – Qualitatively assesses how likely a mitigation action is to achieve its potential benefits once it is implemented. Varies depending on whether the mitigation is a structural or nonstructural action.

Table 4-1. Mitigation Actions Evaluation Criteria

Criteria	Type	Application	Score(s)
Improve Drought Resiliency	Qualitative	Structural & Non-structural Actions	• High = Increase ability to access supplies during drought or emergency conditions. • Moderate = Indirectly improves access to supplies during drought or emergency conditions. • Low = Limited to no benefit to drought resiliency, or beyond scope of drought contingency plan.
Potential Costs	Quantitative	Structural Actions	$
Potential Yield	Quantitative	Structural Actions	acre-feet, million gallon per day (MGD)
Project Status	Qualitative	Structural Actions	• High = Action is in pre-design/design phase. • Moderate = Action has planning documents complete (e.g., Feasibility Study, project assessments). • Low = Action is conceptual only.
Project Schedule	Qualitative	Structural Actions	• High = Less than 5 years to implement. • Moderate = between 5 to 10 years to implement. • Low = More than 10 years to implement.
Implementation Complexity	Qualitative	Structural Actions	• Low = Low relative project cost, no/limited land acquisitions, short project implementation schedule, no/limited environmental compliance/approvals • Moderate = Moderate relative project cost, some land acquisitions, moderate project implementation schedule, moderately complex environmental compliance/approvals • High = High relative project cost, need for land acquisitions, long project implementation schedule, complex environmental compliance/approvals
		Non-structural Actions	• Low = No/limited water rights/contracts approvals, existing institutional arrangements, no/limited environmental compliance/approvals • Moderate = Some water rights/contracts approvals, moderately complex institutional arrangements, moderately complex environmental compliance/approvals • High = Complex water rights/contracts approvals, complex institutional arrangements, complex environmental compliance/approvals

4.2 Mitigation Actions Evaluation Outcomes

This section provides a summary of the retained mitigation actions for the water supply sectors. It also includes mitigation actions that can address the environmental sector vulnerabilities.

4.2.1 Water Supply Sector Mitigation Actions

The retained mitigation actions are grouped into six categories of structural mitigation actions and five categories of non-structural mitigation actions (see **Table 4-2**). Each of these categories of action contribute to drought resiliency in a specific way by addressing the key drought-specific vulnerabilities for the water supply sector as more fully described in the Vulnerability Assessment TM (i.e., low reservoir storage, low flows in rivers, CVP allocation shortages, and water right curtailments). **Table 4-2** describes the contribution of each category of actions to drought resiliency.

Each of the individual mitigations actions were also evaluated using the criteria listed in **Table 4-1**. **Table 4-3** summarizes the count and range of costs for the retained mitigation actions under each category. Of the 62 retained mitigation actions, 38 were structural actions and 24 were institutional actions. The total preliminary cost estimates for all structural actions was between $2 billion and $5.7 billion.

Table 4-4 lists what type of mitigation actions that each of the RDCP partners and other participating agencies proposed to address their drought-specific vulnerabilities. These actions, if implemented could help reduce the impacts of each agency's vulnerabilities, as described in **Table 4-2**.

Detailed tables of the retained structural and non-structural mitigation actions are included in **Tables 4-5** and **4-6**, respectively. The tables list a brief description of each mitigation action by category along with partner agencies and summaries of the qualitative and quantitative evaluations.

Table 4-2. Contribution of Retained Mitigation Actions to Drought Resiliency

Mitigation Action Category	Contribution to Drought Resiliency
Structural	
Intertie 	• Constructing new interties would facilitate sharing of supplies, and enable agencies to access additional supplies should their primary water source become unavailable (e.g., low reservoir storage, low flows in rivers, CVP allocation shortages, water right curtailments).
Groundwater Well • Rehabilitation • New Installation • Injection 	• Rehabilitation of existing groundwater wells and installation of new wells would enable an agency to maintain and increase its extraction capability. The enhanced groundwater capability would provide drought back supplies for the agency, as well as its neighboring agencies. • Retrofitting or installing new wells for injection would increase ability to recharge the groundwater basin. The enhanced groundwater basins conditions provides benefits to drought resiliency should surface water supplies become limited. Improving direct recharge capabilities also would create opportunities for groundwater banking and exchange.
Surface Water Treatment 	• New or expanded surface water treatment facilities would enhance redundancy and reduce reliance on single supply sources (e.g., reduces reliance on Folsom Reservoir). It could provide some agencies with access to different sources should their primary water source become unavailable. It would also enhance the capacity of sharing supplies with other agencies.

Table 4-2. Contribution of Retained Mitigation Actions to Drought Resiliency (contd.)

Mitigation Action Category	Contribution to Drought Resiliency
Surface Water Storage 	• New or redundant surface water storage would provide redundancy of supplies should existing supplies become limited. Upstream storage could also relieve pressure to meet low flow conditions in the American River while still having water for agriculture.
Surface Water Diversion 	• New or redundant surface water diversions could provide redundancy of supplies should the current Folsom Reservoir intake become inoperable (e.g., lake levels below current intake). A permanent emergency intake at Folsom Reservoir could improve reliability to attaining Folsom Reservoir supplies during when reservoir storage levels are below the existing intake. Also, a new river diversion on the Sacramento River would reduce reliance on the American River supplies, and increase drought resiliency by providing access to alternative source of surface water supplies.
Booster Pump/ Pressure Reduction 	• Addressing distribution system pressure differences between agencies would increase the ability to share supplies with neighboring agencies. This would improve drought resiliency and allow for expanding the regional conjunctive use.
Recycled Water 	• Expanding recycled water opportunities could provide another source of water to meet non-potable demands. This would lessen the demand on potable water when surface water supplies are limited.
Non-Structural	
Water transfers 	• Developing and expanding water transfer agreements particularly intrabasin transfer of CVP contract supplies, would facilitate sharing of supplies, and enable agencies to receive additional supplies such as groundwater should their primary water source become unavailable.
Wheeling 	• Wheeling water would allow agencies to move supplies between their different service areas or receive their supplies from other diversion locations (e.g., upstream of Folsom Reservoir). This would help agencies to meet demands when supplies become limited, or relieve conveyance capacity constraints.
Banking 	• Increasing conjunctive use and groundwater banking would increase reliability of groundwater basin to provide dry year supplies. Groundwater banking agreements, including establishing a regional groundwater bank, would facilitate regional collaboration. It would also facilitate collaboration with Reclamation to integrate Folsom operations with the groundwater basin to enhance drought resiliency and protection of environmental resources on the Lower American River.
Modify Contracts/Place of Use 	• Modifying contracts and/or expanding Place of Use would help facilitate sharing of supplies. The improved flexibility to sharing supplies would help some agencies access alternative supplies should their primary water source become unavailable. Additionally, optimizing coordinated use of available temporary and long-term CVP supply (e.g., water service contract allocations, Section 215 surplus water supply), water rights settlement supply and other surface water supplies could enhance conjunctive use opportunities including groundwater banking.
Federal Action and Collaboration 	• Collaborating with Reclamation on securing long-term CVP water supply contracts and Warren Act contracts, implementing opportunities for accelerated intrabasin transfer of CVP supplies, and establishing a sustainable minimum instream flow on the Lower American River are keys to enhancing water supply reliability and drought resiliency.

Table 4-3. Summary of Retained Mitigation Actions by Category

Mitigation Action Category	Number of Actions	Total Capital Cost Preliminary Estimates ($ million)
Structural		
Intertie	13	$70 - $100
Groundwater Well • Rehabilitation • New Installation • Injection	7	$80 - $160
Surface Water Treatment	2	$300 - $400
Surface Water Storage	2	$500 - $2,500
Diversion	2	$500 - $2,000
Booster Pump/ Pressure Reduction	5	$2.5 - $4
Recycled Water	7	$30 - $100
Non-Structural		
Water transfers	8	n/a
Wheeling	2	n/a
Banking	3	n/a
Modify Contracts/Place of Use	6	n/a
Federal Action and Collaboration	5	n/a

Key:
CVP = Central Valley Project
n/a = not assessed

Table 4-4. Structural and Non-Structural Mitigation Action by Agency

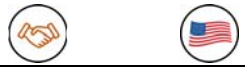
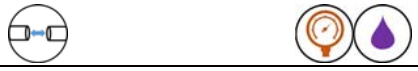
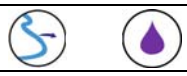
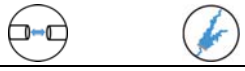
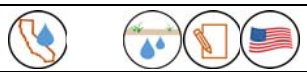
Agency	Structural Mitigation Actions	Non-Structural Mitigation Actions
Regional Drought Contingency Plan Partners		
Placer County Water Agency		
City of Folsom		
City of Roseville		
City of Sacramento		
San Juan Water District (Wholesale)		
San Juan Water District (Retail)		
Other Participating Regional Drought Contingency Plan Agencies in North American Basin		
California American Water – Western Placer		
Carmichael Water District		
Citrus Heights Water District		
City of Lincoln		
Del Paso Manor Water District*		
Fair Oaks Water District		
Golden State Water Company – Arden*		
Orange Vale Water Company		
Rio Linda/Elverta Community Water District*		
Sacramento County Water Agency*		
Sacramento Suburban Water District		
Other Agencies with Mitigation Actions that Could Benefit the North American Basin Regional Drought Contingency Plan Area		
California American Water – Other		
El Dorado County Water Agency		
El Dorado Irrigation District		
Golden State Water Company – Cordova		
Sacramento County Regional Sanitation District		

