Central Valley Project Municipal and Industrial Water Shortage Policy Draft Environmental Impact Statement

Lead Agency
United States Department of the Interior
Bureau of Reclamation
Mid-Pacific Regional Office
Sacramento, California

For further information regarding this Draft Environmental Impact Statement, contact:

Tim Rust
Bureau of Reclamation
2800 Cottage Way, Sacramento CA 95825
Phone: (916) 978–5516
Fax: (916) 978-5290
Email: trust@usbr.gov

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region

November 2014

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Central Valley Project Municipal and Industrial Water Shortage Policy Draft Environmental Impact Statement

Lead Agency
U.S. Department of the Interior
Bureau of Reclamation, Mid-Pacific Region
2800 Cottage Way
Sacramento, CA 95825

ABSTRACT

This Environmental Impact Statement (EIS) evaluates the potential impacts of Central Valley Project (CVP) Municipal and Industrial Water Shortage Policy (M&I WSP) alternatives. The M&I WSP would be used by the Bureau of Reclamation (Reclamation) to: 1) define water shortage terms and conditions for applicable CVP M&I water service contractors, as appropriate; 2) establish CVP water supply allocations that, together with the M&I water service contractors' drought water conservation measures and other non-CVP water supplies, would assist the M&I water service contractors in their efforts to protect public health and safety during severe or continuing droughts; and 3) provide information to M&I water service contractors for their use in water supply planning and development of drought contingency plans. The alternatives evaluated in this EIS utilize different methodologies for allocating available CVP water supplies to CVP water service contractors during shortage conditions. This EIS evaluates potential impacts of the M&I WSP over a 20-year period, 2010 through 2030.

This EIS has been prepared according to requirements of the National Environmental Policy Act. Direct, indirect, and cumulative impacts resulting from the project alternatives on the physical, natural, and socioeconomic environment of the region are addressed.

Comments on this document must be submitted by January 12, 2015. Reclamation will consider comments on the Draft EIS received during the 45-day review period.

FOR FURTHER INFORMATION CONTACT:

Tim Rust
Bureau of Reclamation
2800 Cottage Way, Sacramento CA 95825
Phone: (916) 978–5516
Email: trust@usbr.gov

This page left blank intentionally.

Executive Summary

The Central Valley Project (CVP) is a Bureau of Reclamation (Reclamation) federal water project in the State of California (State). The project supplies irrigation and municipal water, produces hydropower, and provides flood control and recreation from its many large reservoirs. The CVP delivers approximately 7 million acre-feet (AF) per year (AFY) on an average annual basis to agricultural, municipal, and environmental uses in the Sacramento and San Joaquin valleys, cities and industries in Sacramento, and the east and south Bay Areas, and to fish hatcheries and wildlife refuges throughout the Central Valley. CVP facilities include 20 dams and reservoirs, 39 pumping plants, 2 pumping-generating plants, and 11 powerplants. The CVP includes over 500 miles of major canals as well as some conduits, tunnels, and related facilities. Figure ES-1 shows major CVP facilities and the CVP service area.

Persistent drought conditions and state and federal regulatory requirements have reduced the amount of water available for consumptive uses by CVP water service contractors. Additionally, it is anticipated that future hydrologic conditions, climate variability, and regulatory requirements for the operation of CVP and other California water supply projects may also affect and possibly limit water supply availability.

This Environmental Impact Statement (EIS) was prepared to provide National Environmental Policy Act (NEPA) compliance for the updated Municipal and Industrial Water Shortage Policy (M&I WSP) pursuant to and in accordance with NEPA (42 United States Code §4321-4370d), Council on Environmental Quality regulations on implementing NEPA (40 Code of Federal Regulations [CFR] §1500-1508), and Department of the Interior NEPA Implementation Regulations (43 CFR Part 46). As such, this EIS evaluates alternatives considered by Reclamation to update the M&I WSP.

ES.1 Background and History

Reclamation's Mid-Pacific Region is responsible for managing the CVP, which stores and delivers about 20 percent of the State's developed water. The CVP is operated as an integrated system, to the extent practicable, with reservoirs on the Trinity, Sacramento, American, Stanislaus, and San Joaquin rivers. The June 2004 "Long-Term Central Valley Project Operations Criteria and Plan, CVP-OCAP" ("OCAP") described the authorizations for the CVP under the Rivers and Harbors Act of August 26, 1937, which provided that the CVP dams and reservoirs be "used, first, for river regulation, improvement of navigation and flood control; second, for irrigation and domestic uses; and third, for power." The OCAP further details changes, in accordance with the 1992 Central Valley Project

Improvement Act (CVPIA) that "modified the 1937 act and specified that the dams and reservoirs of the CVP should now be used first, for river regulation, improvement of navigation, and flood control; second for irrigation and domestic uses and fish and wildlife mitigation, protection and restoration purposes; and third for power and fish and wildlife enhancement." (Reclamation 2004)

Figure ES-1. CVP Service Area and Major CVP Features

The OCAP also described constraints to the operations of the CVP, stating that:

> *"State Water Resources Control Board (SWRCB) decisions and orders and the biological opinions for endangered species largely determine Delta regulatory requirements for water quality, flow, and operations. SWRCB Water Quality Control Plan (WQCP) and applicable water rights decisions, as well as other agreements, [were] considered in determining the operations of the Central Valley Project (CVP) and the State Water Project (SWP)."* (Reclamation 2004)

The applicable water rights decisions and orders include satisfaction of senior water rights and riparian water rights, requirements of water right settlement and exchange contracts with the CVP, as well as water quality requirements established by the SWRCB. The CVPIA requires the CVP to provide water for refuge water supplies and for implementation of fish and wildlife requirements under Section 3406(b)(2) of the CVPIA. The OCAP also described the allocation of CVP water supply for water service contracts and Sacramento River Settlement Contracts.

As the CVP system was being developed, there were no shortages to contract allocations because the actual water demands were less than the water supply each year. The first drought occurred in 1977 to 1978 when severe hydrologic conditions resulted in extremely restricted water supplies and the second drought occurred in 1987 to 1992. Following adoption of the CVPIA and subsequent changes of the SWRCB orders and decisions related to operations of the CVP, water supplies also were reduced due to regulatory conditions as well as hydrologic reductions. For example, limitations on the CVP ability to convey water across the Sacramento-San Joaquin River Delta (Delta) in accordance with SWRCB orders and decisions can result in lower allocations for CVP water users located south of the Delta as compared to CVP water users located north of the Delta.

During an average year, the CVP delivers approximately 7 million AFY for agricultural, urban, and wildlife use. Of that total, 5 million AFY is delivered to farms, enough water to irrigate approximately one-third of the agricultural land in California. The rest of the CVP deliveries are divided as follows: 600,000 AFY for M&I use in Contra Costa, Santa Clara, and Sacramento counties; 800,000 AFY to fish and wildlife and their habitat; and 422,251 AFY to state and federal wildlife wetlands.

Reclamation balances CVP water allocations for agricultural, environmental, and M&I purposes based on factors such as hydrology, water rights, reservoir storage, environmental considerations, and operational limitations. Each year Reclamation determines the amount of water that can be allocated to each water contractor based on water supply availability conditions for that year. These allocations are expressed as a percentage of the Contract Total or historical use according to the contracts held between Reclamation and the various water districts, municipalities, and other entities. Reduced precipitation, low storage levels, and operational and environmental constraints lead to reduced water allocations. Reclamation and the CVP water service contractors recognize that delivery of the Contract Total is not guaranteed and that deliveries may be equal to or less than historical deliveries. Table ES-1 summarizes CVP allocations, as percentages of contract amount, delivered to agricultural and urban water contractors north and south of the Delta from 2000 through 2014.

Table ES-1. CVP Water Supply Allocation Percentages 2000 through 2014

Year	Year Type	Agriculture[1]		M&I	
		North of Delta (%)	South of Delta (%)	North of Delta (%)	South of Delta (%)
2000	AN	100	65	100	90
2001	D	60	49	85	77
2002	D	100	70	100	95
2003	AN	100	75	100	100
2004	BN	100	70	100	95
2005	AN	100	90	100	100
2006	W	100	100	100	100
2007	D	100	50	100	75
2008	C	40	40	75	75
2009	D	40	10	100	60
2010	BN	100	45	100	75
2011	W	100	80	100	100
2012	BN	100	40	100	75
2013	D	75	20	100/75[2]	70
2014	D[3]	0	0	50[4]	50[4]

Source: Reclamation 2014

Notes:

1 Allocations apply to water service contracts, and do not apply to Sacramento River Settlement Contractors and San Joaquin River Exchange Contractors.

2 In 2013, American River M&I users received 75 percent of contract amount.

3 Calculated utilizing May 1, 2014 50% exceedance forecast for Sacramento River unimpaired runoff.

4 Historical use applied to allocations.

Key:

C = Critical, D = Dry, BN = Below Normal, AN = Above Normal, W = Wet

ES.2 Purpose and Need

The purpose and need statement describes the underlying need for and purpose of a proposed project. The purpose and need statement is a critical part of the environmental review process because it is used to identify the range of reasonable alternatives and focus the scope of analysis.

ES.2.1 History of the WSP

In response to concerns from both M&I and agricultural water service contractors regarding future allocations of water supplies provided by the CVP following the adoption of the CVPIA and the need to more fully define allocations during times of water shortage, Reclamation initiated development of the M&I WSP. Involved stakeholders submitted language for the M&I WSP as part of several proposed policies. Reclamation initiated the preparation of an Environmental Assessment (EA) which included stakeholder input and consideration and evaluation of alternative policies developed in 1993, 1996-1997, and 2000-2001. On September 11, 2001, Reclamation released a Draft M&I WSP. The M&I WSP EA was published on October 2005 and a Finding of No Significant Impact was signed in December 2005. The M&I WSP currently being implemented by Reclamation is the 2001 Draft M&I WSP, as modified by Alternative 1B from the 2005 EA.

Following publication of the Final EA, Reclamation received comments from CVP water service contractors regarding the assumptions relied upon in the analysis and the range of alternatives considered. In addition, the 2008 United States Fish & Wildlife Service's (USFWS) biological opinion (BO) for Delta Smelt also changed some of the CVP operational requirements that were assumed in the Final EA. In 2009, the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) issued a BO for Chinook salmon. While there are continuing legal issues surrounding these BOs, the 2008 USFWS and 2009 NOAA Fisheries BOs will guide operations of the M&I WSP until the issues are resolved.

Because the assumptions supporting the 2005 Final EA have become outdated and due to significant changes in the Delta and CVP/SWP operations, Reclamation decided to undertake the M&I WSP EIS to provide an updated M&I WSP that best recognizes the needs of various segments of the water user community and how those needs could be addressed in times of water shortages.

ES.2.2 Purpose and Need

The purpose of updating the 2001 Draft M&I WSP, as amended, is to provide detailed, clear, and objective guidelines for the allocation of available CVP water supplies to CVP water service contractors during water shortage conditions.

The update to the M&I WSP is needed by water managers and the entities that receive CVP water to help them better plan for and manage available CVP water supplies, and to better integrate the use of CVP water with the use of other available non-CVP water supplies. The update to the M&I WSP is also needed to clarify certain terms and conditions with regard to the applicability and implementation process of the M&I WSP.

The updated M&I WSP would be used by Reclamation to:

- Define water shortage terms and conditions for applicable CVP M&I water service contractors, as appropriate;
- Establish CVP water supply allocations that, together with the M&I water service contractors' drought water conservation measures and other non-CVP water supplies, would assist the M&I water service contractors in their efforts to protect public health and safety during severe or continuing droughts; and
- Provide information to M&I water service contractors for their use in water supply planning and development of drought contingency plans.

ES.3 Applicability of the M&I WSP

There are 271 water contracts or agreements for the delivery of CVP and/or water rights water; including 88 water service contracts (excluding those in the Friant Division); 147 water rights or settlement contracts on the Sacramento, American, San Joaquin, and Stanislaus rivers; 27 Friant Division water repayment contracts and 4 Friant Division water service contracts; and 4 contracts or agreements for Federal and State refuges and 1 for a privately managed refuge.

ES.3.1 Water Service Contractors Subject to the M&I WSP

Reclamation has developed the M&I WSP alternatives to evaluate different methods for allocation of CVP supplies to M&I and agricultural water service contractors during water shortage conditions. The updated M&I WSP will apply to the water service contractors noted in Table ES-2 and shown on Figure ES-2. These water service contractors generally comprise those whose contracts currently reference the M&I WSP and those with a water service contract that is expected to reference the updated policy upon renewal. These water users are generally located throughout the North of Delta Sacramento Valley, and the South of Deltas areas of the San Joaquin River Valley, Tulare Lake Region, and San Francisco Bay/Central Coast area.

Most water service contracts allow for the use of both agricultural and M&I water although some contactors may not currently have a use for both. Not all contracts distinguish between water for agricultural use and water for M&I use. American River contractors, Contra Costa Water District, a few Sacramento River contractors, and a few south of Delta contractors are M&I only contractors. (Reclamation 2013)

Table ES-2. Water Service Contractors Subject to the M&I WSP

General Geographical Region	CVP Division	Water Service Contractors	M&I	Ag[1]
North of Delta	Shasta and Trinity River	Bella Vista Water District	X	X
		Centerville Community Services District	X	-
		City of Redding	X	-
		City of Shasta Lake	X	-
		Clear Creek Community Services District	X	X
		Mountain Gate Community Services District	X	-
		Shasta Community Services District	X	-
		Shasta County Water Agency	X	-
		U.S. Forest Service (Shasta)	X	-
	Sacramento River	4-M Water District	X	X
		Colusa County Water District	X	X
		Corning Water District	X	X
		Cortina Water District	X	X
		County of Colusa	X	X
		County of Colusa (Stonyford)	X	X
		Davis Water District	X	X
		Dunnigan Water District	X	X
		Elk Creek Community Services District	X	-
		Glenn Valley Water District	X	X
		Glide Water District	X	X
		Holthouse Water District	X	X
		Kanawha Water District	X	X
		Kirkwood Water District	X	X
		La Grande Water District	X	X
		Myers-Marsh Mutual Water Company	X	X
		Orland-Artois Water District	X	X
		Proberta Water District	X	X
		Stony Creek Water District	X	X
		Thomes Creek Water District	X	X
		U.S. Forest Service (Salt Creek)	X	-
		Westside Water District	X	X
		Whitney Construction, Incorporated	X	-
	American River	City of Roseville	X	-
		City of Sacramento	X	-
		East Bay Municipal Utility District	X	-
		El Dorado Irrigation District	X	-
		Placer County Water Agency	X	-
		Sacramento County Water Agency	X	-
		Sacramento Municipal Utility District	X	-
		San Juan Water District	X	-
	Delta	Banta-Carbona Irrigation District	X	X
		Byron-Bethany Irrigation District	X	X
		City of Tracy	X	X
		Coelho Family Trust	X	X

General Geographical Region	CVP Division	Water Service Contractors	M&I	Ag[1]
		Contra Costa Water District	X	-
		Del Puerto Water District	X	X
		Eagle Field Water District	X	X
		Fresno Slough Water District	X	X
		James Irrigation District	X	X
		Laguna Water District	X	X
		Mercy Springs Water District	X	X
		Oro Loma Water District	X	X
		Pajaro Valley Water Management Agency, Westlands Water District	X	X
		Patterson Irrigation District	X	X
		Reclamation District No. 1606	X	X
		Tranquillity Irrigation District	X	X
		Tranquillity Public Utility District	X	X
		U.S. Department of Veteran Affairs	X	-
		West Side Irrigation District	X	X
		West Stanislaus Irrigation District	X	X
		Westlands Water District Distribution Districts	X	X
South of Delta	West San Joaquin	City of Avenal	X	-
		City of Coalinga	X	-
		City of Huron	X	-
		Pacheco Water District	X	X
		Panoche Water District	X	X
		San Luis Water District	X	X
		State of California	X	-
		Westlands Water District	X	X
	San Felipe	San Benito County Water District	X	X
		Santa Clara Valley Water District	X	X
	Cross Valley Canal	County of Fresno	X	X
		County of Tulare	X	X
		Hills Valley Irrigation District (includes Rag Gulch Water District)	X	X
		Kern-Tulare Water District	X	X
		Lower Tule River Irrigation District	-	X
		Pixley Irrigation District	X	X
		Tri-Valley Water District	X	X

Note:
[1] Ag = Agricultural water service contractor

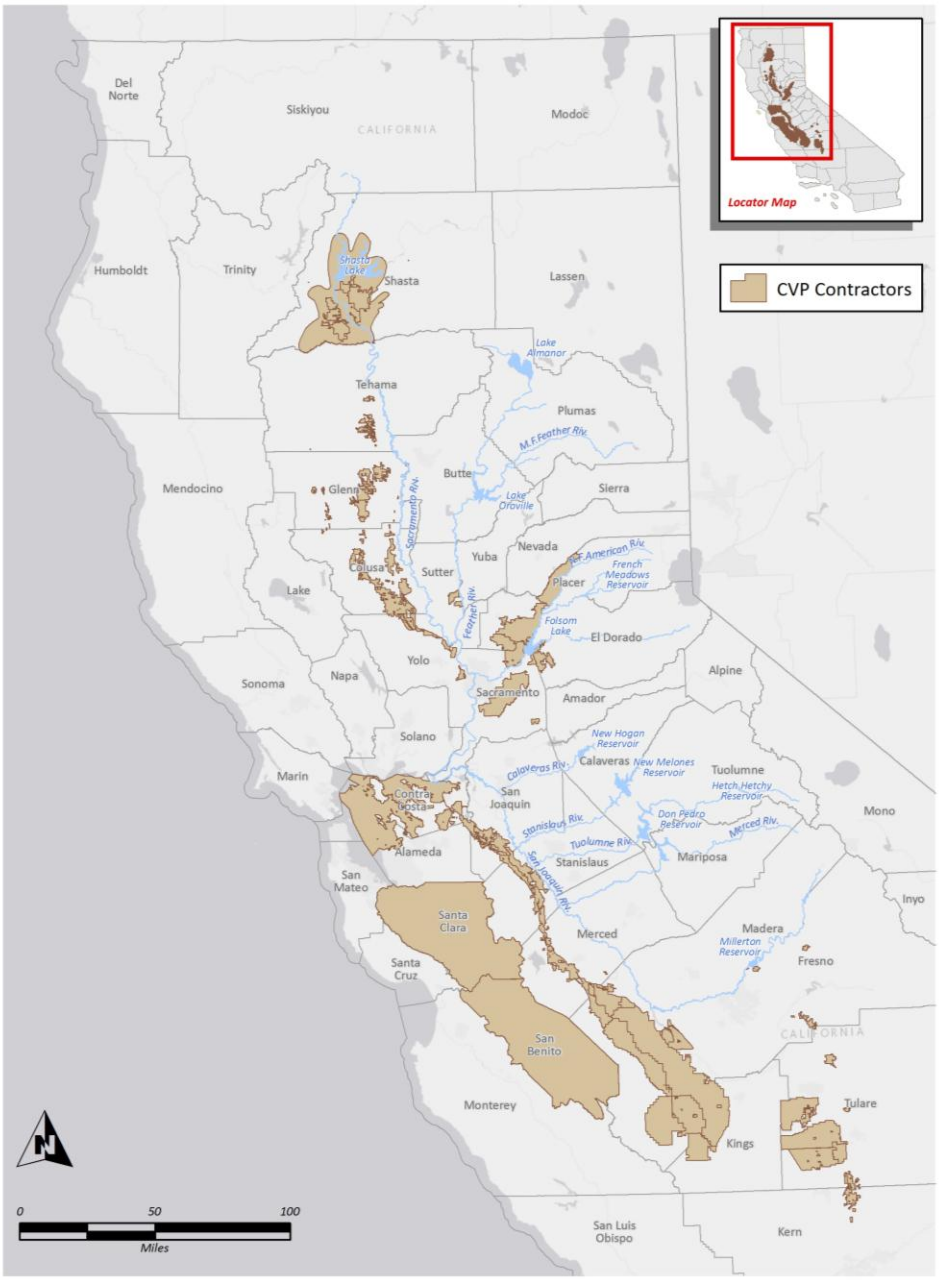


Figure ES-2. Contractors Subject to the M&I WSP

ES.3.2 CVP Contractors Not Subject to the M&I WSP

The M&I WSP does not apply to: 1) CVP water service or repayment contractors with contracts that do not reference the M&I WSP; 2) settlement, exchange, or other types of contracts or agreements in satisfaction of senior water rights; or 3) CVPIA refuge contracts.

ES.4 Development and Screening of Preliminary Alternatives

NEPA requires EISs to identify a reasonable range of alternatives and provide guidance on the identification and screening of such alternatives. NEPA includes provisions that alternatives meet (or meet most of) the purpose and need and be potentially feasible. For this EIS, Reclamation followed a structured, documented process to identify and screen alternatives for inclusion in the EIS. Figure ES-3 illustrates the process that Reclamation conducted to identify and screen alternatives.

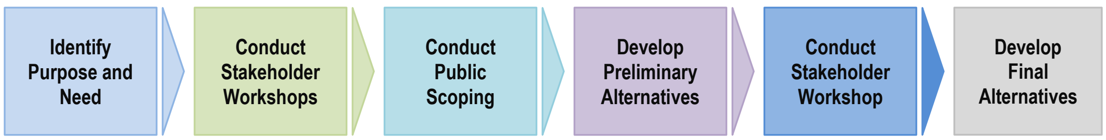


Figure ES-3. Alternatives Development Process

ES.4.1 Public Scoping and Results

During public scoping, the public provided input regarding potential alternatives to be considered in the EIS. Reclamation reviewed the purpose and need statement, public scoping comments, and previous studies in its initial effort to develop conceptual alternatives. This resulted in an initial list of alternatives that included alternatives that were previously considered in the 2005 EA and four new alternatives. Reclamation then developed and applied a set of screening considerations to determine which alternatives should be advanced for analysis and inclusion in the EIS.

ES.4.2 Selected Alternatives

The alternatives that were selected and advanced for more detailed analysis in this EIS are those that best meet the purpose and need, minimize negative effects, are feasible, and represent a range of reasonable alternatives. Some alternatives considered do not fully meet the purpose and need, but they have the potential to minimize some types of environmental effects or help create a reasonable range of alternatives for consideration by decision-makers.

NEPA allows development of representative alternatives that bound the full range of reasonable alternatives. Upper, lower, and intermediate bounding alternatives can be developed in terms of the maximum and minimum range of water shortage sharing conditions between agricultural and M&I water service contractors. This approach was used in the selection of alternatives and ensured that the full range of potential changes in water allocations and resulting environmental impacts from these alternative M&I WSPs can be evaluated in the EIS. The bounding alternatives also facilitate a trade-off analysis of different shortage sharing conditions between agricultural and M&I water service contractors.

As a result of the initial alternatives screening, four action alternatives were selected to move forward for analysis in the EIS with the No Action Alternative, as described in Table ES-3. Analysis of these alternatives will provide the information needed to make an informed decision, and potentially to mix and match elements of the alternatives, if needed, to create an alternative that would reduce environmental impacts and increase environmental benefits.

Table ES-3. Alternatives Selected for Analysis in the EIS

Alternative Number	Alternative Name	Description
Alternative 1	No Action Alternative	Represents the current 2001 Draft M&I WSP, as modified by Alternative 1 B of the 2005 EA. This existing draft policy is currently guiding Reclamation's allocation of water to agricultural and M&I water service contractors.
Alternative 2	Equal Agricultural and M&I Allocation	Provides no preference for either agricultural or M&I contractors. M&I and agricultural water service contractors receive equal allocation percentages during water shortage conditions.
Alternative 3	Full M&I Allocation Preference	M&I water service contractors receive 100% of their Contract Total until CVP supplies are not available to meet those demands. Agricultural allocations are reduced as needed to maintain 100% allocations to M&I contractors.
Alternative 4	Updated M&I WSP	Similar to Alternative 1 but modified to provide a different definition of unconstrained years used in calculating historical use. Attempts to provide minimum public health and safety (PHS) unmet need amounts, but without a guarantee.
Alternative 5	M&I Contractor Suggested WSP	Similar to Alternative 4 except attempts to meet PHS unmet need through modification of operational priorities, such as providing increased carryover to reserve water in storage to meet ensuing year PHS unmet need of M&I contractors.

ES.5 Alternatives Considered in the EIS

ES.5.1 Alternative 1: No Action Alternative

The No Action Alternative represents a projection of current conditions to the most reasonable future conditions that could occur during the life of the proposed federal action without any action alternative being implemented. Thus, the No Action Alternative provides a baseline against which action alternatives can be compared. The No Action Alternative represents continued implementation of the current 2001 Draft M&I WSP, as modified by Alternative 1B of the 2005 EA. This existing draft policy is currently guiding Reclamation's operations of the CVP and the allocation of water to agricultural and M&I water service contractors and would continue to guide CVP allocations if none of the proposed action alternatives are chosen.

ES.5.1.1 Water Allocation Methodology

The allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative is presented in Table ES-4. In years when the CVP water supplies are not adequate to provide water to all contractors, M&I water service contractor allocations are maintained at 100 percent of their Contract Total as the agricultural water service contractor allocations are reduced to 75 percent of their Contract Total in several incremental steps. Then, M&I water service contractor allocations are reduced to 75 percent of historical use (which may be adjusted) in several incremental steps as agricultural water service contractor allocations are reduced to 50 percent of Contract Total. The M&I water service contractor allocations are maintained at 75 percent of historical use until agricultural water service contractor allocations are reduced in incremental steps to 25 percent of Contract Total. Then, M&I water service contractor allocations are reduced in incremental steps to 50 percent of historical use until agricultural water service contract allocations are reduced in incremental steps to zero.

In years when the M&I water service contractor allocations are less than 75 percent of historical use, Reclamation would attempt to provide the unmet PHS needs, up to 75 percent of the M&I historical use, if the water is available. There are some years in which allocations to agricultural water service contractors are at or near zero. In those years, the increased deliveries for unmet PHS needs to M&I water service contractors would not be fully realized. M&I water service contractor deliveries may be reduced below 75 percent of historical use and below the unmet PHS needs when CVP water is not available.

Table ES-4. Alternative 1, No Action Alternative, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of contract total)	Allocation to M&I Water Service Contractors
1	100% to 75%	100% of Contract Total
2	70%	95% of historical use
3	65%	90% of historical use
4	60%	85% of historical use
5	55%	80% of historical use
6	50% to 25%	75% of historical use
7	20% [1]	The Maximum of: (1) 70% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
8	15% [1]	The Maximum of: (1) 65% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
9	10% [1]	The Maximum of: (1) 60% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
10	5% [1]	The Maximum of: (1) 55% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
11	0% [1]	The Maximum of: (1) 50% of M&I historical use or (2) Unmet PHS need up to 75% of historical use

[1] Allocations to agricultural water service contractors will be further reduced, if necessary, within the contract year to provide PHS needs to M&I water service contractors within the same contract year, provided CVP water is available.

ES.5.1.2 Historical Use

An M&I water service contractor's historical use is determined by calculating the average quantity of CVP water put to beneficial use within the service area during the last three years of water deliveries that were unconstrained by the availability of CVP water. The historical use value for an M&I water service contractor is calculated by averaging the annual CVP water deliveries during the most recent three unconstrained years.

Reclamation recognizes that certain circumstances may require adjustment of the historical use, if requested by a contractor, for population growth, extraordinary water conservation measures, or use of non-CVP water supplies. Also, Reclamation may agree to adjust the historical use on the basis of unique circumstances, after consultation with the contractor. An example of a unique circumstance is the year following a drought year, in which a contractor may still be using extraordinary water conservation measures, or the converse, in which a contractor may be using more water than historically used in order to recharge groundwater.

ES.5.1.3 Public Health & Safety

During water shortage conditions, Reclamation will strive to deliver CVP water to M&I water service contractors at not less than their unmet PHS water supply level, provided that sufficient CVP water is available, if: 1) the Governor declares an emergency drought condition due to water shortage; or 2) Reclamation, in consultation with the contractor, determines that an emergency exists due to water shortage. At that time, the PHS level and unmet need would be determined by the contractor and reviewed by Reclamation.