Table 4-5. Retained Structural Mitigation Actions Evaluation Details

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Project Cost - Capital ($M)	Project Yield	Project Status	Implementation Timeframe (years)	Implementation Complexity
S-01	Construct a 30 cubic feet per second pipe from Folsom South Canal to Folsom WTP to provide emergency backup when water cannot be drawn from Folsom Lake. The pipeline could also provide non-potable irrigation to south Folsom Plan area.	Intertie	Folsom	High	$30	15,000 AF (19 MGD)	Planning	>10	Moderate
S-02	Construct Folsom-EID intertie south of Highway 50 for drought and emergency use.	Intertie	Folsom, EID	High	$2	2.0 MGD	Planning	5 - 10	Low
S-03	Construct Folsom-FOWD intertie for drought and emergency use to Zone 1 (historic district area of Folsom).	Intertie	Folsom, FOWD	High	$4	5 MGD	Conceptual	>10	Low
S-04	Construct Folsom-GSWC (Cordova)-SCWA intertie to facilitate conjunctive use and, for drought and emergency use.	Intertie	Folsom, SCWA, GSWC	High	$0.75 - $1.5	4,000 AFY (2,500 GPM or 3 MGD)	Planning	<5	Low
S-05	Construct an additional SJWD-PCWA intertie (to connect to planned pipeline from Ophir WTP) for drought and emergency use.	Intertie	PCWA, SJWD	High	$2	2 MGD, emergency	Conceptual	5 - 10	Low
S-06	Construct City of West Sacramento-City of Sacramento intertie to receive treated water for drought and emergency use.	Intertie	West Sac, Sac City	High	*$1 - $10*	*2-10 MGD*	Conceptual	>10	Moderate
S-07	Use/expand SSWD-CWD intertie on Manzanita Avenue (at Cypress Avenue) and address operational pressure differences for in-lieu opportunities and improving CWD's drought reliability.	Intertie	CWD, SSWD, Sac City	High	*$0.5 -$2*	*1-5 MGD*	Planning	<5	Low
S-08	Construct Foothill WTP raw water pipeline between PCWA and NID for drought and emergency use.	Intertie	PCWA, NID, wholesale partners	High	$11.4	38 MGD	Pre-Design/ Design	5 - 10	Moderate

Table 4-5. Retained Structural Mitigation Actions Evaluation Details (contd.)

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Project Cost - Capital ($M)	Project Yield	Project Status	Implementation Timeframe (years)	Implementation Complexity
S-09	PCWA and NID explore oversizing facilities to increase redundancy and reliability of Bear River supplies.	Intertie	PCWA, NID, wholesale partners	High	$10	25,000 AFY	Conceptual	5 - 10	Moderate
S-10	Replace uncontrolled valve at Franklin Road intertie to improve delivery of water into City of Sacramento from SCWA for emergency use.	Intertie	SCWA, Sac City	Moderate	*$0.1-1*	*? MGD*	Conceptual	<5	Low
S-11	CalAm to construct new intertie with SCWA via Mather Air Force Base in coordination with Aerojet, for emergency use.	Intertie	CalAm, SCWA, Aerojet	High	*$0.2-2*	0.5 -1 MGD	Conceptual	5 - 10	Moderate
S-12	Construct 12-inch or 18-inch intertie between DPMWD and CWD, to provide DPMWD with surface water supplies to increase in-lieu recharge and provide redundancy in case of groundwater contamination.	Intertie	DPMWD, CWD	Moderate	*(available mid-June)*	4 - 6 MGD	Planning	<5	Low
S-13	RLECWD to modify current intertie with SSWD to include control valve & telemetry/SCADA equipment for better control of flow during conjunctive, drought and emergency use.	Intertie	EDCWA, SSWD, SJWD, Folsom, RLECWD	Moderate	$0.26	2.2-2.9 MGD	Planning	<5	Low
S-14	City of Lincoln to participate in construction of NID WTP (share of 2-5 MGD) to reduce reliance on /provide redundancy for PCWA supplies.	SW Treatment	Lincoln, NID	High	*$10 -$50*	*2-5 MGD*	Conceptual	5 - 10	High
S-15	Construct Ophir WTP to provide access to Middle Fork Project supplies upstream of Folsom Lake, to enhance conjunctive use and increase resiliency for droughts and emergencies.	SW Treatment	Lincoln, PCWA, Roseville, NID, CalAm, SJWD, Potentially Others (e.g., SSWD)	High	$301.4	30 MGD	Pre-Design/ Design	5 - 10	High

Table 4-5. Retained Structural Mitigation Actions Evaluation Details (contd.)

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Project Cost - Capital ($M)	Project Yield	Project Status	Implementation Timeframe (years)	Implementation Complexity
S-16	Construct Alder Creek Reservoir (175 TAF) and add diversion points for Grizzly Flat Community Service District (e.g. White Rock). The reservoir would serve agricultural demands in the EDCWA, and potentially enhance water supply and flood protection functions of Folsom Reservoir.	SW Storage	EDCWA, Folsom, TBD	Moderate	*$500 - $2,000*	25 - 185 TAF	Planning	>10	High
S-17	CalAm to upgrade Mather Tank to connect to Rockingham well in coordination with Aerojet, for emergency use.	SW Storage	CalAm, Aerojet	High	$12 - $15	*1-3 MGD*	Conceptual	5 - 10	Low
S-18	Design and construct emergency water intake capability (two 36-inch pipes) at Folsom Dam and Reservoir to convey CVP M&I supply in the event of major unforeseen outages or if the existing Folsom M&I intake becomes inoperable because of extreme reductions in reservoir storage levels.	Diversion	Folsom, SJWD, Roseville, Reclamation	High	$0.75 - $1.5		Conceptual	<5	Moderate
S-19	Complete River Arc to provide ability to divert American River supplies of the Sacramento River, to enhance conjunctive use and increase resiliency for droughts and emergencies.	Diversion	PCWA, Roseville, GSWC, RLECWD, Sac City, SCWA, CalAm, SSWD	High	*$500 - $2,000*	*20-80 TAF*	Planning	>10	High
S-20	Rehabilitate City of Sacramento's existing groundwater wells and replace as water quality and aging infrastructure requires to maintain extraction capability for conjunctive use and emergencies.	GW Well Rehabilitation	Sac City	High	*$0.5-$2 per well*	*1-3 MGD each*	Planning	<5	Low

Table 4-5. Retained Structural Mitigation Actions Evaluation Details (contd.)

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Project Cost - Capital ($M)	Project Yield	Project Status	Implementation Timeframe (years)	Implementation Complexity
S-21	Construct additional groundwater wells to replace aging City of Sacramento's wells, and to increase extraction capability for conjunctive use and emergencies.	GW Well New Installation	Sac City	High	*$2 - $4 per well*	*1-3 MGD each*	Planning	5 - 10	Moderate
S-22	Retrofit 4 of Lincoln's existing wells for injection to expand conjunctive use opportunities.	GW Well Injection	Lincoln	Moderate	*$0.5-$2 per well*	*1-3 MGD each*	Planning	<5	Moderate
S-23	Lincoln to capture stormwater by storing for later use (e.g., flooding dormant crops) to offset some agriculture demands.	GW Well Injection	multiple agencies, Lincoln	Moderate	*??*	*??*	Conceptual	>10	Moderate
S-24	Expand Roseville's aquifer storage and recovery (ASR) program, including installing 10 wells, building 2.1 mile-long conveyance to Cooperative Transmission Pipeline and improving public acceptance of groundwater in the City.	GW Well Injection	Lincoln, PCWA, Roseville, others	Moderate	$3M per well, $8-10M for pipeline	2.2 MGD each	Planning	5 - 10	Moderate
S-25	Employ ASR in the SJWD's wholesale service area (by retrofitting existing wells in CHWD, FOWD, OVWC) to enhance conjunctive use and dry-year protection.	GW Well Injection	SJWD, CHWD, FOWD, OVWC, Folsom	Moderate	$0.5-$2 per well	*1-3 MGD each*	Planning	5 - 10	High
S-26	Employ ASR in SSWD's service area (by retrofitting existing wells) to enhance conjunctive use and dry-year protection.	GW Well Injection	SSWD	Moderate	$0.5-$2 per well	1-3 MGD each	Planning	5 - 10	High
S-27	CHWD and/or SSWD to partner with SMUD for energy generation through pressure reduction project that help increase ability to share supplies.	Booster pump/ Pressure Reduction	CHWD, SSWD	Moderate	*??*	*??*	Planning	5 - 10	Moderate

Table 4-5. Retained Structural Mitigation Actions Evaluation Details (contd.)