The PHS water criteria in this analysis are used to estimate the water that is needed for consumption, for operation of necessary water and wastewater facilities, and to avoid economic disruption. The PHS needs will be calculated using the M&I water service contractor's domestic, commercial, institutional, and industrial demands and system losses. M&I water service contractors are expected to first use their non-CVP supplies to meet their PHS demands. Reclamation would then use CVP water to assist the M&I water service contractor to meet the unmet need portion of their respective PHS demand. Unmet need is calculated as the difference between a contractor's PHS demand and its available non-CVP supplies. CVP water provided for PHS needs would be non-transferable.

ES.5.2 Alternative 2: Equal Agricultural and M&I Allocation

Under Alternative 2, Equal Agricultural and M&I Allocation, M&I water service contractors would receive the same allocation, as a percentage of Contract Total, as the agricultural water service contractors. This means that in years when the CVP water supplies are not adequate to provide water to all water service contractors, agricultural and M&I water service contractor allocations would be reduced by the same percentage.

This allocation methodology would provide a larger volume of CVP water to agricultural water service contractors than the No Action Alternative, as there would be no reductions to agricultural contractors to provide a larger volume of CVP water to M&I water service contractors. Deliveries to both north of Delta and south of Delta M&I contractors would be lower than under the No Action Alternative in order to provide an equal allocation to agricultural water service contractors. Alternative 2 would have no provisions for unmet PHS needs that would be made available by Reclamation from CVP water supplies. During water shortage conditions, M&I water service contractors would need to rely on available non-CVP supplies.

Reclamation would benefit from a simplified allocation system that would be easier to implement and CVP water users would benefit by having a more comprehensible and simpler shortage allocation approach. This alternative will facilitate a tradeoff analysis that considers the potential effects associated with reduced CVP deliveries to M&I water service contractors.

The allocation of available CVP water supplies between M&I and agricultural water service contractors during water shortage conditions is presented in Table ES-5.

Table ES-5. Alternative 2, Equal Agricultural and M&I Allocation, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors (% of Contract Total)
1	100%	100%
2	95%	95%
3	90%	90%
4	85%	85%
5	80%	80%
6	75%	75%
7	70%	70%
8	65%	65%
9	60%	60%
10	55%	55%
11	50%	50%
12	45%	45%
13	40%	40%
14	35%	35%
15	30%	30%
16	25%	25%
17	20%	20%
18	15%	15%
19	10%	10%
20	5%	5%
21	0%	0%

ES.5.3 Alternative 3: Full M&I Allocation Preference

Under Alternative 3, Full M&I Allocation Preference, M&I water service contractors would receive a 100 percent allocation as compared to the No Action Alternative and other action alternatives. Under this alternative, Reclamation would attempt to provide a 100 percent allocation to M&I water service contractors during water shortage conditions, to the extent that adequate CVP water supplies are available. This would be achieved by reducing allocations to agricultural water service contractors as needed to maximize the frequency of 100 percent allocations to the M&I water service contractors.

This allocation methodology would provide the lowest volume of CVP water to agricultural water service contractors compared to the No Action and other action alternatives. Also, this alternative will facilitate a tradeoff analysis that considers the potential effects associated with providing larger volumes of CVP water to M&I water service contractors. Alternative 3 would have no provisions for unmet PHS needs that would be made available by Reclamation from CVP water supplies. During water shortage conditions, M&I water service contractors would need to rely on available non-CVP supplies.

The allocation of available CVP water supplies between M&I and agricultural water service contractors during water shortage conditions is presented in Table ES-6.

Table ES-6. Alternative 3, Full M&I Allocation Preference, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors (% of Contract Total)
1	100%	100%
2	95%	100%
3	90%	100%
4	85%	100%
5	80%	100%
6	75%	100%
7	70%	100%
8	65%	100%
9	60%	100%
10	55%	100%
11	50%	100%
12	45%	100%
13	40%	100%
14	35%	100%
15	30%	100%
16	25%	100%
17	20%	100%
18	15%	100%

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors (% of Contract Total)
19	10%	100%
20	5%	100%
21[1]	0%	Between 100% to 0%

[1] Once agricultural water service contractor allocations have been reduced to zero and if CVP water supplies are not adequate to provide a 100 percent allocation to the M&I water service contractors, then the allocation to the M&I water service contractors would be reduced and would equal available CVP water supply.

ES.5.4 Alternative 4: Updated M&I WSP

Alternative 4, Updated M&I WSP, is similar to the No Action Alternative. This alternative comprises the updated M&I WSP developed by Reclamation with stakeholder input received during the M&I WSP stakeholder workshops held between May 2010 and January 2011.

The modifications made to the current Draft M&I WSP that are reflected in the Updated M&I WSP include the following:

- Deleted reference to 1996 M&I Water Rate book: Reclamation deleted the reference to 1996 M&I Water Rate book. In lieu of the M&I water service contractor demand projections provided in the 1996 M&I Water Rate book, implementation of Alternative 4 would make use of the M&I water service contractor demand projections provided in the most recent Water Needs Assessment that Reclamation and the respective water contractors developed for the Long-Term CVP Water Service Contract renewals.

- Replaced the two tables in Terms and Conditions 4 and 5: Reclamation deleted two tables in Terms and Conditions 4 and 5 of the 2001 Draft M&I WSP and replaced these with Table 3-5 (Alternative 1B) from the 2005 EA. This was done strictly for clarification purposes only since Table 3-5 is already in effect based on the adoption of the recommendations from the 2005 EA and associated Findings of No Significant Impact.

- Amended the methodology used to make adjustments to contractor's historical use: At the M&I water service contractors' request, Reclamation modified the method that would be used to adjust an M&I water service contractor's historical use.

- Clarification of key terms: Reclamation expanded the definitions of the key terms and also defined terms not previously defined to provide greater clarity on the intent and requirements of the key terms and conditions of the M&I WSP.

- Inclusion of recycled water as non-CVP supply: Reclamation expanded the definition of non-CVP supplies to include recycled water, subject to Reclamation approval.

ES.5.4.1 Water Allocation Methodology

The allocation of available CVP water supplies between M&I and agricultural water service contractors during water shortage conditions is presented in Table ES-7. In years when the CVP water supplies are not adequate to provide the Contract Total to all water service contractors, M&I water service contractor allocations would be maintained at 100 percent of their Contract Total as agricultural water service contractor allocations would be reduced to 75 percent of their Contract Total in several incremental steps. M&I water service contractor allocation reductions would begin once agricultural contractor allocations are reduced to 75 percent of Contract Total. At this point, M&I water service contractor allocations would be reduced to 75 percent of their historical use in several incremental steps as agricultural water service contractor allocations would be reduced to 50 percent of their Contract Total. The M&I water service contractor allocations would be maintained at 75 percent of their historical use until agricultural water service contractor allocations would be reduced in incremental steps to 25 percent of their Contract Total. Then, M&I water service contractor allocations would be reduced in incremental steps to 50 percent of historical use until agricultural water service contractor allocations would be reduced in incremental steps to zero.

In years when the M&I water service contractor allocations are less than 75 percent of historical use, M&I water service contractors may request an adjustment to their allocation to provide at least the unmet need portion of their PHS demand, up to a maximum of 75 percent of the M&I water service contractor historical use. There are some years in which allocations to agricultural water service contractors are at or near zero. In those years, the increased allocations to M&I water service contractors would not be fully realized. Also, though this alternative would target a minimum M&I water service contractor allocation of 50 percent of historical use or unmet PHS need, whichever is greater, the increased allocation is not guaranteed and would only be made available to the extent that CVP water supplies are available.

Alternative 4 does not guarantee delivery of any unmet PHS needs. Rather, the unmet PHS needs identified in this alternative would be targets that Reclamation would try to meet provided that sufficient CVP water supplies are available and provided that M&I water service contractors would first try to meet their PHS demands using their non-CVP supplies. In cases where an M&I water service contractor does not have access to sufficient non-CVP supplies to meet their PHS demands, Reclamation would try to meet their unmet portion of the PHS demands.

Table ES-7. Alternative 4, Updated M&I WSP, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors
1	100% - 75%	100% of contract total
2	70%	95% of historical use
3	65%	90% of historical use
4	60%	85% of historical use
5	55%	80% of historical use
6	50%-25%	75% of historical use [1]
7	20%	70% of historical use [1]
8	15%	65% of historical use [1]
9	10%	60% of historical use [1]
10	5%	55% of historical use [1]
11	0%	50% of historical use [1]

[1] Subject to PHS considerations described in Implementation Guidelines. Depending on CVP water supply conditions and CVP operational constraints, it is possible for M&I deliveries to be less than the unmet PHS needs and to be reduced below 50 percent if CVP water availability is insufficient.

ES.5.5 Alternative 5: M&I Contractor Suggested WSP

Alternative 5, M&I Contractor Suggested WSP, is similar to Alternative 4, Updated M&I WSP. This alternative was developed and recommended by several M&I water service contractors who participated in the M&I WSP workshops held between May 2010 and January 2011.

The differences between Alternative 4 and Alternative 5 include the following:

- Attempts to provide a greater level of assurance that CVP water will be allocated to M&I water service contractors to supply the unmet portion of the PHS demands during water shortage conditions.
- Requires modification to CVP operations, i.e., would provide increased carryover in CVP storage facilities to reserve water in storage to meet the ensuing year anticipated unmet portion of the M&I water service contractors' PHS demands.
- Increases the upper limit of when water would be reallocated from the agricultural water service contractors to provide at least the unmet PHS demands from 75 percent of historical use (used in Alternative 4) to 95 percent of historical use. This means that in years when the M&I water service contractor allocations would be 95 percent of historical use or less, water would be reallocated from agricultural water service contractors to provide the greater of the allocation percentage of historical use or the PHS need.
- Adjusts historical use first by the use of non-CVP supplies, then population growth, and finally extraordinary water conservation

measures, before the three years of adjusted historical use are averaged to calculate the overall adjusted historical use.

- Qualifies the use of non-potable supplies when considering non-CVP supplies for the determination of PHS unmet need. Non-potable non-CVP supplies would not be included as available non-CVP water satisfying PHS needs except to the extent that they are used to meet non-domestic uses of commercial, institutional, and industrial demands.

This alternative provides a greater level of assurance that CVP water will be allocated to M&I water service contractors to meet unmet PHS demands during water shortage years. This may mean that the water allocations to agricultural water service contractors would need to be reduced, and may require changing the timing and frequency of releases from CVP reservoirs. This alternative will facilitate an analysis of the tradeoff between providing a greater allocation of CVP water to M&I water service contractors and a reduced allocation to agricultural contractors compared to Alternative 4.

ES.5.5.1 Water Allocation Methodology

The allocation of available CVP water supplies between M&I and agricultural water service contractors during water shortage conditions is presented in Table ES-8. Alternative 5 does not guarantee delivery of any PHS needs. Rather the PHS needs identified in this alternative would be targets that Reclamation would try to meet provided that sufficient CVP water supplies are available and that M&I water service contractors would first try to meet their PHS demands using their non-CVP supplies. In cases where an M&I water service contractor does not have access to sufficient non-CVP supplies, or none at all, to meet their PHS demands, Reclamation would try to meet the unmet portion of the PHS demands with CVP water.

Alternative 5 may require the modification of priorities in terms of scheduling releases and calculating CVP carryover storage requirements. CVP and SWP storage facilities may be affected by Alternative 5 and storage targets and release objectives would be re-evaluated each year there is a water shortage condition. Reclamation may need to estimate the ensuing year M&I water service contractors' unmet PHS needs and retain sufficient carryover storage to increase the likelihood that sufficient CVP water supplies will be available in the ensuing year to meet these demands.

Table ES-8. Alternative 5, M&I Contractor Suggested WSP, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract total)	Allocation to M&I Water Service Contractors
1	100% to 75%	100% of contract total
2	70%	95% of historical use [1]
3	65%	90% of historical use [1]
4	60%	85% of historical use [1]
5	55%	80% of historical use [1]
6	50%-25%	75% of historical use [1]
7	20%	70% of historical use [1]
8	15%	65% of historical use [1]
9	10%	60% of historical use [1]
10	5%	55% of historical use [1]
11	0%	50% of historical use [1]

[1] Subject to PHS considerations described in Implementation Guidelines. Depending on CVP water supply conditions and CVP operational constraints, it is possible for M&I deliveries to be less than the PHS needs and to be reduced below 50 percent if CVP water availability is insufficient.

ES.6 Environmental Consequences

Table ES-9 summarizes the potential environmental impacts, including beneficial effects, for each alternative and identifies the magnitude and context of impacts with respect to certain resources. It was determined that no impacts or only minor impacts would occur to aquatic resources, terrestrial resources, environmental justice, Indian Trust Assets, Indian sacred sites, recreation, flood hydrology, and visual resources, so these resource areas are not included in Table ES-9. Potential effects discussion for all the resource areas is included within the respective chapters of the Draft EIS.

The potential resource impact discussions are organized by CVP division or unit, river system, hydrologic region, or modeling region, depending on the resource area.

ES.6.1 Impact Comparison – No Action Alternative

The No Action Alternative represents a projection to 2030 of current conditions (2010) to the most reasonable future conditions that could occur without any action alternative being implemented. There are foreseeable differences between the future No Action Alternative and the existing conditions, as described below. Potential impacts of the future No Action Alternative are compared against existing conditions, and these impacts are presented in the second column (Alternative 1) of Table ES-9.

CalSim II, the planning model designed to simulate operations of CVP and SWP reservoirs and water delivery systems, was used to simulate CVP operations, including CVP allocations and deliveries to water service contractors. The CalSim II model was first set up to model existing conditions, i.e., to simulate how the Delta, its major tributaries, and the CVP/SWP operate at the current level of development, associated water demands, and existing operating criteria.

To model the No Action Alternative, the CalSim II model incorporated how surface water operations may change in the future (2030) without implementation of any action alternative. Areas tributary to the Delta have experienced numerous physical and institutional changes over the decades, and are continuing to experience changes. However, reasonable assumptions must be made regarding these factors to estimate future conditions. Changes considered in the future No Action Alternative relative to existing conditions, which lead to the largest changes in the CVP/SWP system, include:

- Use of full Contract Totals for M&I water service contractor demand;
- Land use conversion from agricultural demand to urban demand, primarily in the American River Basin;
- Full San Joaquin River Restoration Program flows; and
- South Bay Aqueduct capacity expansion.

ES.6.2 Impact Comparison – Action Alternatives

Under NEPA, the basis of impact comparison for each of the action alternatives is the No Action Alternative**.** This provides for an evaluation of potential impacts of future conditions under an action alternative compared to future conditions under the No Action Alternative.

As noted in Chapter ES.6.1, anticipated system changes between the existing conditions and No Action Alternative will likely yield potential environmental impacts associated with the modeled differences between existing and No Action conditions. These impacts are irrespective of any of the policy changes associated with the action alternatives. The potential impacts that can be attributed to each action alternative are the relative differences of impacts observed between each respective action alterative and the No Action Alternative. These potential impacts are shown in the third through sixth columns of Table ES-9.

Although not required for NEPA analysis, it may be informational for the reader to consider the potential impact of an action alternative compared to existing conditions. The modeled differences between the existing conditions and future No Action Alternative are common in all the Action Alternatives. Therefore, the associated potential impacts observed between existing conditions and future No Action Alternative conditions are also common under all the Action Alternatives. In general, the impacts of the action alternatives compared to the No Action Alternative build upon the impacts of the No Action Alternative compared to existing conditions.

Table ES-9. Potential Impacts Summary

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Chapter 4, Surface Water					
Changes to the M&I WSP could result in changes to CVP deliveries to north of Delta (NOD) agricultural (ag) and M&I CVP water service contractors.	NOD Ag: 23 thousand acre-feet (TAF) to 37 TAF less NOD M&I: 91 TAF to 189 TAF more	NOD Ag: 3 TAF to 27 TAF more NOD M&I: 21 TAF o 176 TAF less	NOD Ag: 2 TAF to 14 TAF less NOD M&I: 5 TAF to 76 TAF more	No change from the No Action Alternative.	No change from the No Action Alternative.
Changes to the M&I WSP could result in years that PHS demand is not fully met in NOD CVP divisions.	Shasta/Trinity River Divisions: PHS demands not fully met in 10% of years Sacramento River Division: PHS demands met in all years American River Division: PHS demands met in all years	Shasta/Trinity River Divisions: PHS demands not fully met in 37% of years Sacramento River Division: PHS demands met in all years American River Division: PHS demands not fully met in 2% of years	Shasta/Trinity River Divisions: PHS demands not fully met in 1% of years Sacramento River Division: PHS demands met in all years American River Division: PHS demands met in all years	No change from the No Action Alternative.	Shasta/Trinity River Divisions: PHS demands met in all years Sacramento River Division: PHS demands met in all years American River Division: PHS demands met in all years
Changes to the M&I WSP could result in changes to the amount of unmet PHS demand in NOD CVP divisions.	Shasta/Trinity River Divisions: <1% of PHS demands unmet Sacramento River Division: PHS demands fully met American River Division: PHS demands fully met	Shasta/Trinity River Divisions: <1% to 14% of PHS demands unmet Sacramento River Division: PHS demands fully met American River Division: <1% of PHS demands unmet	Shasta/Trinity River Divisions: <1% of PHS demands unmet Sacramento River Division: PHS demands fully met American River Division: PHS demands fully met	No change from the No Action Alternative.	Shasta/Trinity River Divisions: PHS demands fully met Sacramento River Division: PHS demands fully met American River Division: PHS demands fully met

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes to the M&I WSP could result in changes to CVP deliveries to south of Delta (SOD) agricultural and M&I CVP water service contractors.	SOD Ag: 9 TAF to 109 TAF less SOD M&I: 20 TAF to 45 TAF more	SOD Ag: 35 TAF to 102 TAF more SOD M&I: 32 TAF to 78 TAF less	SOD Ag: 15 TAF to 71 TAF less SOD M&I: 17 TAF to 49 TAF more	No change from the No Action Alternative.	No change from the No Action Alternative.
Changes to the M&I WSP could result in years that PHS demand is not fully met in SOD CVP divisions.	Delta Division: PHS demands met in all years Cross Valley Canal Unit: PHS demands not fully met in 15% of years West San Joaquin Division: PHS demands not fully met in 85% of years San Felipe Division: PHS demands met in all years	Delta Division: PHS demands not fully met in 49% of years Cross Valley Canal Unit: PHS demands not fully met in 5% of years West San Joaquin Division: PHS demands not fully met in 90% of years San Felipe Division: PHS demands not fully met in 17% years	Delta Division: PHS demands met in all years Cross Valley Canal Unit: PHS demands not fully met in 19% of years West San Joaquin Division: PHS demands not fully met in 30% of years San Felipe Division: PHS demands met in all years	No change from the No Action Alternative.	Delta Division: PHS demands met in all years Cross Valley Canal Unit: PHS demands not fully met in 15% of years West San Joaquin Division: PHS demands met in all years San Felipe Division: PHS demands met in all years
Changes to the M&I WSP could result in changes to the amount of unmet PHS demand in SOD CVP divisions.	Delta Division: PHS demands fully met Cross Valley Canal Unit: <1% of PHS demands unmet West San Joaquin Division: <1% to 15% of PHS demands unmet San Felipe Division: PHS demands fully met	Delta Division: <1% of PHS demands unmet Cross Valley Canal Unit: <1% of PHS demands unmet West San Joaquin Division: <1% to 56% of PHS demands unmet San Felipe Division: 3% to 14% of PHS demands unmet	Delta Division: PHS demands fully met Cross Valley Canal Unit: <1% of PHS demands unmet West San Joaquin Division: <1% to 15% of PHS demands unmet San Felipe Division: PHS demands fully met	No change from the No Action Alternative.	Delta Division: PHS demands fully met Cross Valley Canal Unit: <1% of PHS demands unmet West San Joaquin Division: PHS demands fully met San Felipe Division: PHS demands fully met