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Project Cost - Capital ($M)	Project Yield	Project Status	Implementation Timeframe (years)	Implementation Complexity
S-28	Address City of Sacramento's distribution system pressure (install booster pumps and flow control structure) to increase ability to share supplies with neighboring agencies to improve conjunctive use.	Booster pump/ Pressure Reduction	Sac City	Moderate	??	??	Conceptual	<5	Low
S-29	Construct booster pump between DPMWD and CWD, to provide CWD with groundwater during droughts and emergencies. To be installed at proposed intertie (see S-12).	Booster pump/ Pressure Reduction	DPMWD, CWD	Moderate	$0.5M	??	Conceptual	<5	Low
S-30	Build a pump station to deliver Middle Fork Project water supplies to Georgetown Divide Public Utility District to provide another source of water to meet build-out demands.	Booster pump/ Pressure Reduction	EDCWA, PCWA	Moderate	??	up to 7,500 AFY	Planning	5 - 10	Moderate
S-31	Install booster pump to enable City of Sacramento to wholesale water to SCWA's Northgate 880 service area, and to flow water from Northgate 880 service area to the City of Sacramento or wheeling to other systems.	Booster pump/ Pressure Reduction	SCWA, Sac City	Moderate	$0.55	2.9 MGD (max)	Planning	<5	Low
S-32	Construct a scalping plant in Folsom with 1000-1400 AF capacity to provide an additional source of non-potable water.	Recycled Water	Folsom	High	$40	2.6 MGD	Planning	>10	High
S-33	Increase Lincoln's capacity to provide recycled water via expansion of wastewater treatment plant and recycled water distribution system to provide an additional source of non-potable water.	Recycled Water	Lincoln, PCWA, Placer County	High	??	??	Planning	5 - 10	Moderate
S-34	Expand Roseville's recycled water system to provide an additional source of non-potable water.	Recycled Water	Roseville, PCWA	High	$11	850 AFY	Planning	>10	Moderate

Table 4-5. Retained Structural Mitigation Actions Evaluation Details (contd.)

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Project Cost - Capital ($M)	Project Yield	Project Status	Implementation Timeframe (years)	Implementation Complexity
S-35	Regional San to continue to expand recycled water opportunities with SCWA and City of Sacramento through the CoGen project and expansion of conveyance. The non-potable water supply would increase conjunctive use.	Recycled Water	Regional San, SCWA, Sac City	High	*??*	*??*	Pre-Design/ Design	5 - 10	Moderate
S-36	Explore recycled water opportunities in partnership with Regional San by GSWC, OVWC, and CWD for conjunctive use.	Recycled Water	Regional San, GSWC, OVWC, CWD	Moderate	*??*	*??*	Conceptual	>10	High
S-37	Work in partnership with Reclamation to update and improve the reliability of Reclamation's 2016 Emergency Action Plan for temporary conveyance capability at Folsom Dam. Evaluate the benefits of potential options for design and construction of a permanent emergency M&I intake capability.	Recycled Water	PCWA, Roseville, Lincoln, Cal Am	Moderate	$0.50	2,000 AFY	Planning	5 - 10	Moderate
S-38	Use Regional San's recycled water to offset groundwater pumping for South County Ag lands.	Recycled Water	Regional San, South County Ag	Low	*??*	*??*	Pre-Design/ Design	5 - 10	Moderate

Key:
AF = acre-feet
AFY = acre-feet/year
ARD = American River Diversion
ASR = aquifer storage and recovery
CalAm = California American Water
CHWD = Citrus Heights Water District
CVP = Central Valley Project
CWD = Carmichael Water District
DPMWD = Del Paso Manor Water District
EDCWA = El Dorado County Water Agency
EID = El Dorado Irrigation District
Folsom = City of Folsom
FOWD = Fair Oaks Water District
gpm = gallons per minute
GSWC = Golden State Water Company
GW = groundwater
ID = identification
Lincoln = City of Lincoln
LTWSC = long-term water supply contract
M = million
mgd = million gallons per day
M&I = municipal and industrial
NID = Nevada Irrigation District
NS = non-structural
NSA = north service area
PCWA = Placer County Water Agency
POU = place of use
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
RLECWD = Rio Linda/Elverta Community Water District
Roseville = City of Roseville
S = Structural
Sac City = City of Sacramento
SCADA = Supervisory control and data acquisition
SCWA = Sacramento County Water Agency
SJWD = San Juan Water District
SMUD = Sacramento Municipal Utility District
SSWD = Sacramento Suburban Water District
TAF = thousand acre-feet
WTP = water treatment plant

Table 4-6. Retained Non-Structural Mitigation Actions Evaluation Details

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Implementation Complexity
NS-01	CWD to partner with SSWD, GSWC, DPMWD, and/or FOWD to reduce in-district groundwater extraction and improve conjunctive use.	Water Transfers	CWD, SSWD, GSWC, DPMWD, FOWD	Moderate	Moderate
NS-02	RLECWD to form agreements with EDCWA, SSWD, City of Folsom and/or others to receive surface water via the Cooperative Transmission Pipeline extension to address groundwater contamination challenges and expand conjunctive use.	Water Transfers	SJWD, SSWD, Folsom, RLECWD, DPMWD, EDCWA, Sac City	Moderate	Moderate
NS-03	SSWD to evaluate long-term partnership agreement options to improve water supply reliability and operational flexibility with SCWA, City of Sacramento, and/or others.	Water Transfers	SSWD, SCWA, Sac City	Moderate	Moderate
NS-04	Develop agreement with GSWC (Cordova) to provide City of Folsom's south of Hwy 50 development with groundwater during drought or emergency conditions.	Water Transfers	GSWC, Folsom	High	Low
NS-05	Develop agreement with FOWD to provide City of Folsom's south of Hwy 50 development with groundwater during drought or emergency conditions.	Water Transfers	FOWD, Folsom	High	Low
NS-06	Expand agreement with SCWA to provide GSWC with surface water to improve conjunctive use and improve drought resiliency.	Water Transfers	GSWC, SCWA	High	Low
NS-07	Develop agreement with SSWD to supply SJWD with groundwater for droughts and emergencies.	Water Transfers	SJWD, SSWD	High	Low
NS-08	SJWD to improve conjunctive use by pursuing institutional arrangements via (1) short- and long-term transfers with agencies outside SJWD's existing service area (e.g., Folsom, EDCWA), and/or (2) new wholesale agreements.	Water Transfers	SJWD, Folsom, EDCWA	Moderate	Moderate
NS-09	Develop agreement with City of Sacramento to allow SCWA to wheel water to its Southwest Track during droughts and emergencies.	Wheeling	SCWA, Sac City	High	Low

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Implementation Complexity
NS-10	Roseville, SJWD, and Folsom to develop agreement with PCWA to receive supplies through Ophir WTP/PCWA system at times when diversion capacity through Folsom Dam limits realization of full conjunctive use potential.	Wheeling	Lincoln, PCWA, Roseville, Folsom, Potentially Others (e.g., SSWD)	Moderate	Moderate
NS-11	Participate in regional groundwater bank.	Banking	GSWC, DPMWD, SSWD, SJWD, SCWA, Sac City, FOWD, CHWD, Folsom, EDCWA	Moderate	High
NS-12	SJWD to enter into a banking agreement with one or more agencies in the Sacramento Groundwater Authority area (e.g., SSWD (NSA), CalAm, RLECWD, CWD, GSWC, SCWA (Arden), DPMWD) to maximize full use of supplies.	Banking	SJWD, CHWD, FOWD, SSWD (NSA), CalAm, RLECWD, CWD, GSWC, SCWA (Arden), DPMWD, Folsom	Moderate	Moderate
NS-13	CalAm to develop process to improve Public Utilities Commission approvals of groundwater sales to improve conjunctive use and banking potential.	Banking	CalAm	Low	High
NS-14	Update City of Sacramento's Sacramento River/American River water rights contract to expand POU beyond city's boundary to improve conjunctive use.	Modify Contracts/POU	Sac City	Moderate	High
NS-15	Expand City of Sacramento's POU to increase flexibility of transfers through the Freeport Regional Water Authority or future River Arc during droughts and emergencies.	Modify Contracts/POU	Sac City	High	High
NS-16	Establish an agreement between City of Sacramento and SCWA to wheel surface water to SCWA's Arden system and Northgate 880 service area to improve conjunctive use.	Modify Contracts/POU	SCWA, Sac City	Low	Low
NS-17	Expand PCWA's CVP service area to improve conjunctive use opportunities with NID and wholesale agencies.	Modify Contracts/POU	PCWA, NID, wholesale partners	Moderate	High

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Implementation Complexity
NS-18	Modify EDCWA's SMUD Agreement Water (30 TAF/year) without affecting SMUD's ability to generate hydropower to improve conjunctive use with a partnering agency (TBD).	Modify Contracts/POU	EDCWA, SMUD, Folsom, TBD	Moderate	High
NS-19	City of Sacramento to explore options to encourage wholesale deliveries during Hodge Flow periods.	Modify Contracts/POU	Sac City	High	High
NS-20	EDCWA to get commitment by Reclamation leadership to collaborate with EDCWA on a priority basis to complete all remaining actions and expedite award of the Fazio contract by a certain date.	Federal Action & Collaboration	EDCWA, Reclamation	Moderate	High
NS-21	Commitment by Reclamation leadership to collaborate with Roseville, PCWA, SCWA and SMUD on a priority basis to promote a continuing partnership among the parties and develop a structured process and firm schedule for renewing LTWSCs by a certain date.	Federal Action & Collaboration	Roseville, PCWA, SCWA, SMUD, Reclamation	Moderate	High
NS-22	Work with Reclamation to establish a sustainable minimum instream flow and minimum storage for Lower American River and Folsom Reservoir to ensure availability of local supplies.	Federal Action & Collaboration	Reclamation, PCWA, Roseville, SJWD, Sac City, SCWA, CWD, Folsom, Water Forum, all CVP users	High	High
NS-23	Attain temporary or permanent storage rights in Folsom Reservoir or further upstream in cooperation with Reclamation.	Federal Action & Collaboration	CWD, EID, EDCWA, or other local agencies for GW Storage	High	High
NS-24	Collaborate with Reclamation to implement an accelerated water transfer program within the CVP ARD to improve opportunities among CVP ARD contractors to optimize available supplies particularly during shortage conditions.	Federal Action & Collaboration	Reclamation, PCWA, Roseville, SJWD, Sac City, SCWA, CWD, Folsom, all CVP users	High	High

Key:
ARD = American River Diversion
CalAm = California American Water
CHWD = Citrus Heights Water District
NID = Nevada Irrigation District
NS = non-structural
NSA = north service area
PCWA = Placer County Water Agency

ID	Mitigation Action	Category	Partners	Benefit to Drought Resiliency	Implementation Complexity

CVP = Central Valley Project
CWD = Carmichael Water District
DPMWD = Del Paso Manor Water District
EDCWA = El Dorado County Water Agency
EID = El Dorado Irrigation District
Folsom = City of Folsom
FOWD = Fair Oaks Water District
GSWC = Golden State Water Company
GW = groundwater
ID = identification
Lincoln = City of Lincoln
LTWSC = long-term water supply contract
POU = place of use
Reclamation = U.S. Department of the Interior Bureau of Reclamation
RLECWD = Rio Linda/Elverta Community Water District
Roseville = City of Roseville
S = Structural
Sac City = City of Sacramento
SCWA = Sacramento County Water Agency
SJWD = San Juan Water District
SMUD = Sacramento Municipal Utility District
SSWD = Sacramento Suburban Water District
TAF = thousand acre-feet
TBD = to be determined
WTP = water treatment plant

4.2.2 Environmental Sector Mitigation Actions

To address the identified drought vulnerabilities of the environmental sector on the Lower American River, two specific actions are proposed. One is the Lower American River modified flow standard, which helps establish a sustainable in-stream flow. The other action is the Folsom Dam Temperature Control Device (TCD), which would enhances access to the cold water within the reservoir. Cold water releases are essential for the survival of endangered salmonid species during certain times of the year. These mitigation actions would improve the efficiency and effectiveness of meeting environmental requirements, thus leaving more water available to meet M&I demands.

Lower American River Modified Flow Management Standard

The 2000 Water Forum, which includes the LAR Flow Management Standard (FMS), is a comprehensive package of linked actions to achieve the following two co-equal objectives:

- Provide a reliable and safe water supply for the region's economic health and planned development to the year 2030; and

- Preserve the fishery, wildlife, recreational, and aesthetic values of the lower American River.

Reclamation implemented standards consistent with the completed LAR FMS. The completed LAR FMS and was incorporated in the National Marine Fisheries Service (NMFS) 2009 Biological Opinion (BiOp) as a Reasonable and Prudent Alternative (RPA) for long-term operation of the CVP in coordination with the State Water Project. The Water Forum subsequently developed an updated Modified LAR FMS to include, among other improvements, a carryover storage target at Folsom Dam and Reservoir. The Water Forum and Reclamation are currently collaborating to refine and implement the Modified LAR FMS.

Folsom Dam Temperature Management Improvements

Temperature is an important environmental factor affecting the survival of American River salmonids protected under Federal and State Endangered Species Acts. Reclamation is currently collaborating with the U.S. Army Corps of Engineers (USACE) and local water agencies to plan, design and implement structural improvements for temperature management at Folsom. Such improvements include reconfiguration of interconnecting gate panels on the existing TCD, located on the upstream face of Folsom Dam at the M&I intake. It also includes improvements to the existing Selective Withdrawal System (SWS) on the upstream face of the three existing penstock intakes which currently has limited capability to be adjusted efficiently and effectively to make releases. In conjunction with the reconfigurations, Reclamation and participating partners would simultaneously address cold water leakage to the existing gates. Other potential cold water improvements may include an "elephant trunk"-type structure below the SWS to access cold water pool resources deeper in the Reservoir, and a TCD on EID raw water intake located at the confluence of Folsom Reservoir and the South Fork American River. Selective release of water with different temperature provide great flexibility in managing the survival of endangered fishery specifies.

4.3 Addressing Future Threats

The mitigation actions developed for this RDCP are focused on addressing the identified drought-specific vulnerabilities for the water supply sector (low reservoir storage, low flows in rivers, CVP allocation shortages, and water right curtailments), and those for the environmental sector (increasing river temperatures). Future climate change and population growth are among the factors that are likely to exacerbate these vulnerabilities. Moreover, ongoing State-led initiatives are likely to substantially alter state-wide water system operations, including those affecting Folsom Reservoir and the RDCP agencies. These initiatives include the Delta Water Quality Control Plan and California WaterFix. These potential future threats and vulnerabilities would require further assessment, and potentially a broader set of mitigation actions.

Reclamation's American River Basin Study (ARBS) is examining strategies to integrate or better coordinate local and Federal water management practices, incorporate new scientific information on climate change that are specific for the American River Basin, and address significant recent changes in conditions and regulatory requirements related to the CVP and regional water management including but not limited by Biological Opinions for endangered fishery species protection and protection of the Sacramento-San Joaquin Delta, and the State of California's Sustainable Groundwater Management Act and water rights administration in drought conditions. Specifically, the ARBS will provide basin-specific, integrated water management strategies to improve regional water supply reliability within the American River Basin, while improving Reclamation's flexibility in operating Folsom Reservoir to meet flow and water quality standards and protect endangered fishery species in the lower American River. In addition, as part of this study, non-Federal Partners are performing cost-share efforts that explore other opportunities to improve water supply reliability in the region (e.g., Alder Reservoir, RiverArc).

Regional groundwater banking is identified as an important strategy to address long-term regional reliability. Under Reclamation's WaterSMART grant, El Dorado County Water Agency (EDCWA) proposed to develop the American River Basin Water Marketing Strategy Project to leverage the great potential for regional conjunctive use and banking to further enhance existing regional market transfers through surface water reoperation and individual groundwater substitution practices. The proposed project will evaluate the potential for water market asset development; determine the infrastructure investments needed to realize that market; and formulate an implementation plan that includes recommendations on governance, reporting and monitoring procedures.

5.0 Response Actions

5.1 Introduction

California has experienced many significant droughts in its history. As a result, the State of California (State) (through DWR) requires all urban water suppliers providing over 3,000 acre-feet of potable water annually or serving more than 3,000 end users, to prepare and submit an UWMP to support "long-term resource planning, and ensure adequate water supplies are available to meet existing and future water demands." One component of an UWMP is the Water Shortage Contingency Plan (WSCP), the product of a "strategic planning process to prepare for and respond to water shortages." Shortages can result from a variety of events such as drought, fire, water quality contamination and system infrastructure failure. The purpose of a WSCP is to "maintain reliable supplies and reduce the impacts of supply interruptions." [20] As drought has been the most common of these shortage concerns, WSCP's serve as an effective framework for response actions. The remaining sections below describe: 1) the State-required WSCP components; 2) existing RDCP partner agencies' WSCPs; and 3) a framework for regional response actions during drought.

5.2 Water Agency Response Actions

5.2.1 State Requirements for Water Shortage Contingency Plans

While UWMPs as a whole are required to be updated every 5 years (last cycle was in 2015), WSCPs are a "living" document meaning they can be updated at any time to respond to current conditions and refined over time to accurately reflect a water supplier's supply diversity and availability, local preferences for reducing use and compliance with state and local laws such as water waste prohibitions. However the most current version of the WSCP must be included in the each cyclical UWMP submission.

There are nine required components of a WSCP, with four of these components being most relevant to response actions of the RDCP. The four components include the following:

1. Stages of Action
2. Prohibitions on End Uses
3. Penalties, Charges, Other Enforcement of Prohibitions
4. Consumption Reduction Methods

Components 1 through 4 focus on the development of the end product, the WSCP itself. The WSCP includes information that gets communicated to customers and includes actions to achieve savings to match a shortage, as necessary. Component 1: Stages of Action acts as the

[20] California Department of Water Resources, 2015 Urban Water Management Plans website, assessed January 30, 2017. www.water.ca.gov/urbanwatermanagement/

framework from which all the other components are organized around. Urban water suppliers are required to design a WSCP to account for up to a 50 percent reduction in supply, however, shortages occur on a spectrum and therefore need a variety of stages to match the spectrum of potential shortages. Typically urban water suppliers create WSCPs with 3 to 5 stages, each with an increasing level of shortage with the last stage representing a 50 percent shortage.