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes to the M&I WSP could cause indirect water supply effects as CVP contractors secure alternative supplies or reduce water demands in response to reduced deliveries.	Potential increased use of surface water transfers and groundwater substitution by agricultural contractors due to decreased CVP deliveries.	Potential increased use of surface water transfers and groundwater substitution by M&I contractors above what would be anticipated under the No Action Alternative due to decreased CVP deliveries.	Potential increased use of surface water transfers and groundwater substitution by agricultural contractors above what would be anticipated under the No Action Alternative due to decreased CVP deliveries.	No change from the No Action Alternative.	Potential increased use of surface water transfers and groundwater substitution by agricultural contractors above what would be anticipated under the No Action Alternative due to decreased CVP deliveries.
Chapter 5, Water Quality					
Changes in salinity and bromide concentrations could affect water quality in the Delta Division.	Small changes in salinity and bromide concentrations from changes to river flows would not affect water quality.	Increase in electrical conductivity (EC) of 1.5 to 4.8% in April through June of critical years.	Increase in EC of 0.5 to 2.6% in July through September of critical years.	No change from the No Action Alternative.	Small changes from the No Action Alternative would not affect water quality.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Chapter 6, Groundwater					
M&I and/or agricultural water service contractors could supplement their surface water supplies through groundwater pumping.	Net change in pumping in the Sacramento River Region: up to 71 TAF less. Net change in groundwater pumping in the San Joaquin River Region: up to 50 TAF less. Net change in groundwater pumping in the Tulare Lake Region: range from 30 TAF less to 13 TAF more. Decreases in pumping due to increased pumping costs. Potential for increased groundwater pumping in San Francisco Bay/Central Coast Hydrologic Region due to reduced agricultural deliveries; however, no M&I PHS unmet need in this region.	Net change in groundwater pumping in the Sacramento River Region: up to 4 TAF less. Net change in groundwater pumping in the San Joaquin River Region: up to 32 TAF less. Net change in groundwater pumping in the Tulare Lake Region: up to 38 TAF less. Decreases in pumping due to increases in deliveries to agricultural contractors. Net change in groundwater pumping in the San Francisco Bay/Central Coast Hydrologic Region: up to 21 TAF more to meet M&I PHS needs.	Net change in groundwater pumping in the Sacramento River Region: up to 2 TAF more. Net change in groundwater pumping in the San Joaquin River Region: up to 21 TAF more. Net change in groundwater pumping in the Tulare Lake Region: up to 15 TAF more. Increases in pumping due to decreases in deliveries to agricultural contractors. Net change in groundwater pumping in the San Francisco Bay/Central Coast Hydrologic Region: up to 1.5 TAF less due to increased M&I deliveries.	No change from the No Action Alternative.	Net change in groundwater pumping in less than 1 TAF in all regions compared to the No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Increased groundwater pumping to supplement supply shortages may cause groundwater level declines that could lead to permanent land subsidence	No impact to the Sacramento River and San Joaquin River regions. Net increase in pumping could potentially increase subsidence in the Tulare Lake Region.	No impact to the Sacramento River, San Joaquin River, and Tulare Lake regions. Net increase in pumping could potentially increase subsidence in the San Francisco Bay/Central Coast Hydrologic Region.	Net increase in pumping could potentially increase subsidence in the Sacramento Valley, San Joaquin Valley, and Tulare Lake regions. No impact to the San Francisco Bay/Central Coast Hydrologic Region.	No change from the No Action Alternative.	Minor changes in pumping not expected to affect subsidence in all regions.
Chapter 7, Geology and Soils					
Reduced CVP deliveries to agricultural water service contractors could indirectly lead to fugitive dust if crop idling is implemented.	Possible increased fugitive dust from new barren land if crop idling implemented due to decreased deliveries to agricultural contractors.	No impacts due to increased deliveries to agricultural contractors.	Possible increased fugitive dust from new barren land if crop idling implemented due to decreased deliveries to agricultural contractors.	No change from the No Action Alternative.	No change from the No Action Alternative.
Chapter 8, Air Quality					
Changes in CVP deliveries to M&I and agricultural water service contractors could result in a change in emissions if more pumping is necessary to deliver water.	Possible increased emissions at powerplants because of increased CVP deliveries to M&I water service contractors.	Possible decreased emissions at powerplants because of decreased CVP deliveries to M&I water service contractors.	Possible increased emissions at powerplants because of increased CVP deliveries to M&I water service contractors.	No change from the No Action Alternative.	No change from the No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes in CVP deliveries to agricultural and M&I water service contractors in the Sacramento Valley Air Basin could affect agricultural production, leading to changes in emissions from groundwater pumping from agricultural contractors	• volatile organic compound (VOC): -4 tons per year (tpy) to -3 tpy • nitrogen oxides (NOx): -77 tpy to -54 tpy • carbon monoxide (CO): -101 tpy to -72 tpy • sulfur oxides (SOx): -25 tpy to -18 tpy • inhalable particulate matter (PM_{10}): -6 tpy to -4 tpy • fine particulate matter ($PM_{2.5}$): -6 tpy to -4 tpy Decreases in emissions due to decreases in pumping as a result of increased pumping costs.	• VOC: <1 tpy • NOx: -5 tpy to -1 tpy • CO: -7 tpy to -2 tpy • SOx: -2 tpy to <1 tpy • PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Decreases in emissions due to decreases in pumping as a result of increased deliveries to agricultural contractors.	• VOC: <1 tpy • NOx: <1 tpy to 2 tpy • CO: <1 tpy to 3 tpy • SOx: <1 tpy to 1 tpy • PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Small increases in emissions due to small increases in pumping as a result of decreases in deliveries to agricultural contractors.	No change from the No Action Alternative.	• VOC: <1 tpy • NOx: <1 tpy • CO: <1 tpy • SOx: <1 tpy • PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Minor changes to emissions and pumping compared to the No Action Alternative.
Changes in CVP deliveries to agricultural and M&I water service contractors in the Sacramento Valley Air Basin could affect agricultural production, leading to changes in fugitive dust emissions from land preparation and harvesting activities from agricultural contractors, as well as changes to windblown dust erosion.	• PM_{10}: 164 tpy to 233 tpy • $PM_{2.5}$: 25 tpy to 35 tpy Increases in emissions due to increases in land under production, as agricultural contractors make use of alternative water supplies or shift to less water intensive crops.	• PM_{10}: <1 tpy to 41 tpy • $PM_{2.5}$: <1 tpy to 6 tpy Increases in emissions due to increases in land under production as a result of increased CVP deliveries to agricultural contractors.	• PM_{10}: -26 tpy to <1 tpy • $PM_{2.5}$: -4 tpy to <1 tpy Decreased emissions due to decreased land under production as a result of decreased CVP deliveries to agricultural contractors.	No change from the No Action Alternative.	• PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Very minimal changes to emissions due to negligible changes in CVP deliveries.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes in CVP deliveries to agricultural and M&I water service contractors in the San Joaquin Valley Air Basin could affect agricultural production, leading to changes in emissions from groundwater pumping from agricultural contractors	• VOC: -5 tpy to <1 tpy • NOx: -87 tpy to +5 tpy • CO: -114 tpy to +6 tpy • SOx: -28 tpy to +1 tpy • PM_{10}: -7 tpy to <1 tpy • $PM_{2.5}$: -7 tpy to <1 tpy Decreases in emissions due to decreases in pumping as a result of increased pumping costs.	• VOC: -3 tpy to -2 tpy • NOx: -54 tpy to -38 tpy • CO: -71 tpy to -49 tpy • SOx: -18 tpy to -12 tpy • PM_{10}: -4 tpy to -3 tpy • $PM_{2.5}$: -4 tpy to -3 tpy Decreases in emissions due to decreases in pumping as a result of increased pumping costs.	• VOC: 1 tpy to 2 tpy • NOx: 14 tpy to 32 tpy • CO: 19 tpy to 42 tpy • SOx: 5 tpy to 10 tpy • PM_{10}: 1 tpy to 2 tpy • $PM_{2.5}$: 1 tpy to 2 tpy Increases in emissions due to increases in pumping as a result of decreases in deliveries to agricultural contractors.	No change from the No Action Alternative.	• VOC: <1 tpy • NOx: <1 tpy to 1 tpy • CO: <1 tpy to 1 tpy • SOx: <1 tpy • PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Minor changes to emissions and pumping compared to the No Action Alternative.
Changes in CVP deliveries to agricultural and M&I water service contractors in the San Joaquin Valley Air Basin could affect agricultural production, leading to changes in fugitive dust emissions from land preparation and harvesting activities from agricultural contractors, as well as changes to windblown dust erosion.	• PM_{10}: 26 tpy to 34 tpy • $PM_{2.5}$: -2 tpy to +4 tpy Increases in emissions due to increases in land under production, as agricultural contractors make use of alternative water supplies or shift to less water intensive crops.	• PM_{10}: -36 tpy to <1 tpy • $PM_{2.5}$: -15 tpy to <1 tpy Decreases in emissions due decreases in windblown dust erosion from the increase in land under production.	• PM_{10}: <1 tpy to 26 tpy • $PM_{2.5}$: <1 tpy to 10 tpy Increased emissions due to dust erosion from increased barren land as a result of decreased CVP deliveries to agricultural contractors.	No change from the No Action Alternative.	• PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Very minimal changes to emissions due to negligible changes in CVP deliveries.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes in emissions that would occur from groundwater pumping and differences in irrigated acreages could exceed the general conformity de minimis thresholds.	Impact not applicable to the No Action Alternative.	Emissions from all pollutants except for PM_{10} in the Sacramento Metropolitan region would decrease compared to the No Action Alternative. PM_{10} emissions increase would not exceed general conformity de minimum thresholds.	Emissions from all pollutants would increase compared to the No Action Alternative. Emissions in the Sacramento Metropolitan region would not exceed the general conformity de minimis thresholds. NOx emissions in San Joaquin Valley would exceed the de minimis threshold and a general conformity determination would need to be developed if Alternative 3 is selected as the preferred alternative because the alternative could indirectly affect criteria pollutant emissions,	No change from the No Action Alternative.	Emission increases would be minimal compared to the No Action Alternative and general conformity de minimis thresholds would not be exceeded.
Chapter 9, Greenhouse Gases and Climate Change					
Changes in CVP deliveries to agricultural and M&I water service contractors in the area of analysis could affect agricultural production, leading to changes in greenhouse gas (GHG) emissions from groundwater pumping from agricultural contractors.	Change in GHG emissions compared to existing conditions: -30,044 metric tons carbon dioxide equivalent per year ($MTCO_2e$/yr) to -9,187 $MTCO_2e$/yr. Decreases in emissions due to decreases in pumping as a result of increased pumping costs.	Change in GHG emissions compared to the No Action Alternative: -10,894 $MTCO_2e$/yr to -7,506 $MTCO_2e$/yr. Decreases in emissions due to decreases in pumping as a result of increased deliveries to agricultural contractors.	Change in GHG emissions compared to the No Action Alternative: +2,715 $MTCO_2e$/yr to +5,753 $MTCO_2e$/yr. Increases in emissions due to increases in pumping as a result of decreases in deliveries to agricultural contractors.	No change from the No Action Alternative.	Change in GHG emissions compared to the No Action Alternative: +15 $MTCO_2e$/yr to +136 $MTCO_2e$/yr. Slight increases to emissions and pumping compared to the No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Chapter 12, Agricultural Resources					
Changes in CVP deliveries to agricultural water service contractors could convert agricultural lands under the Williamson Act and other land resource programs to an incompatible use.	Minimal changes compared to existing conditions due to minor changes agricultural land use.	No conversion of agricultural land to incompatible uses compared to the No Action Alternative.	An adverse impact to the Tulare Lake Region by reducing agricultural acreage by 23,000 acres (approximately a 1% loss). Minimal loses to irrigated farmlands in the other regions for all year types.	No change from the No Action Alternative.	No change from the No Action Alternative.
Indirect effects could occur from implementation of the alternative.	Possible decrease in agricultural land in production north of the Delta and increase in agricultural land in production south of the Delta as a result of water transfers or crop idling.	None.	Possible decrease in agricultural land in production north of the Delta and increase in agricultural land in production south of the Delta as a result of water transfers or crop idling.	No change from the No Action Alternative.	No change from the No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Chapter 13, Socioeconomics					
Alternatives could result in economic effects to M&I water service contractors and the regional economy.	Sacramento Valley Region: In some years, minimal PHS needs would not be met, which could result in minimal adverse economic effects to the region if contractors implement options that increase costs. American River Region – all PHS needs would be met, which would result in positive economic effects for existing and new developments. San Joaquin Valley Region – PHS needs would not be met in multiple years for some contractors, which would result in short- and long-term adverse economic impacts. Bay Area Region – all PHS needs would be met, which would result in positive economic effects for existing and new developments.	Adverse impacts to regional economies due to decreased CVP deliveries to M&I contractors. *Average annual* impacts would be: Sacramento Valley Region Output: -$1.5 million Employment: -13 jobs Labor Income: -$0.46 million Value Added: -$0.93 million American River Region Output: -$6.7 million Employment: -52 jobs Labor Income: -$4.3 million Value Added: -$4.3 million San Joaquin Valley Region Output: -$5.5 million Employment: -43 jobs Labor Income: -$1.6 million Value Added: -$1.8 million Bay Area Region Output: -$5.4 million Employment: -37 jobs Labor Income: -$2.0 million Value Added: -$3.5 million	Positive effects to regional economies due to increased CVP deliveries to M&I contractors. *Average annual* impacts would be: Sacramento Valley Region Output: $0.75 million Employment: 6 jobs Labor Income: $0.24 million Value Added: $0.48 million American River Region Output: $3.8 million Employment: 30 jobs Labor Income: $1.3 million Value Added: $2.5 million San Joaquin Valley Region Output: $3.0 million Employment: 24 jobs Labor Income: $0.9 million Value Added: $1.8 million Bay Area Region Output: $6.4 million Employment: 44 jobs Labor Income: $2.4 million Value Added: $4.2 million	Same as No Action Alternative.	Similar to or less than No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Alternatives could result in economic effects to crop value of production and the regional economy.	Adverse impacts to agricultural value of production due to CVP water shortages in the Sacramento River, San Joaquin River, and Tulare Lake regions.	Positive effects to regional economies due to increased CVP deliveries to agricultural contractors: Effects in *critical* water years - Sacramento River Region Output: $52.3 million Employment: 402 jobs Labor Income: $18.4 million Value Added: $31.1 million San Joaquin River Region Output: -$7.5 million Employment: -55 jobs Labor Income: -$2.7 million Value Added: -$4.4 million Tulare Lake Region Output: $71.4 million Employment: 332 jobs Labor Income: $15.1 million Value Added: $27.8 million	Adverse Impacts to regional economies due to decreased CVP deliveries to agricultural contractors: Effects in *critical* water years - Sacramento River Region Output: -$23.6 million Employment: -185 jobs Labor Income: -$8.4 million Value Added: -$14.2 million San Joaquin River Region Output: $8.1 million Employment: 54 jobs Labor Income: $3.0 million Value Added: $4.9 million Tulare Lake Region Output: -$72.8 million Employment: -502 jobs Labor Income: -$21.1 million Value Added: -$36.6 million	Same as No Action Alternative.	Similar to or less than No Action Alternative.
Alternatives could change groundwater pumping costs for agricultural water service contractors.	CVP water shortages could increase pumping costs for agricultural water service contractors.	Pumping costs would decrease by $2.4 million in San Joaquin Region and $1.5 million in Tulare Lake Region.	Pumping costs would increase by $1.3 million in San Joaquin River Region and $0.8 million in Tulare Lake Region.	Same as No Action Alternative.	Similar to or less than No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Implementation of cropland idling water transfers could result in indirect economic effects.	Adverse impacts - cropland idling transfers could result in reductions in value of output, employment, labor income and value added in Sacramento Valley counties where cropland idling could occur.	Adverse impacts - cropland idling transfers could result in reductions in value of output, employment, labor income and value added in Sacramento Valley counties where cropland idling could occur.	Adverse impacts - cropland idling transfers could result in reductions in value of output, employment, labor income and value added in Sacramento Valley counties where cropland idling could occur.	Same as No Action Alternative.	Similar to or less than No Action Alternative.
Chapter 17, Power					
Changes in CVP deliveries may cause changes in power generation from hydroelectric power generation facilities by changing reservoir releases or by changing reservoir storage (as represented by changes in reservoir elevations).	There would be an adverse impact in the amount of power generated by Folsom and Nimbus powerplants as a result of a reduction in monthly flows of up to 39%. In addition, monthly changes in storage at San Luis Reservoir would vary between 23% less to 17% more and therefore adversely impact the amount of power generated.	Minimal reductions to the amount of power generated at the Folsom and Nimbus powerplants, as a result of changes in flows between 2% less and 17% more as compared to the No Action Alternative. Power generated at the San Luis Reservoir powerplants would slightly change as compared to the No Action Alternative as a result of changes in storage between 5% less and 10% more.	Decrease in the amount of power generated at the Folsom and Nimbus powerplants as a result of an up to 10% decrease in flows in the American River. Storage at the San Luis Reservoir would change between 3% less and 10% more, compared to the No Action Alternative, and therefore minimal decrease the amount of power generated from the San Luis Reservoir powerplants.	No change from No Action Alternative.	No change from No Action Alternative.

ES.7 Issues of Known Controversy

Issues and concerns raised during the public scoping process are documented in the M&I WSP Public Scoping Meeting Summary Report (Reclamation 2011). Key issues raised during the public scoping process that are applicable for inclusion in the EIS are listed below.

- The final M&I WSP should be a single document that clearly states how Reclamation interprets and implements the M&I WSP.
- Any additional water provided to M&I water service contractors is viewed as water "taken" from agricultural contractors.
- M&I water service contractors would like a guaranteed level of PHS deliveries and do not want their use of non-CVP supplies to count against their deliveries of CVP water in shortage years.
- The analysis should use an appropriate baseline given ongoing regulatory issues regarding CVP/SWP operations.
- The effects analysis should include a cumulative impact discussion in the context of other reasonably foreseeable past, present, and future actions potentially affecting the allocation of CVP water, including the Bay Delta Conservation Plan.
- The EIS should analyze the impacts to water service contractors who have limited access to alternative water supplies and to "mixed use" contractors.
- The M&I WSP EIS should specifically state the agencies that are and are not affected by the policy, and state that the M&I WSP will apply equally to all M&I contractors, including the American River Division contractors.
- The American River Division contractors disagree with Reclamation's interpretation of Term 14 of SWRCB Decision 893 and believe it should provide them with additional supply reliability beyond what the M&I WSP provides in their water service contracts.

ES.8 Issues to be Resolved

The Final EIS will present the preferred alternative.

ES.9 References

Reclamation. 2004. *Long-Term Central Valley Project Operations Criteria and Plan, CVP-OCAP*. June 30, 2004.

______. 2011. *Central Valley Project Municipal and Industrial Water Shortage Policy Scoping Report*. July 2011.

______. 2013. *Central Valley Project (CVP) Water Contracts Fact Sheet*. Accessed on: 07/16/2014. Available: http://www.usbr.gov/mp/PA/water/docs/CVP_Water_Contracts_Fact_Sheet.pdf.

______. 2014. *Summary of Water Supply Allocations*. Accessed on: 08/01/2014. Available: http://www.usbr.gov/mp/cvo/vungvari/water_allocations_historical.pdf.

This page left blank intentionally.

Contents

Page

Tables

Figures

Appendices

Abbreviations and Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
µg/m3	micrograms per cubic meter
µg/L	micrograms per liter
1-D	one-dimensional
AB	Assembly Bill
ACEP	Agricultural Conservation Easement Program
AF	acre-feet or acre-foot
AFY	Acre-feet per year
Ag	Agriculture
Alt	alternative
AN	above normal
AP	Agricultural Preserve
AP-42	Compilation of Air Pollutant Emission Factors
APA	Administrative Procedure Act
APCD	Air Pollution Control District
AQMD	Air Quality Management District
Arvin-Edison	Arvin-Edison Water Storage District
ATCM	Airborne Toxic Control Measure
BAWSCA	Bay Area Water Supply and Conservation Agency
BDCP	Bay Delta Conservation Plan
bgs	below ground surface
BHP	brake-horsepower
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMO	basin management objective
BMP	best management practice
BN	below normal
BO	Biological Opinion
C	critical
C&I	commercial and industrial
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CalEEMod	California Emissions Estimator Model

Cal/EPA	California Environmental Protection Agency
CALFED	State (CAL) and Federal (FED) agencies participating in the Bay-Delta Accord
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CAT	Climate Action Team
CCAA	California Clean Air Act
CCC	Central California Coast
CCCC	California Climate Change Center
CCFB	Clifton Court Forebay
CCR	California Code of Regulations
CCSM	Community Climate System Model
CCWD	Contra Costa Water District
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CDPR	California Department of Parks and Recreation
CEC	California Energy Commission
CED	constant elasticity of demand
CEQ	Council on Environmental Quality
CES	Constant Elasticity of Substitution
CESA	California Endangered Species Act
CFCP	California Farmland Conservancy Program
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH4	Methane
cm	centimeters
CNPS	California Native Plant Society
CNRM	Centre National de Recherches Meteorologiques
CO	carbon monoxide
CO2	carbon dioxide
CO2e	carbon dioxide equivalent
COA	Coordinated Operations Agreement
CRP	Conservation Reserve Program
CSAC	California State Association of Counties
CSD	Community Services District
CSWR	California Wild and Scenic Rivers

CVC	Cross Valley Canal
CVFPB	Central Valley Flood Protection Board
CVHM	Central Valley Hydrologic Model
CVP	Central Valley Project
CVP IRP	Central Valley Project Integrated Resource Plan
CVPIA	Central Valley Project Improvement Act
CVPM	Central Valley Production Model
CWA	Clean Water Act
CWHR	California Wildlife Habitats Relationship System
CWSR	California Wild and Scenic Rivers
D	dry
DAU	Detailed Analysis Units
DCC	Delta Cross Channel
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DDW	Division of Drinking Water
Delta	Sacramento-San Joaquin River Delta
DICU	Delta Island Consumptive Use
DLRP	Division of Land Resource Protection
DMC	Delta-Mendota Canal
DMS	Delta Modeling Section
DOC	Department of Conservation
DOC	dissolved organic carbon
DOI	Department of the Interior
DOSS	Delta Operations for Salmonids and Sturgeon
DPS	Distinct Population Segment
DSM2	Delta Simulation Model-2
DWR	Department of Water Resources
EA	Environmental Assessment
EBMUD	East Bay Municipal Utility District
EC	electrical conductivity
EDD	Economic Development Department
EFH	Essential Fish Habitat
EI	Ensemble-Information
EIS	Environmental Impact Statement
ESA	Endangered Species Act

ESU	Evolutionarily Significant Units
ET	evapotranspiration
FEMA	Federal Emergency Management Agency
FMMP	Farmland Mapping and Monitoring Program
FR	Federal Register
FRAP	Fire and Resource Assessment Program
FRPM10	fraction of PM10
FRSA	Feather River Service Area
FSZ	Farmland Security Zone
ft	feet
GAMA	Groundwater Ambient Monitoring and Assessment
GCM	global climate model
GFDL	Geophysical Fluids Dynamics Laboratory
GHG	greenhouse gas
GMPs	Groundwater Management Plan
GPS	Global Positioning System
GWP	global warming potential
HCP	Habitat Conservation Plan
HDBs	Hamlet Development Boundaries
hp	horsepower
hr/yr	hours per year
HYDRO	hydrodynamic module
ID	Irrigation District
IMPLAN	IMpact analysis for PLANning
InSAR	Interferometric Synthetic Aperture Radar
IPCC	Intergovernmental Panel on Climate Change
ITA	Indian Trust Asset
ITP	Incidental Take Permit
km	kilometer
LARFMS	Lower American River Flow Management Standard
LCPSIM	Least Cost Planning Simulation Model
LOC	local surface water delivery or direct diversion
LOD	Level of Development
LP	linear programming
M&I	municipal and industrial

M&I WSP	Municipal and Industrial Water Shortage Policy
MAF	million acre-feet
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
mg/L	milligrams per liter
mgd	million gallons per day
MIG	Minnesota IMPLAN Group
MILP	mixed integer linear programming
mph	miles per hour
MTCO2e/yr	metric tons carbon dioxide equivalent per year
MW	megawatts
MWC	Mutual Water Company
MWh	megawatt-hours
N2O	nitrous oxide
NAA	nonattainment area
NAAQS	National Ambient Air Quality Standards
NCAR	National Center for Atmospheric Research
NCP	Navigational Control Point
NDO	Net Delta Outflow
NDOI	Net Delta Outflow Index
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NH3	ammonia
NHPA	National Historical Preservation Act
NO2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Oceanic and Atmospheric Administration National Marine Fisheries Service
NoCC	No Climate Change
NOD	North of Delta
NOx	nitrogen oxides
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRDC	Natural Resources Defense Council
NTU	nephelometric turbidity units

NWSR	National Wild and Scenic River
NWSRA	National Wild and Scenic Rivers Act
NWSRS	National Wild and Scenic Rivers System
O&M	operations and maintenance
O3	ozone
OCAP	Operations Criteria and Plan
OEHHA	Office of Environmental Health Hazard Assessment
OMR	Old and Middle River
OPWEM	Other Project Water Economic Model
OPR	Office of Planning and Research
Or	Old River
Pb	lead
PCBs	polychlorinated biphenyls
PCE	perchloroethylene
PCM	Parallel Climate Model
PCWA	Placer County Water Agency
PFMC	Pacific Fishery Management Council
PHS	public health and safety
PL	Public Law
PM10	inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns
PM2.5	fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PMP	Positive Mathematical Programming
Porter-Cologne Act	California Porter-Cologne Water Quality Act
ppm	parts per million
ppt	parts per thousand
PRC	Public Resource Code
PTM	particle tracking module
PVWMA	Pajaro Valley Water Management Agency
QUAL	water quality module
Reclamation	Department of the Interior, Bureau of Reclamation
RKI	River Kilometer Index
ROD	Record of Decision
RPA	Reasonable and Prudent Alternative
RS	Rock Slough

RWQCB	Regional Water Quality Control Board
SAFCA	Sacramento Flood Control Agency
SB	Senate Bill
SBCWD	San Benito County Water District
SCS	USDA, Soil Conservation Service
SCVWD	Santa Clara Valley Water District
SCWA	Sacramento County Water District
SDIP	South Delta Improvements Program
SDWA	Safe Drinking Water Act
SIP	State Implementation Plan
SJRRP	San Joaquin River Restoration Program
SJWD	San Juan Water District
SLC	San Luis Canal
SLDMWA	San Luis & Delta-Mendota Water Authority
SLLPIP	San Luis Reservoir Low Point Improvement Project
SMS	Scenery Management System
SMSCG	Montezuma Slough salinity control gates
SMUD	Sacramento Municipal Utility District
SO2	sulfur dioxide
SOD	South of Delta
SOx	sulfur oxides
SR	State Route
SRA	State Recreation Area
SRTTG	Sacramento River Temperature Task Group
State	State of California
SWAP	Statewide Agricultural Production
SWP	State Water Project
SWRB	State Water Rights Board
SWRCB	State Water Resources Control Board
SWRI	Surface Water Resources Inc.
TAF	thousand acre-feet
TBI	The Bay Institute
TDS	total dissolved solids
TIPU	transportation, information, public utilities
THMs	trihalomethanes
TMDL	Total Maximum Daily Loads
tpy	tons per year
U.S.	United States

UCCE	University of California Cooperative Extension
UDBs	Urban Development Boundaries
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
VC	Victoria Canal
VOCs	volatile organic compounds
W	wet
Water Code	California Water Code
WCM	Water Control Manual
WD	Water District
WEG	Wind Erodibility Group
WOMT	Water Operations Management Team
WQCP	Water Quality Control Plan
WSD	Water Storage District
WY	Water Year
yr	year

This page left blank intentionally.

Chapter 1
Introduction

The Central Valley Project (CVP) is a Bureau of Reclamation (Reclamation) federal water project in the State of California (State). The project supplies irrigation and municipal water, produces hydropower, and provides flood control and recreation from its many large reservoirs. The CVP delivers approximately 7 million acre-feet (AF) of water on an average annual basis to agricultural, municipal, and environmental uses in the Sacramento and San Joaquin valleys, cities and industries in Sacramento and the east and south Bay Areas, and to fish hatcheries and wildlife refuges throughout the Central Valley. CVP facilities include 20 dams and reservoirs, 39 pumping plants, 2 pumping-generating plants, and 11 powerplants. The CVP includes over 500 miles of major canals as well as conduits, tunnels, and related facilities. Figure 1-1 shows major CVP facilities and the CVP service area.

Persistent drought conditions and state and federal regulatory requirements have reduced the amount of water available for consumptive uses by CVP water service contractors. Additionally, in the future, it is anticipated that hydrologic conditions, climate variability, and regulatory requirements for the operation of CVP and other California water supply projects may also affect and possibly limit water supply availability.

This Environmental Impact Statement (EIS) was prepared to provide National Environmental Policy Act (NEPA) compliance for an updated Municipal and Industrial Water Shortage Policy (M&I WSP) pursuant to and in accordance with NEPA (42 United States Code §4321-4370d), Council on Environmental Quality regulations on implementing NEPA (40 Code of Federal Regulations [CFR] §1500-1508), and Department of the Interior NEPA Implementation Regulations (43 CFR Part 46). As such, this EIS evaluates alternatives considered by Reclamation to update the M&I WSP. Reclamation is the Lead Agency under NEPA.

Figure 1-1. CVP Service Area and Major CVP Features

1.1 Background and History

Reclamation was established in 1902 to encourage homesteading and economic development in the western United States (U.S.). Today, Reclamation is the largest wholesaler of water in the country, and second largest producer or hydroelectric power in the western U.S. Reclamation's Mid-Pacific Region is responsible for managing the CVP, which stores and delivers about 20 percent of the State's developed water. Construction of the CVP began in the 1930s under the California Central Valley Project Act. Designs for the CVP were originally initiated by the State, motivated by a fear of floods and drought, and a desire to transport water from the northern end of the Central Valley to the drier southern end to meet the increasing demand for water. The project was stalled due to economic constraints on the sale of revenue bonds by the state, and as a result, the federal government assumed control of the project in 1935 with the Rivers and Harbors Act. When the River and Harbors Act was reauthorized in 1937, Reclamation took over CVP construction and operation and the CVP became subject to Reclamation law.

The CVP is operated as an integrated system, to the extent practicable, with reservoirs on the Trinity, Sacramento, American, Stanislaus, and San Joaquin rivers. The June 2004 "Long-Term Central Valley Project Operations Criteria and Plan, CVP-OCAP" (OCAP) described the authorizations for the CVP under the Rivers and Harbors Act of August 26, 1937, which provided that the CVP dams and reservoirs be "used, first, for river regulation, improvement of navigation and flood control; second, for irrigation and domestic uses; and third, for power." The OCAP further details changes, in accordance with the 1992 Central Valley Project Improvement Act (CVPIA) that "modified the 1937 act and specified that the dams and reservoirs of the CVP should now be used first, for river regulation, improvement of navigation, and flood control; second for irrigation and domestic uses and fish and wildlife mitigation, protection and restoration purposes; and third for power and fish and wildlife enhancement." (Reclamation 2004)

The OCAP also described constraints to the operations of the CVP, stating that:

> *"State Water Resources Control Board (SWRCB) decisions and orders and the biological opinions for endangered species largely determine Delta regulatory requirements for water quality, flow, and operations. SWRCB Water Quality Control Plan (WQCP) and applicable water rights decisions, as well as other agreements, [were] considered in determining the operations of the Central Valley Project (CVP) and the State Water Project (SWP)." (Reclamation 2004)*

The applicable water rights decisions and orders include satisfaction of senior water rights and riparian water rights, requirements of water right settlement and exchange contracts with the CVP, as well as water quality requirements established by the SWRCB. The CVPIA also requires the CVP to provide water for refuge water supplies and for implementation of fish and wildlife requirements under Section 3406(b)(2) of the CVPIA.

The OCAP also described the allocation of CVP water supply for water service contracts and Sacramento River Settlement Contracts, as described in the following manner.

> *"Those water service contracts had many varying water shortage provisions. In some contracts, M&I and agricultural use shared shortages equally. In most of the larger M&I contracts, agricultural water was shorted 25 percent of its contract entitlement before M&I water was shorted, and then both shared shortages equally." (Reclamation 2004)*

As the CVP system was being developed, there were no shortages to contract allocations because the actual water demands were less than the water supply each year. The first drought occurred in 1977 to 1978 when severe hydrologic conditions resulted in extremely restricted water supplies and the second drought occurred in 1987 to 1992. Following adoption of the CVPIA and subsequent changes of the SWRCB orders and decisions related to operations of the CVP, water supplies also were reduced due to regulatory conditions as well as hydrologic reductions. For example, limitations on the CVP ability to convey water across the Sacramento-San Joaquin River Delta (Delta) in accordance with SWRCB orders and decisions can result in lower allocations for CVP water users located south of the Delta as compared to CVP water users located north of the Delta.

During an average year, the CVP delivers approximately 7 million AF per year (AFY) of water for agricultural, urban, and wildlife use. Of that total, 5 million AFY is delivered to farms, enough water to irrigate approximately one-third of the agricultural land in California. The balance of the CVP deliveries is divided as follows: 600,000 AFY for M&I use in Contra Costa, Santa Clara, and Sacramento counties; 800,000 AFY to fish and wildlife and their habitat; and 422,251 AFY to state and federal wildlife wetlands.

Reclamation balances CVP water allocations for agricultural, environmental, and M&I purposes based on factors such as hydrology, water rights, reservoir storage, environmental considerations, and operational limitations. Each year Reclamation determines the amount of water that can be allocated to each water contractor based on water supply availability conditions for that year. These allocations are expressed as a percentage of the Contract Total or historical use according to the contracts held between Reclamation and the various water districts, municipalities, and other entities. Reduced precipitation, low storage levels, and operational and environmental constraints lead to reduced water allocations. Reclamation and the CVP water service contractors recognize that delivery of the Contract Total is not guaranteed and that deliveries may be equal to or less than historical deliveries. Table 1-1 summarizes CVP allocations, as percentages of contract amount, delivered to agricultural and urban water contractors north and south of the Delta from 2000 through 2014.

Table 1-1. CVP Water Supply Allocation Percentages 2000 through 2014

Year	Year Type	Agriculture[1]		M&I	
		North of Delta (%)	South of Delta (%)	North of Delta (%)	South of Delta (%)
2000	AN	100	65	100	90
2001	D	60	49	85	77
2002	D	100	70	100	95
2003	AN	100	75	100	100
2004	BN	100	70	100	95
2005	AN	100	90	100	100
2006	W	100	100	100	100
2007	D	100	50	100	75
2008	C	40	40	75	75
2009	D	40	10	100	60
2010	BN	100	45	100	75
2011	W	100	80	100	100
2012	BN	100	40	100	75
2013	D	75	20	100/75[2]	70
2014	D[3]	0	0	50[4]	50[4]

Source: Reclamation 2014

Notes:

[1] Allocations apply to water service contracts, and do not apply to Sacramento River Settlement Contractors, San Joaquin River Exchange Contractors, or CVPIA refuges.

[2] In 2013, American River M&I users received 75 percent of Contract Total.

[3] Calculated utilizing May 1, 2014 50% exceedance forecast for Sacramento River unimpaired runoff.

[4] Historical Use applied to allocations.

Key:

C = Critical, D = Dry, BN = Below Normal, AN = Above Normal, W = Wet

1.2 Proposed Action

The proposed action is the adoption of an updated M&I WSP and implementation guidelines. The M&I WSP and implementation guidelines would remain in effect through 2030 and would be used to determine M&I water supply allocations under low water supply or shortage conditions.

The updated M&I WSP would be used by Reclamation to:

- Define water shortage terms and conditions for applicable CVP M&I water service contractors, as appropriate;
- Establish CVP water supply allocations that, together with the M&I water service contractors' drought water conservation measures and other non-CVP water supplies, would assist the M&I water service contractors in their efforts to protect public health and safety during severe or continuing droughts; and
- Provide information to M&I water service contractors for their use in water supply planning and development of drought contingency plans.

1.3 Purpose and Need for Action

1.3.1 History of the WSP

In January 1993, following the adoption of the CVPIA, many CVP M&I water service contractors expressed concerns regarding future allocations of water supplies provided by the CVP. Reclamation subsequently initiated an effort to develop an M&I WSP that would be incorporated into long-term water service contracts during the contract renewal process implemented under the CVPIA.