Once an urban water supplier develops a stage framework (Component 1), demand reducing actions must be matched to "meet" the anticipated shortage defined by the stage percentages, thus maintaining a balance of supply and demand. These actions are defined by Component 2: Prohibitions of End Uses as "mandatory prohibitions against specific water use practices during water shortages, including, but not limited to, prohibiting the use of potable water for street cleaning."[21] Water suppliers are tasked with the responsibility of deciding which prohibitions are appropriate for which stage for their service area. For most urban water suppliers, some level of prohibitions are always in place regardless if there is a shortage or not like no excessive runoff from irrigation, required recycling systems for fountains, required hose nozzles for washing cars at home, etc. However, when shortages occur, increasing water restrictive prohibitions are designated for each additional stage.

The WSCP is then "matched" with a system of penalties, charges and other enforcement measures (Component 3) to ensure the prohibitions are being followed by all water customers with the ultimate goal of achieving the expected water savings to mitigate the shortage. Enforcement can range from a customer warning with a focus on education to monetary fines to water service shut off. Typically water agencies issue a no fee warning to customers on their first violation of a prohibition and increase the enforcement measures (fine or shut off) with each subsequent violation or repeat offense. Enforcement can also be handled through a water agency's rate structure by implementing a drought/conservation rate or surcharge on bills during shortage periods. Enforcement structures vary greatly between water agencies in the Sacramento region and throughout the State.

The WSCP serves as the anchor for a water supplier to enhance water savings beyond prohibition with additional categories of consumption reduction methods (Component 4). These categories can include expanded public information campaigns, improved customer billing, increased frequency of meter reading, customer water surveys, rebates, reduction in system water loss, increased water waste patrols, and decreased line flushing among others. The selection and extent of implementation of these additional methods vary greatly between water agencies in the Sacramento region and throughout the State.

Together, the WSCP (Components 1 and 2), enforcement (Component 3) and additional categories of consumption reduction methods (Component 4) all contribute to achieving the desired reduction target selected in the WSCP to mitigate the shortage.

In response to California's most recent drought (2013 to 2016) and as directed in Executive Order B-37-16, the State Water Resources Control Board was tasked with developing recommendations regarding a number of water resource management related issues including

[21] DWR 2015 UWMP Guidebook, page 8-5.
http://www.water.ca.gov/urbanwatermanagement/docs/2015/UWMP_Guidebook_Mar_2016_FINAL.pdf

water waste prohibitions and WSCPs. It is expected that recommendations will result in additional response actions in WSCPs going forward to be further prepared for future droughts.

5.2.2 Existing RDCP Partner Agencies' Water Shortage Contingency Plans

As part of the RDCP development, existing WSCPs were collected and reviewed for each of the RDCP partner agencies. This section outlines each water supplier's WSCP stage definitions and the penalties, charges and other enforcement measures associated with each plan.[22] For each RDCP partner agency, excerpted tables from their respective WSCPs of Component 1 (Stages of Action) and Component 3 (Penalties, Charges and Other Enforcement) are included below. Following those excerpts is a summary table of additional consumption reduction methods taken by the agencies during the recent drought.

Placer County Water Agency

The Placer County Water Agency designates 5 stages in their WSCP and specifies stage names and brief descriptions of water supply conditions by stage. These stages are matched with a penalty structure in the table below with consistent monetary fines, but increasing additional enforcement actions such service disconnection for the fourth violation.

Table 5-1. Treated Water Shortage Contingency Plan Stages

Stage	Water Supply Conditions	Target	Response Actions
Normal	Normal supply	None	Water use efficiency
1 – Water Alert	Slightly restricted water supplies	Up to 20%	Mandatory actions as provided
2 – Water Warning	Moderately restricted water supplies	Up to 30%	Mandatory actions as provided
3 – Water Crisis	Severely restricted water supplies	Up to 40%	Mandatory actions as provided
4 – Water Emergency	Extremely restricted water supplies	Up to 50% and greater	Mandatory actions as provided

Table 5-2. Penalties for Violations of Contingency Plan

Occurrence	Penalty
First	Personal/written notification
Second	Writing warning and notice of correction
Third	$75 fine
Fourth	$75 fine and service disconnection

[22] California Department of Water Resources. 2015 Urban Water Management Plans. https://wuedata.water.ca.gov/

City of Folsom

The City of Folsom designates 5 stages in their WSCP and specifies stage names and variable percentage reduction based on their local supply needs. These stages are matched with a penalty structure in the table below to help enforce the necessary reductions. The penalties vary from written notice to discontinuation of water service.

Table 5-3. Drought Stages Contingency Plan

Stage	Water Supply Conditions	Response Actions
1 – Voluntary	Normal supply	Voluntary Conservation
2 – Water Alert	Slightly restricted water supplies	Voluntary Conservation and up to a 12% water use reduction
3 – Water Warning	Moderately restricted water supplies	Moderate conservation with some mandatory conservation for up to 20% water use reduction
4 – Water Crisis	Severely restricted water supplies	Mandatory water conservation and some use prohibition with up to 35% water use reduction
5 – Water Emergency	Extremely restricted water supplies	Mandatory prohibition and conservation for up to 50% water use reduction

Table 5-4. Stages of Penalties

Violation	Penalty
First	Personal or written notification of the violation
Second (within three months of the first violation)	Written notification and issuance of a notice to correct
Third (within six months of the first violation)	Issuance of an administrative penalty, mandatory installation of a water meter, discontinued water service and/or other penalties as provided in the notice of violation and as determined by the utilities director.

City of Roseville

The City of Roseville designates five stages in their WSCP and specifies water availability levels that will "trigger" each corresponding stage into action. These stages are matched with water shortage rate charges in the table below to help enforce the necessary reductions and also mitigate revenue losses the city may experience from decreased water sales.

Table 5-5. Retail: Stages of Water Shortage Contingency Plan

Stage	Complete Both	
	Percent Supply Reduction[1] ***Numerical value as a percent***	**Water Supply Condition** ***(Narrative description)***
I	Up to 10%	Surface water supply availability of 53, 010 AF[2]
II	Up to 20%	Surface water supply availability of 47,120 AF
III	Up to 30%	Surface water supply availability of 41,230 AF
IV	Up to 40%	Surface water supply availability of 35,340 AF[3]
V	Up to 50%	Surface water supply availability of 29,450 AF[3]

Notes:
[1] One stage in the Water Shortage Contingency Plan must address a water shortage of 50%
[2] Surface water availability consistent with Water Forum Agreement for water taken from the American River system.
[3] Bases on water supply portfolio available it is not projected or anticipated that shortages would ever get to levels of 40-50% shortage. Measures are planned, however, to meet regulatory requirements or UWMP.
Key:
AF = acre-feet
DWR = California Department of Water Resources
UWMP = Urban Water Management Plan

Table 5-6. Summary of Water Shortage Rate Charges

Stage	Water Use Restriction	Water Shortage Surcharge (*1)	Excess Water Use Charge (*2)
First Year of a Water Shortage			
Stage 1	10%	None	None
Stage 2	20%	15%	None
Stage 2	30%	33%	25%
Stage 4	40%	45%	50%
Stage 5	50%	60%	100%
Subsequent Year(s) of a Water Shortage			
Stage 1	10%	15%	None
Stage 2	20%	20%	25%
Stage 2	30%	40%	50%
Stage 4	40%	50%	100%
Stage 5	50%	75%	200%

City of Sacramento

The City of Sacramento designates 4 stages in their WSCP and specifies stage names to describe the water supply conditions. These stages are matched with a penalty structure in the table below to help enforce the necessary reductions. The penalties increase with the number of violations up to $500.

Table 5-7. Retail: Stages of Water Shortage Contingency Plan

Stage	Complete Both	
	Percent Supply Reduction[1]	Water Supply Condition
1	Up to 20%	Water Alert
2	Up to 30%	Water Warning
3	Up to 40%	Water Crisis
4	Up to 50%	Water Emergency

Notes:
[1] One stage in the Water Shortage Contingency Plan must address a water shortage of 50%.
Key:
DWR = California Department of Water Resources

- For the first violation, regardless of water conservation stage, the owner and the occupant (if different than the owner) of the premises where the violation occurred shall be issued a written notice describing the violation and the penalties imposed for subsequent violations.

- For the second violation in a normal water supply year, the owner and the occupant (if different than the owner) of the premises shall be issued another written notice describing the violation and a penalty charge of $25. This penalty can be removed from the water service bill for the premises if the owner, or the occupant (if different than the owner, and the occupant committed the violation), attends a water conservation seminar offered by the department within sixty (60) days after the date of the penalty notice; provided that only one removal of this penalty shall be allowed for the premises within any twenty-four (24) month period.

- For the third violation in a normal water supply year, the owner and the occupant (if different than the owner) of the premises where the violation occurred shall be issued another written notice describing the violation and a penalty charge of $100.