As part of the process to develop an M&I WSP, the M&I water service contractors identified the following reasons for the need for increased water supply allocations during shortage conditions:

(1) Long-term planning processes and facilities construction require long-term knowledge of water supply allocations; and

(2) Consideration for increased reliability due to higher M&I water service rates than agricultural water service contract rates.

Agricultural water service contractors were concerned that changes to the CVP allocation process could reduce water supplies and that increased M&I allocations could be implemented through willing buyer/willing seller transfers. Agricultural water service contractors also indicated that if higher water rates were used as justification of increased reliability, then agricultural water service contractors should be allowed to also pay higher water rates for increased reliability.

In response to these concerns and the need to more fully define allocations during times of water shortage, Reclamation initiated development of the M&I WSP. Involved stakeholders submitted language for the M&I WSP as part of several proposed policies. Reclamation initiated the preparation of an Environmental Assessment (EA) which included stakeholder input and consideration and evaluation of alternative policies developed in 1993, 1996-1997, and 2000-2001. On September 11, 2001, Reclamation released a Draft M&I WSP. The M&I WSP EA was published on October 2005 and a Finding of No Significant Impact was signed in December 2005. The M&I WSP currently being implemented by Reclamation is the 2001 Draft M&I WSP, as amended by Alternative 1B from the 2005 EA, which is the No Action Alternative for this EIS.

The M&I WSP EA assumed that when the M&I water service contract allocations would be less than 75 percent of historical use, water would be re-allocated from the irrigation water service contractors to provide the additional water to M&I users. In years in which allocations to irrigation water service contractors would be at or near zero, the increased allocations to M&I water service contractors would not be fully realized.

The alternatives analysis in the EA was based on several assumptions. One assumption was that the American River Division M&I water service contractors would not participate in the M&I WSP because water supplies under drought conditions would be provided under a separate agreement between water users of the American River water supply, called the Water Forum Agreement.

During the preparation of the EA, Reclamation received various comments asking to expand the range of alternatives to include those that re-operate reservoirs, expand the analysis of economic impacts on irrigation water service contractors, and consider water transfers between irrigation and M&I water service contractors. Other comments related to the relevance of the method used in the EA to project public health and safety (PHS) water demands and identifying future conflicts when PHS water demands are developed by individual water service contractors. Several comments were received on the EA concerning the American River Division water service contractor assumptions.

Following publication of the Final EA in 2005, Reclamation received additional comments from several CVP water service contractors. The contractors indicated that the Water Forum Agreement was not being implemented as described in environmental document; therefore, the American River Division assumptions in the EA were no longer valid. Other comments were related to the range of alternatives considered, including the need to evaluate the effectiveness of changes in reservoir operations that would allow for additional storage in wetter years.

The 2008 U.S. Fish & Wildlife Service's (USFWS) biological opinion (BO) for Delta Smelt changed some of the CVP operational requirements that were assumed in the Final EA. In 2009, the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) issued a BO for Chinook salmon. While there are continuing legal issues surrounding these BOs, the 2008 USFWS and 2009 NOAA Fisheries BOs will guide operations of the M&I WSP until the issues are resolved.

Because the assumptions supporting the 2005 Final EA have become outdated and due to significant changes in the Delta and CVP/SWP operations, Reclamation decided to undertake the M&I WSP EIS to provide an updated M&I WSP that best recognizes the needs of various segments of the water user community and how those needs could be addressed in times of water shortages.

1.3.2 Purpose and Need

The purpose of updating the 2001 Draft M&I WSP, as amended, is to provide detailed, clear, and objective guidelines for the allocation of available CVP water supplies to CVP water service contractors during water shortage conditions.

The update to the M&I WSP is needed by water managers and the entities that receive CVP water to help them better plan for and manage available CVP water supplies, and to better integrate the use of CVP water with the use of other available non-CVP water supplies. The update to the M&I WSP is also needed to clarify certain terms and conditions with regard to the applicability and implementation process of the M&I WSP.

1.4 Applicability of the M&I WSP

There are 271 water contracts or agreements for the delivery of CVP and/or water rights water; including 88 water service contracts (excluding those in the Friant Division); 147 water rights or settlement contracts on the Sacramento, American, San Joaquin, and Stanislaus rivers; 27 Friant Division water repayment contracts and 4 Friant Division water service contracts; and 4 contracts or agreements for Federal and State refuges and 1 for a privately managed refuge.

1.4.1 Water Service Contractors Subject to the M&I WSP

Reclamation has developed the M&I WSP alternatives described in Chapter 2 to evaluate different methods for allocation of CVP supplies to M&I and agricultural water service contractors during water shortage conditions. The updated M&I WSP will apply to the water service contractors noted in Table 1-2 and shown on Figure 1-2. These water service contractors generally comprise those whose contracts currently reference the M&I WSP and those with a water service contract that is expected to reference the updated policy. These water users are generally located throughout the Sacramento Valley, San Joaquin River Valley, Tulare Lake Region, and San Francisco Bay/Central Coast area.

Most water service contracts allow for the use of both agricultural and M&I water although some contactors may not currently have a use for both. Not all contracts distinguish between water for agricultural use and water for M&I use. American River contractors, Contra Costa Water District, a few Sacramento River contractors, and a few south of Delta contractors are M&I only contractors. (Reclamation 2013)

Table 1-2. Water Service Contractors Subject to the M&I WSP

General Geographical Region	CVP Division	Water Service Contractors	M&I	Ag[1]
North of Delta	Shasta and Trinity River	Bella Vista Water District	X	X
		Centerville Community Services District	X	-
		City of Redding	X	-
		City of Shasta Lake	X	-
		Clear Creek Community Services District	X	X
		Mountain Gate Community Services District	X	-
		Shasta Community Services District	X	-
		Shasta County Water Agency	X	-
		U.S. Forest Service (Shasta)	X	-

General Geographical Region	CVP Division	Water Service Contractors	M&I	Ag[1]
	Sacramento River	4-M Water District	X	X
		Colusa County Water District	X	X
		Corning Water District	X	X
		Cortina Water District	X	X
		County of Colusa	X	X
		County of Colusa (Stonyford)	X	X
		Davis Water District	X	X
		Dunnigan Water District	X	X
		Elk Creek Community Services District	X	-
		Glenn Valley Water District	X	X
		Glide Water District	X	X
		Holthouse Water District	X	X
		Kanawha Water District	X	X
		Kirkwood Water District	X	X
		La Grande Water District	X	X
		Myers-Marsh Mutual Water Company	X	X
		Orland-Artois Water District	X	X
		Proberta Water District	X	X
		Stony Creek Water District	X	X
		Thomes Creek Water District	X	X
		U.S. Forest Service (Salt Creek)	X	-
		Westside Water District	X	X
		Whitney Construction, Incorporated	X	-
	American River	City of Roseville	X	-
		City of Sacramento	X	-
		East Bay Municipal Utility District	X	-
		El Dorado Irrigation District	X	-
		Placer County Water Agency	X	-
		Sacramento County Water Agency	X	-
		Sacramento Municipal Utility District	X	-
		San Juan Water District	X	-
	Delta	Banta-Carbona Irrigation District	X	X
		Byron-Bethany Irrigation District	X	X
		City of Tracy	X	X
		Coelho Family Trust	X	X
		Contra Costa Water District	X	-
		Del Puerto Water District	X	X
		Eagle Field Water District	X	X
		Fresno Slough Water District	X	X
		James Irrigation District	X	X
		Laguna Water District	X	X
		Mercy Springs Water District	X	X
		Oro Loma Water District	X	X
		Pajaro Valley Water Management Agency, Westlands Water District	X	X
		Patterson Irrigation District	X	X
		Reclamation District No. 1606	X	X

General Geographical Region	CVP Division	Water Service Contractors	M&I	Ag[1]
		Tranquillity Irrigation District	X	X
		Tranquillity Public Utility District	X	X
		U.S. Department of Veteran Affairs	X	-
		West Side Irrigation District	X	X
		West Stanislaus Irrigation District	X	X
		Westlands Water District Distribution Districts	X	X
South of Delta	West San Joaquin	City of Avenal	X	-
		City of Coalinga	X	-
		City of Huron	X	-
		Pacheco Water District	X	X
		Panoche Water District	X	X
		San Luis Water District	X	X
		State of California	X	-
		Westlands Water District	X	X
	San Felipe	San Benito County Water District	X	X
		Santa Clara Valley Water District	X	X
	Cross Valley Canal	County of Fresno	X	X
		County of Tulare	X	X
		Hills Valley Irrigation District (includes Rag Gulch Water District)	X	X
		Kern-Tulare Water District	X	X
		Lower Tule River Irrigation District	-	X
		Pixley Irrigation District	X	X
		Tri-Valley Water District	X	X

Note:
[1] Ag = Agricultural water service contractor

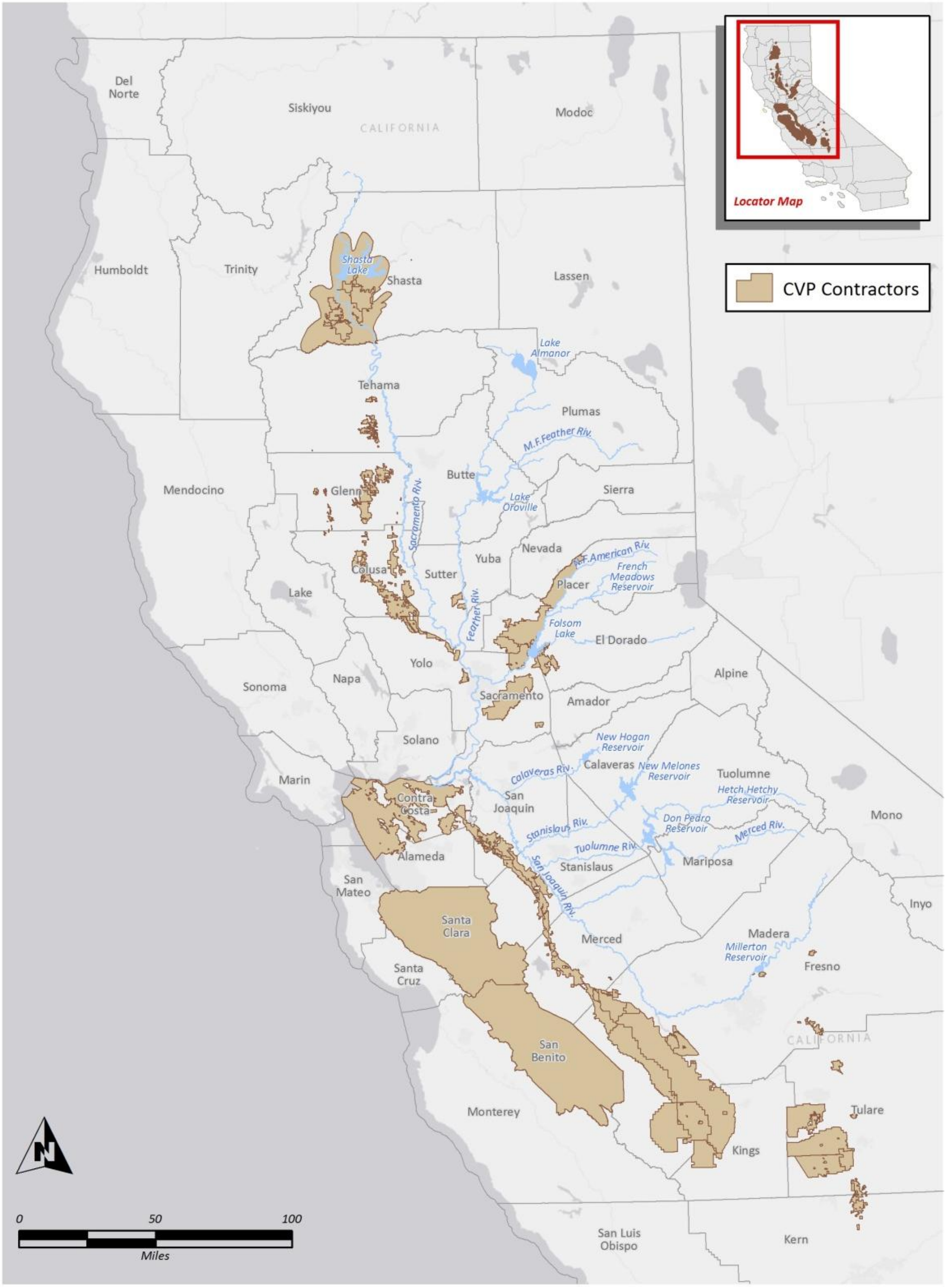


Figure 1-2. Contractors Subject to the M&I WSP

1.4.2 CVP Contractors Not Subject to the M&I WSP

The M&I WSP does not apply to: 1) CVP water service or repayment contractors with contracts that do not reference the M&I WSP; 2) settlement, exchange, or other types of contracts or agreements in satisfaction of senior water rights; or 3) CVPIA refuge contracts.

1.5 Decisions to be Made

This EIS has been prepared to support the development and adoption of an updated M&I WSP. Reclamation will use this EIS to decide on the M&I WSP alternative that best meets the purpose and need based on a full understanding of the environmental consequences of each alternative. Possible decision outcomes are:

- Take no action and continue use of the 2001 Draft M&I WSP, as amended by the 2005 EA;
- Approve Alternative 2, Equal Agricultural and M&I Allocation;
- Approve Alternative 3, Full M&I Allocation Preference;
- Approve Alternative 4, Updated M&I WSP; or
- Approve Alternative 5, M&I Contractor Suggested WSP.

Following the Final EIS, it is anticipated that an updated M&I WSP will be recommended for approval.

1.6 Issues of Known Controversy

Issues and concerns raised during the public scoping process are documented in the M&I WSP Public Scoping Meeting Summary Report (Reclamation 2011). Key issues raised during the public scoping process that are applicable for inclusion in the EIS are listed below.