- For the third violation in a normal water supply year, the owner and the occupant (if different than the owner) of the premises where the violation occurred shall be issued another written notice describing the violation and a penalty charge of $500.

San Juan Water District

The San Juan Water District designates 5 stages in their WSCP and specifies supply conditions in terms of GPCD. These stages are matched with a penalty structure shown below with clarification of what stage specific penalties are implemented.

Table 5-8. Wholesale and Retail: Stages of Water Storage Contingency Plan

Stage	Percent Supply Reduction[1]	Water Supply Condition
1	0	Normal Water Conditions GPCD = 413
2	5-10	Minimal supply reduction, GPCD Range = 370-392
3	11-25	Supplies not able to meet demands, GPCD Range = 308-369
4	26-50	Supplies not able to meet demands, GPCD Range = 206-307
5	50 and greater	Major failure of a supply, storage, or distribution system, GPCD Range < 206

Notes:
Based on DWR Table 8-1 Wholesale: Stages of WSCP.
Stages and conditions as shows in this UWMP are draft.
[1] One stage in the Water Shortage Contingency Plan must address a water shortage magnitude of 50%.
Key:
GPCD = gallons per capita per day
UWMP = Urban Water Management Plan
WSCP = Water Shortage Contingency Plan

At the height of the most recent drought, the RDCP partners employed a host of additional consumption reductions methods (Component 4) to reduce customer demands. Based on a survey conducted by RWA in November 2015 of member agencies, the RDCP partners employed the additional reduction methods included in **Table 5-9**.

Table 5-9. 2015 Consumption Reduction Methods[1]

Water Supplier	Consumption Reduction Methods
Placer County Water Agency	Cash for Grass, Toilet Rebates, Clothes Washer Rebates, CII Landscape Water Budgets, Irrigation Efficiency Rebates, Indoor Fixtures Direct Installation, Residential surveys, CII surveys, Large Landscape Survey, Residential Retrofit Kits, Pre-rinse Spray Valves, Water Wise House Calls, Local School Education Program, Local Public Outreach Program (Mailers, Door tags, Online ads (weather.com, etc.), Social media ads (Facebook, etc.), Social media posts (Facebook, twitter), Billboards, Newspaper ads, Bill Inserts, Personal calls to select customer groups, Lawn Signs, Water supplier website, E-blasts and Utility Truck Magnets
City of Folsom	Cash for Grass Rebates, Toilet Rebates, Irrigation Efficiency Rebates, Local Public Outreach Program (Mailers, Door tags, Personalized conservation information reports (WaterSmart, Dropcountr), CII surveys, Large Landscape Survey, Water Wise House Calls and Water supplier website
City of Roseville	Cash for Grass Rebates, Toilet Rebates, Irrigation Efficiency Rebates, Commercial Water Budgets, Residential surveys, CII surveys, Large Landscape Survey, Residential Retrofit Kits, Pre-rinse Spray Valves, Water Wise House Calls, Local School Education Program and Local Public Outreach Program (Mailers, Door tags, Online ads (weather.com, etc.), Social media posts (Facebook, twitter), Billboards, Street Signs, Bill Inserts, Personal calls to select customer groups, Personalized conservation information reports (WaterSmart, Dropcountr), Water supplier website and E-blasts
City of Sacramento	Cash for Grass Rebates, Toilet Rebates, Clothes Washer Rebates, Rain barrel Rebates, Irrigation Efficiency Rebates, Indoor Fixtures Direct Installation, Residential surveys, CII surveys, Large Landscape Survey, Residential Retrofit Kits, Pre-rinse Spray Valves, Water Wise House Calls and Local Public Outreach Program (Mailers, Door tags, Social media ads (Facebook, etc.), Social media posts (Facebook, twitter), Billboards, Personalized conservation information reports (WaterSmart, Dropcountr), Water supplier website and E-blasts
San Juan Water District	Toilet Rebates, Clothes Washer Rebates, Irrigation Efficiency Rebates, Residential surveys, CII surveys, Large Landscape Survey, Residential Retrofit Kits, Local School Education Program and Local Public Outreach Program (Door tags. Social media posts (Facebook, twitter), Personalized conservation information reports (WaterSmart, Dropcountr), Water supplier website and E-blasts

Note:
[1] Regional Water Authority, 2015 Drought Conservation Summary Survey, sent November 15, 2015.

5.2.3 Effectiveness of RDCP Partner Agencies' Water Shortage Contingency Plans

The main goal of a WSCP is to achieve the appropriate level of savings (reduction in water demand) to mitigate the current water shortage taking into account local factors. All five of RDCP partner agencies' WSCPs were implemented at various stages from 2014 to 2016 in response to a statewide drought emergency declared by Governor Brown. A series of Executive Orders to address California's drought called for both mandatory and voluntary savings during different periods of time.

Table 5-10 below summarizes conservation targets and conservation savings achieved between 2014 and 2016 (compared to a "pre-drought" 2013 baseline) using the WSCP (Component 1 and 2), enforcement (Component 3) and other consumption reduction methods (Component 4).

Overall, the RDCP partner agencies largely met their savings targets despite the high degree of variability of their respective WSCPs. This is important because it shows that there is no single approach to achieving results.

Table 5-10. RDCP Participants Target and Water Savings from 2014-2016

Year	Agency	Target Savings	Actual Savings
2014	Placer County Water Agency	20%	18%
	City of Folsom	20%	20%
	City of Roseville	20%	19%
	City of Sacramento	20%	19%
	San Juan Water District	25%	26%
2015	Placer County Water Agency	29%	27%
	City of Folsom	29%	26%
	City of Roseville	25%	33%
	City of Sacramento	25%	29%
	San Juan Water District	33%	34%
2016	Placer County Water Agency	20%	19%
	City of Folsom	10%	11%
	City of Roseville	10%	23%
	City of Sacramento	20%	26%
	San Juan Water District	10%	22%

Key:
RDCP = Regional Drought Contingency Plan

5.3 Regional Response Actions

The recent drought conditions were very valuable in terms of improving a regional response to drought. Despite the statewide declaration of drought, local conditions in many cases did not result in an actual supply deficit. It was very challenging for individual agencies to explain to customers why their degree of WSCP implementation might be different to that of their neighbors. It became imperative to develop consistent messaging and information to the region's customer base. As a result of the multi-year drought, a regional response framework emerged that will continue to be implemented under future drought conditions. The regional drought response actions focus on public outreach messaging organized into the following four areas:

1. Increased coordination between local water agencies.

2. Increased media buys to support the coordinated public outreach messages.

3. Designated regional media contact for drought-related water conservation inquires.

4. Increased data collection at the regional level to track water savings and weather data for inclusion in regular RWA issued press releases.

The first area is increased coordination between local water agencies. RWA held regular meetings in 2014 and 2015 for water agencies to share their local public outreach messages with other agencies to identify opportunities for coordination to create a stronger overall public presence. For example, RWA created an editorial calendar with specific water savings tips for each week/month and provided the calendar to water agencies for a coordinated release to customers throughout the region. Standard water savings estimates for common water conservation actions were also distributed. Water agencies included water savings tips in bill inserts, agency websites, billboards, and other relevant outlets. Additionally, RWA updated the regional water efficiency website, bewatersmart.info, to include an interactive drought map that featured watering days, water waste hotlines, local websites, staff contacts, and water supply information for each agency. Customers were able to enter their address in the map and receive all pertinent drought information specific to their water provider.

The second area is an overall increase in media buys to support the coordinated public outreach messages described above. For example, in 2015, RWA member water agencies pooled together an additional $150,000, double the regular public outreach budget, to increase the level (number of ads) and extend the timeframe (12 months versus 9 months) of regional media buys including radio, television, and online ads (Google and Facebook). The increase in regional media buys was further supported by an increase in local media buys that also featured regionally coordinated public outreach messages, further leveraging the regional response.

The third area is to designate a regional media contact for drought-related water conservation inquires. For example, RWA served as the point of contact for local radio and television media outlets to quickly respond to requests for interviews and conservation savings updates. RWA also delegated media requests to local water agencies as needed. This increased the conservation related media coverage in the region resulting in more customers being reached while reinforcing regional and local public outreach messages.

The fourth area is an increase in data collection at the regional level to track water savings and weather data for inclusion in regular RWA issued press releases. RWA collected monthly water production, residential gallons per capita daily water use and local weather data to analyze regional water savings. The information was used to proactively issue press releases prior to State-issued drought updates. This allowed the Sacramento region to communicate with customers in a timely fashion and created more opportunities to share the regionally coordinated public outreach messages. Press releases were also used to solicit interview opportunities for RWA and local water agencies.

6.0 Operational and Administrative Framework and Update Process

6.1 Purpose and Scope

The North American Basin RDCP and associated planning are meant to be part of a living process that is routinely updated to reflect the evolving needs in the region.

The purpose of this section is to describe the roles, responsibilities, and procedures for ongoing activities associated with the RDCP including conducting drought monitoring; initiating mitigation and response actions, including communicating with the public about those actions; and evaluating and updating the RDCP. Anticipated frequencies for these activities and potential funding and financing mechanisms are also discussed.

6.2 Development of Operational and Administrative Framework

The six Planning Leads reviewed and provided feedback on an initial RDCP Operational and Administrative Framework (Framework). A revised Framework was circulated to the DPTF and feedback was addressed in the draft RDCP. Feedback from the meeting was addressed in the Framework section included in the draft RDCP submitted to Reclamation; the DPTF, and other interested parties. Feedback on the Framework section in the draft RDCP was addressed in the final RDCP.

6.3 Operational and Administrative Framework

6.3.1 Activities, Process, and Schedule

The anticipated activities, process, and schedule for implementing, monitoring, evaluating, and updating the RDCP are presented in **Table 6-1** and **Figure 6-1**. The Planning Leads expect that RDCP implementation will involve regular monitoring and evaluation efforts to assess the potential for initiation of response actions, to keep tabs on mitigation action progress, and to use available information to guide future changes in the RDCP. The Planning Leads expect that monitoring and evaluating activities would occur throughout each year of implementation, with an evaluation of the need for a comprehensive update of the RDCP every 5 years. A process flow chart for RDCP updates, should a need to update the RDCP be identified, is shown on **Figure 6-2**. Initiation and completion of implementation and update activities will be contingent on the availability of sufficient funding.

Table 6-1. Anticipated RDCP Implementation and Update Activities

Activity	Frequency	RACI Matrix[1]			
		Planning Leads	Water Supply Agencies in RDCP Area	DPTF	Stakeholders and Interested Parties
RDCP Monitoring and Evaluation. The Planning Leads and water supply agencies in the RDCP area will do the following:					
• ***Drought Monitoring.*** On an ongoing and at the frequencies described in the Drought Monitoring section of the RDCP, the Planning Leads will monitor indicators and indices for trigger levels that may indicate the onset of drought conditions.	Ongoing	R, A	C[2]	C	I
• ***Vulnerability Assessment*.** On an annual basis, the Planning Leads and water supply agencies will gather information and make any necessary updates to the Vulnerability Assessment.	Annual	R, A	R	I	I
• ***Mitigation Actions and Response Actions.*** On an annual basis, the Planning Leads and water supply agencies will review any changes in the Vulnerability Assessment, determine the need for new/revised actions, and update the status of existing actions and add new actions (as needed).	Annual	R, A	R	I	I
Development and Initiation of Mitigation and Response Actions. Development and initiation of actions will be the responsibility of the project proponent(s), meaning the individual agency or group of agencies**.**	As needed	C	R, A	I	I
Efforts Identified by Planning Leads/DPTF. In non-update years, the Planning Leads and/or DPTF may identify planning and technical efforts outside those anticipated (see above) that need to be undertaken based on changed conditions or a potential need.	Ongoing	R, A	R, C[3]	R, C[3]	I
RDCP Update Need Evaluation. Every 5 years, the Planning Leads will assess the need for and prepare an updated RDCP (as necessary).	Every 5 years (or as necessary)	R, A	C	C	I
Communication and Outreach. The Planning Leads and water supply agencies in the RDCP area will do the following:					
• ***RDCP.*** This effort will include website updates and email communications to keep interested stakeholders informed of meetings, new materials, and other information related to the RDCP and its implementation.	As needed	R, A[4]	I	I	I
• ***Mitigation Actions and Response Actions.*** Each individual agency will be responsible for apprising its ratepayers and the public of any actions initiated and related progress/results.	As needed	R, A[5]	R, A	I	I

Table 6-1. Anticipated RDCP Implementation and Update Activities (contd.)

Activity	Frequency	RACI Matrix[1]			
		Planning Leads	Water Supply Agencies in RDCP Area	DPTF	Stakeholders and Interested Parties
Coordination with Other Ongoing Efforts. Coordination and information sharing with other ongoing efforts will be beneficial to both the RDCP and the other efforts (American River Basin Integrated Regional Water Management Plan 2018 Update, Regional Water Management Plan, American River Basin Study, individual water agency and other regional planning efforts, etc.). It is anticipated that this will occur on an as needed basis.	As needed	R, A	R [2]	R	I
Planning Leads Meetings. The Planning Leads will meet at least once a year to: (1) prepare for the monitoring and evaluation effort for the current year; (2) discuss evolving needs in the region, any triggers (as described above), and issues to be addressed with the DPTF; and (3) identify funding needs and sources for the following year's activities, and develop a plan to pursue identified funds.	Annually (more frequently if needed)	R, A	I	I	I
DPTF Meetings. The DPTF will meet annually to discuss progress and results of the RDCP monitoring and evaluation effort, other items brought forth by the Planning Leads, and review content from the updated RDCP (every 5 years). The DPTF meetings will coincide with other existing meeting venues to allow for coordination and time efficiency of participants.	Annually (more frequently if needed)	R, A	C [2]	C	I

Notes:
[1] RACI responsibility matrix. R = Responsible; A = Accountable; C = Consulted; I = Informed
[2] Water supply agencies in the RDCP area are also members of the DPTF.
[3] Responsible or Consulted depends in specific effort.
[4] RWA will be continue to be Responsible for RDCP updates on the RWA website, as well as email communications. The Planning Leads (including RWA) will be Accountable the effort.
[5] With the exception of RWA, the Planning Leads are also water suppliers in the RDCP area.
Key:
DPTF = Drought Planning Task Force
RDCP = Regional Drought Contingency Plan

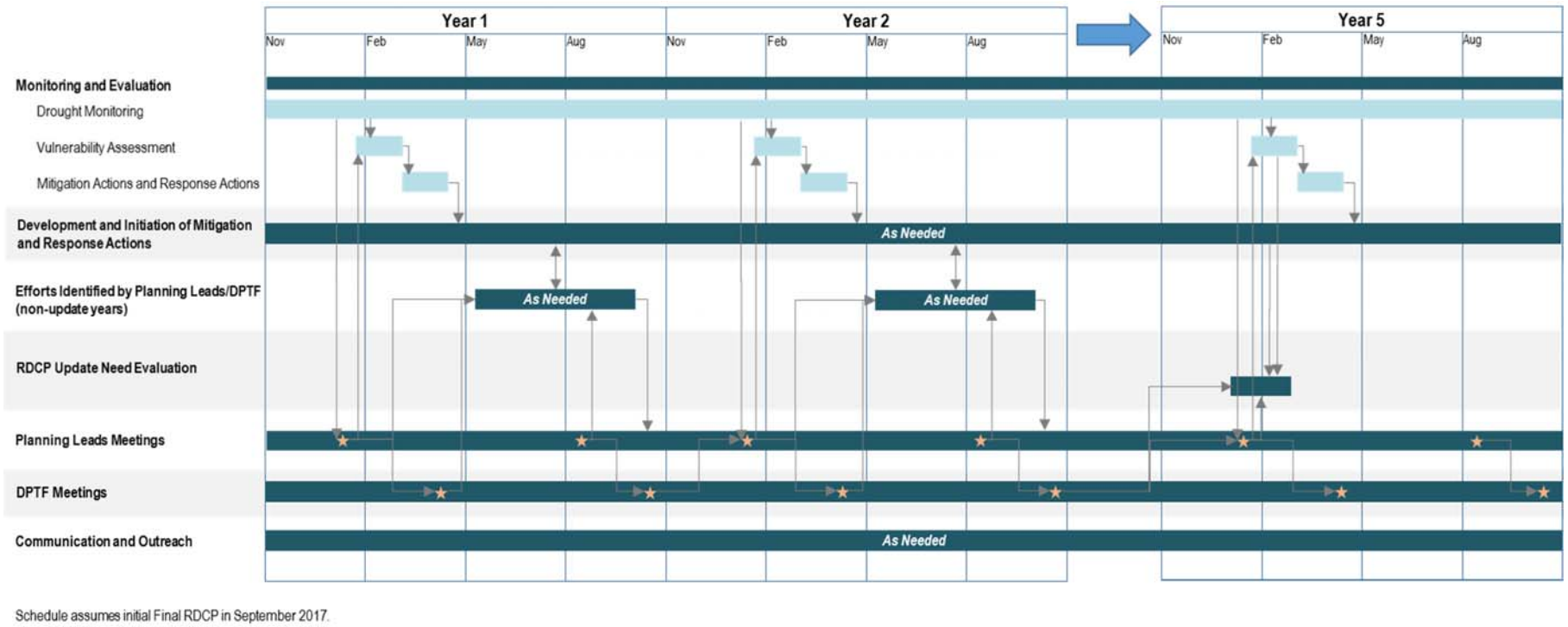


Figure 6-1. Anticipated RDCP Implementation and Update Evaluation Schedule

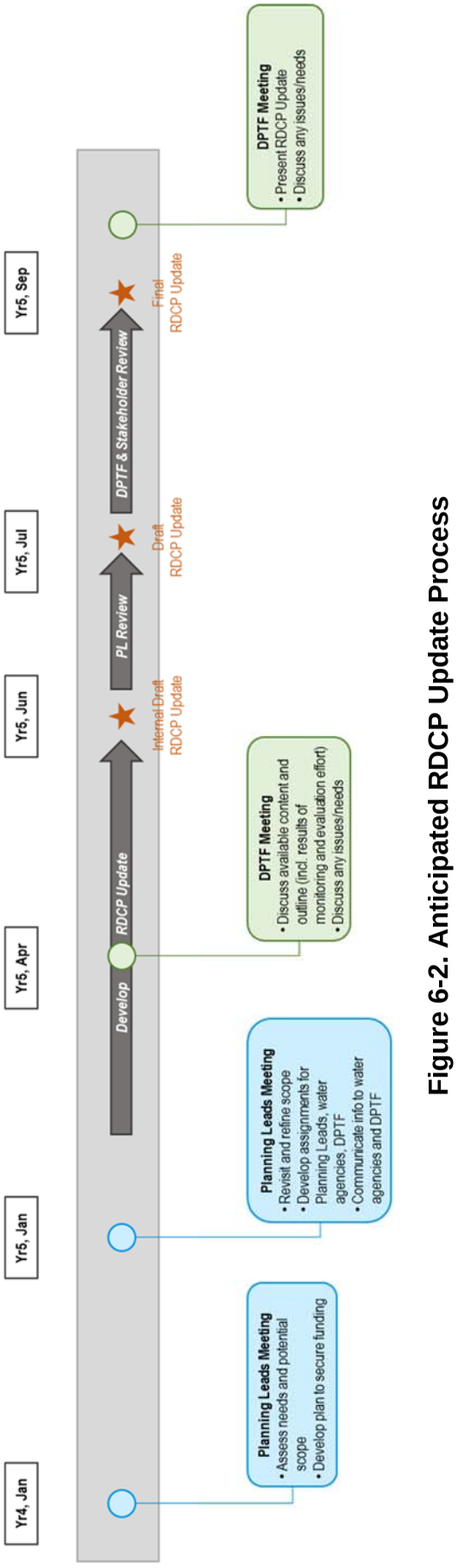


Figure 6-2. Anticipated RDCP Update Process

6.3.2 Roles and Responsibilities

Successful implementation of the RDCP depends on the clearly defined roles and responsibilities of the Planning Leads, DPTF, water agencies in the RDCP area, and stakeholders and interested parties. **Table 6-1** shows the roles and responsibilities for each anticipated implementation and update activity.

Planning Leads

The primary purpose of the Planning Leads will be to provide oversight of the RDCP and make related decisions, resolve any issues presented by the DPTF, provide guidance and direction on next steps and recommended actions (as appropriate), and engage with stakeholders and interested parties. The Planning Leads will continue to consist of:

- The 5 water agencies in the North American Basin with Reclamation contracts – Placer County Water Agency, City of Folsom , City of Roseville, City of Sacramento, San Juan Water District – that were the Partners in the 2017 RDCP.

- The RWA, a joint powers authority formed in 2001 and consisting of more than 20 water suppliers in the greater Sacramento region for the purpose of protecting and enhancing the sustainability of regional water supplies.

Agency representatives will continue to be management-level officials with authority to commit their respective organizations to a course of action.

Drought Planning Task Force

The purpose of the DPTF will be to provide input on the RDCP and its implementation, review progress, and discuss RDCP related issues and needs. Participation will continue to be voluntary. At this time, this group consists of:

- The 6 Planning Leads, as each may the responsible for mitigation and response actions.

- The 12 other water agencies in the RDCP area – California American Water, Carmichael Water District, Citrus Heights Water District, City of Lincoln, Del Paso Manor Water District, Fair Oaks Water District, Golden State Water Company, Natomas Central Mutual Water Company, Orange Vale Water Company, Rio Linda/Elverta Community Water District, Sacramento County Water Agency, Sacramento Suburban Water District.

- Sacramento Water Forum.

- California Department of Water Resources.

- Reclamation.

Water Agencies in the RDCP Area

The Planning Leads will continue to engage with the 12 other water agencies in the RDCP area separately from the DPTF, as these water agencies may choose to implement RDCP-related mitigation and response actions. Participation will not be mandatory, and each water agency will make its own decisions on project implementation and any associated activities.

It is important to note that outside of their responsibilities as Planning Leads, those 6 entities will also need to make individual decisions regarding project implementation and any associated activities.

Stakeholders and Interested Parties

Consistent with the RDCP Communications and Outreach Plan, stakeholders and interested parties will continue to be provided with updates on RDCP progress and opportunities to comment by the Planning Leads and the DPTF. All DPTF meetings will continue to be open for stakeholder and public involvement, and RWA will continue to post information and materials on its website as well as email notifications as needed. Participation in this group will continue to be voluntary and open to any organization or individual expressing interest.

6.3.3 Initiation of Drought Response Conditions

Because of the unique water supply portfolio of each agency, the initiation of water contingency plans and the level of response will be an individual agency action and responsibility. For example, the City of Folsom was the first agency in the region in December 2013 to call for a mandatory 20 percent conservation savings of its customers when Folsom Reservoir storage levels went below 200,000 acre-feet.

Following individually agency responses, there are two likely conditions locally that will result in a more regional response. The first is a response through the Regional Water Authority. This response is initiated at the request of one of more of RWA's members. This response occurs in the form of an adopted resolution of the entire RWA Board declaring that drought conditions are present and that all agencies in the region are encouraged to take appropriate, and consistent to the degree feasible, actions under their respective water shortage contingency plans. RWA also coordinates regional messaging of the conditions to the public. An example of this occurred in January 2014 when RWA adopted a resolution calling for 20 percent voluntary conservation for all its members despite whether or not they had available supplies.

The second regional response is coordination under the Water Forum Successor Effort. This occurs when projected unimpaired inflows for March through November at Folsom Reservoir are projected to be below 400,000 acre-feet. This condition occurred in 2015 and resulted in recurring meetings throughout the year facilitated by the Water Forum. This is known locally as a Conference Year, and stakeholders confer to identify impacts for the dry conditions and propose actions to mitigate those impacts. Reduced water demands are a key mitigation action during those conditions.

6.3.4 Triggers to Reassess the RDCP

Although the Planning Leads intend to regularly revisit the RDCP and its performance and assess the need for an update every 5 years, there will likely be events or occurrences that have substantial effects on the local water supply outlook and trigger an update of the RDCP (or a portion thereof) outside of that cycle. These triggers may include, but are not limited to:

- **State and federal regulations or requirements** often change as well as new ones go into effect. These may have effects on the availability, timing, and potential uses of water supplies, such as water conservation requirements, reservoir releases to meet instream flow or water quality requirements, and regulations governing indirect and direct potable reuse.

- **Policy or operational changes** related to State or federal facilities may impact local water resources.

- **New information from drought monitoring activities or other efforts** (climate change or planning studies, modeling efforts, etc.) may also impact the future availability of local water resources.

- **Unanticipated changes in water supply availability** resulting from natural disasters, infrastructure failures, or other events may require reassessment of response and/or mitigation actions.

6.4 Funding and Financing

Implementing, evaluating, and updating the RDCP will be contingent on the availability of sufficient funding and financing. This section discusses potential RDCP funding and project financing mechanisms.

6.4.1 RDCP Funding

Development of the 2017 RDCP was funded by a Reclamation WaterSMART Drought Contingency Planning Grant and in-kind and direct funding support from the Planning Leads. Additional funds for RDCP implementation (not including projects), evaluation, and updates will need to be identified by the Planning Leads, and a funding plan developed that will likely incorporate in-kind services, direct funding by local agencies, and State and federal grant funding opportunities.

6.4.2 Financing Mitigation and Response Actions

Financing projects is always a challenge, and it sometimes prevents projects from proceeding to implementation. In recent years, these challenges have only increased. Municipal and agency revenues have been constrained due to pressures to keep user rate increases low, few new development fees, and reduced water usage resulting in reduced revenues. State and federal funding sources are increasingly competitive and sometimes cause schedule delays. Further, some projects with benefits that are difficult to quantify, face challenges in securing external funding. The demands on these limited funds include increasing construction costs, aging infrastructure, and increased regulations.

To realize progress toward drought preparedness and response in the region, mitigation and response actions (projects) will need to be implemented now and into the future. The Planning Leads and DPTF recognize the importance of maintaining the highest standards of cost effectiveness for priority projects. Financing options will vary according to each project proponent. The various funding sources will differ in their longevity and certainty as well. While extremely helpful in covering costs, grant program funds will continue to be dependent on successful applications. Grant funds are also better suited to finance construction or a one-time project cost, as opposed to covering operation and maintenance (O&M) costs. Generally, user fees and rates are more secure and reliable, and are better suited to cover O&M costs than relying on grant funding.

Financing for most of the RDCP mitigation and response actions has not been identified at this time. The Planning Leads will help project proponents move forward on an ongoing basis, by providing opportunities to coordinate with other ongoing efforts in the region (American River Basin IRWMP, Sustainable Groundwater Management Act implementation, etc.); encouraging the pursuit many types of appropriate funding, both external (e.g., grants, loans, development fees, private sector financing) and internal (e.g., user fees, user rates, revenue bonds, assessment districts); and encouraging the formation of partnerships for those projects that benefit multiple water agencies and stakeholders.

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