- The final M&I WSP should be a single document that clearly states how Reclamation interprets and implements the M&I WSP.
- Any additional water provided to M&I water service contractors is viewed as water "taken" from agricultural contractors.
- M&I water service contractors would like a guaranteed level of PHS deliveries and do not want their use of non-CVP supplies to count against their deliveries of CVP water in shortage years.
- The analysis should use an appropriate baseline given ongoing regulatory issues regarding CVP/SWP operations.
- The effects analysis should include a cumulative impact discussion in the context of other reasonably foreseeable past, present, and future actions potentially affecting the allocation of CVP water, including the Bay Delta Conservation Plan.

- The EIS should analyze the impacts to water service contractors who have limited access to alternative water supplies and to “mixed use” contractors.

- The M&I WSP EIS should specifically state the agencies that are and are not affected by the policy, and state that the M&I WSP will apply equally to all M&I contractors, including the American River Division contractors.

- The American River Division contractors disagree with Reclamation’s interpretation of Term 14 of SWRCB Decision 893 and believe it should provide them with additional supply reliability beyond what the M&I WSP provides in their water service contracts.

1.7 CVP Water Supply Management and Operation

Beneficial uses of CVP water are many and varied. The ability of the CVP to meet its beneficial uses results from a combination of carryover storage and runoff into the reservoirs and unregulated and unstored flows in the system, together with the operational flexibility to deliver the water. In this context, operational flexibility refers to: the availability of supply at the time it is needed; physical storage and conveyance capacity; sufficient supplies and ability to control cold/warm water releases; and the ability to export water from the Delta without a “take” of threatened or endangered fish species. Increasing constraints have been placed on CVP operations by legislative requirements including implementation of the CVPIA and the requirement under Section 3406(b)(2) for 800,000 AF of water for fish and wildlife purposes, Endangered Species Act requirements including BOs covering protections of the winter-run chinook salmon and the delta smelt, and the SWRCB’s Decision D-1641, partially implementing the Sacramento-San Joaquin Bay-Delta WQCP. These constraints have removed some of the capability and operational flexibility required to actually deliver the water to CVP contractors especially in dry years and sequential dry years. Water allocations south of the Delta have been most affected by changes in operations due to the CVPIA and the BOs. It is the combination of these factors which define the limits of water allocation.

Water deliveries to CVP water service contractors are based primarily on the following five variables.

- Forecasted reservoir inflows to CVP reservoirs and Central Valley hydrologic water supply conditions

- Current amounts of storage in upstream reservoirs and San Luis Reservoir

- Projected water demands in the Sacramento Valley

- Instream and Delta regulatory requirements
- Annual management of 3406(b)(2) resources.

In many years, the combination of carryover storage and runoff into the CVP reservoirs is not sufficient to provide water contract totals to CVP water service contractors. Each CVP storage reservoir must be operated to provide water and reasonable assurance that minimum storage, instream flows, diversion pools, and hydroelectric power pools can be sustained.

In wetter years, CVP water service contract allocations are based upon the availability of water for users located both north and south of the Delta. In addition, allocations for users located south of the Delta may be further restricted due to regulatory and capacity limitations of the Delta export pumping facilities and, sometimes, by capacity limitations in San Luis Reservoir. Therefore, in wet, above normal, and below normal contract year types, allocations for irrigation and M&I water service contractors may be greater for users located north of the Delta than users located south of the Delta.

In drier years, the maximum volume of water allowed by regulations to be diverted by Delta export pumping facilities is usually higher than the available volume of water for CVP water users. Therefore, deliveries to users located south of the Delta generally are not limited by Delta export restrictions in dry and critical dry years, and CVP water service contract allocations are similar for users located north of the Delta and south of the Delta users. In these years, allocations to all CVP water service contract users are limited by hydrologic conditions, rather than by regulatory and capacity limitations of the Delta export pumping facilities.

Although the CVP is operated as an integrated system, poor hydrologic conditions in some parts of the CVP, CVP storage or conveyance system operational constraints, regulatory requirements, or other factors could create a regionalized low water supply or shortage condition. As such, M&I water shortage allocations may differ between CVP divisions. This common occurrence is applicable to and highly probable under the No Action and all action alternatives. This means that Reclamation could, in some cases, declare a shortage in only one or more CVP division(s) as opposed to CVP-wide, and in other cases, could simultaneously declare different M&I allocations for different CVP divisions or regions of the CVP.

1.8 Uses of the Document

In addition to the decision highlighted in Chapter 1.5, Reclamation will use this document as the environmental analysis for a decision on whether to continue to implement the current Draft M&I WSP or update the M&I WSP. This EIS provides additional information to meet the requirements of NEPA. Reclamation is also expected to use this document as the environmental analysis for actions to implement the selected M&I WSP alternative, including:

- CVP water delivery reductions on the selected alternative;
- Applicable CVP long-term contract renewals; and
- Real-time decisions to change upstream flows, Delta outflows, and pumping consistent with existing CVP operating rules.

It is anticipated that the CVP water service contractors will use information provided in this document for their water supply planning and development of drought contingency plans.

1.9 Organization of the EIS

The EIS is organized into the following chapters:

- Chapter 1 - Provides background information relevant to the M&I WSP, identifies the purpose and need, and describes the decision to be made, intended uses of the EIS, and issues of known controversy.
- Chapter 2, Description of Alternatives – Summarizes the alternatives development process and describes the No Action Alternative and action alternatives.
- Chapters 3-19 – These chapters describes the affected environment, evaluation methods, direct, indirect, and cumulative effects of the alternatives, and mitigation measures for environmental resources.
- Chapter 20, Cumulative Effects Methodology – This chapter describes the methods used to evaluate cumulative effects and projects included in the analysis. The analysis of the cumulative impacts occurs within each resource area in Chapters 3-19.
- Chapter 21, Other Required Disclosures – This chapter describes irreversible and irretrievable commitment of resources, the relationship between short-term uses and long-term productivity, growth inducing impacts, and unavoidable adverse impacts.
- Chapter 22, Consultation and Coordination – This chapter describes the consultation and outreach activities that have occurred during the EIS preparation process.
- Chapter 23, List of Preparers – This chapter lists the authors and other contributors to the development of the EIS and their qualifications.

- Chapter 24, Index – This chapter presents an index of keywords used in the Draft EIS.

1.10 References

Reclamation. 2004. *Long-Term Central Valley Project Operations Criteria and Plan, CVP-OCAP*. June 30, 2004.

______. 2011. *Central Valley Project Municipal and Industrial Water Shortage Policy Scoping Report*. July 2011.

______. 2013. *Central Valley Project (CVP) Water Contracts Fact Sheet*. Available: http://www.usbr.gov/mp/PA/water/docs/CVP_Water_Contracts_Fact_Sheet.pdf.

______. 2014. *Summary of Water Supply Allocations.* Accessed on: 08/01/2014. Available: http://www.usbr.gov/mp/cvo/vungvari/water_allocations_historical.pdf.

Chapter 2
Description of Alternatives

This chapter includes an overview of the National Environmental Policy Act (NEPA) requirements for development of project alternatives. It also includes a description of the alternatives formulation process to select a reasonable range of alternatives and a description of the No Action Alternative and action alternatives.

2.1 NEPA Requirements

Federal law outlines the required components of the "alternatives" section of an Environmental Impact Statement (EIS) (40 Code of Federal Regulations Part 1502.14), which include the following:

(a) Rigorous exploration and objective evaluation of all reasonable alternatives, and for alternatives which were eliminated from study, a brief discussion of the reasons for their having been eliminated.

(b) Substantial treatment of each alternative considered in detail, including the proposed action, so that reviewers may evaluate their comparative merits.

(c) Inclusion of reasonable alternatives that are not within the jurisdiction of the lead agency.

(d) Inclusion of the alternative of no action.

(e) Identification of the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identification of such alternative in the final statement unless another law prohibits the expression of such a preference.

(f) Inclusion of appropriate mitigation measures that are not already included in the proposed action or alternatives.

2.2 Alternatives Development

NEPA requires EISs to identify a reasonable range of alternatives and provide guidance on the identification and screening of such alternatives. NEPA includes provisions that alternatives meet (or meet most of) the purpose and need and be potentially feasible. For this EIS, the Bureau of Reclamation (Reclamation), as the Lead Agency, followed a structured, documented process to identify and screen alternatives for inclusion in the EIS. Figure 2-1 illustrates the process that Reclamation conducted to identify and screen alternatives.

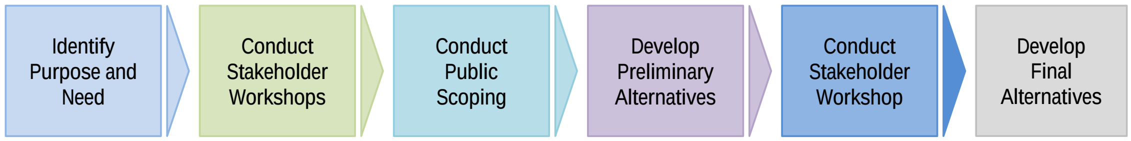


Figure 2-1. Alternatives Development Process

2.2.1 Public Scoping and Results

During public scoping, the public provided input regarding potential alternatives to be considered in the EIS. Reclamation reviewed the purpose and need statement, public scoping comments, and previous studies in its effort to develop conceptual alternatives. This resulted in an initial list of alternatives that included alternatives that were previously considered in the 2005 Environmental Assessment (EA), suggested by stakeholders, and newly developed alternatives. Reclamation then developed and applied a set of screening considerations to determine which alternatives should be advanced for analysis and inclusion in the EIS.

2.2.2 Selected Alternatives

The alternatives that were selected and advanced for more detailed analysis in this EIS are those that best meet the purpose and need, minimize negative effects, are feasible, and represent a range of reasonable alternatives. Some alternatives considered do not fully meet the purpose and need, but they have the potential to minimize some types of environmental effects or help create a reasonable range of alternatives for consideration by decision-makers.

NEPA allows development of representative alternatives that bound the full range of reasonable alternatives. Upper, lower, and intermediate bounding alternatives can be developed in terms of the maximum and minimum range of water shortage sharing conditions between agricultural and municipal and industrial (M&I) Central Valley Project (CVP) water service contractors. This approach was used in the selection of alternatives and ensured that the full range of potential changes in water allocations and resulting environmental impacts from these alternative M&I Water Shortage Policies (WSPs) can be evaluated in the EIS. The bounding alternatives also facilitate a trade-off analysis of different water shortage sharing conditions between agricultural and M&I water service contractors.

As a result of the initial alternatives screening, four action alternatives were selected to move forward for analysis in the EIS along with the No Action Alternative, as described in Table 2-1. Analysis of these alternatives will provide the information needed to make an informed decision, and potentially to mix and match elements of the alternatives, if needed, to create an alternative that would reduce environmental impacts and increase environmental benefits.

Table 2-1. Alternatives Selected for Analysis in the EIS

Alternative Number	Alternative Name	Description
Alternative 1	No Action Alternative	Represents the current 2001 Draft M&I WSP, as modified by Alternative 1 B of the 2005 EA. This existing draft policy is currently guiding Reclamation's allocation of water to agricultural and M&I water service contractors.
Alternative 2	Equal Agricultural and M&I Allocation	Provides no preference for either agricultural or M&I contractors. M&I and agricultural water service contractors receive equal allocation percentages during water shortage conditions.
Alternative 3	Full M&I Allocation Preference	M&I water service contractors receive 100% of their Contract Total until CVP supplies are not available to meet those demands. Agricultural allocations are reduced as needed to maintain 100% allocations to M&I contractors.
Alternative 4	Updated M&I WSP	Similar to Alternative 1 but modified to provide a different definition of unconstrained years used in calculating historical use. Attempts to provide minimum public health and safety (PHS) unmet need amounts, but without a guarantee.
Alternative 5	M&I Contractor Suggested WSP	Similar to Alternative 4 except attempts to meet PHS unmet need through modification of operational priorities, such as providing increased carryover to reserve water in storage to meet ensuing year PHS unmet need of M&I contractors.

2.2.3 Alternatives Considered but not Carried Forward

A large number of potential M&I WSP alternatives could be developed for inclusion and analysis in the EIS; however, it is not practical to develop alternatives that include all of the potential combinations of elements that could be considered in alternative M&I WSPs. The following alternatives were considered but not carried forward for detailed analysis and inclusion in the EIS.

2.2.3.1 Two-Tiered M&I WSP

This alternative would provide a two-tier level of water supply allocations to M&I water service contractors when M&I allocations are less than 75 percent of historical use. The first tier would be provided in a similar manner as done under the No Action Alternative. The second tier of allocation would be added incrementally to the first tier and would provide up to 100 percent of M&I demands under certain conditions. The conditions under which the second tier would be supplied would vary by M&I water service contractor and also annual water supply and demand conditions. The second tier would be priced every year at a higher level than cost of service M&I water service contract rates. Due to these variables, it is impractical and will be difficult to quantify these factors sufficiently to model or analyze this alternative. This alternative was considered but not carried forward for detailed evaluation in the EIS.

2.2.3.2 Maximize PHS Deliveries

This alternative would maximize the PHS deliveries. As such, Reclamation would attempt to provide M&I water service contractor allocations at not less than the PHS demands, provided adequate CVP supplies are available. This means that agricultural demands would be reduced as needed to make sufficient water available to meet the M&I PHS demands. This alternative is similar to Alternative 5, M&I Contractor Suggested WSP, and, therefore, considered somewhat redundant. This alternative was considered but not carried forward for detailed evaluation in the EIS.

2.2.3.3 Alternatives that Violate Standards

Several comments were received on the 2005 EA that suggested additional alternatives for evaluation, including changing Folsom Lake operations to reduce releases to meet Sacramento-San Joaquin River Delta (Delta) water quality objectives. This alternative was not carried forward for evaluation in this EIS because it would be unreasonable for Reclamation to evaluate alternatives that consider violating state and federal standards as a matter of policy.

Another alternative suggested during the 2005 EA process was to change the water quality requirements established by the State Water Resources Control Board (SWRCB) orders. Reclamation does not have jurisdiction over the SWRCB, and, therefore, this alternative was not carried forward for evaluation in this EIS.

2.3 Alternative 1: No Action Alternative

The No Action Alternative represents a projection of current conditions to the most reasonable future conditions that could occur during the life of the proposed federal action without any action alternative being implemented. Thus, the No Action Alternative provides a baseline against which action alternatives can be compared.

The No Action Alternative represents continued implementation of the current 2001 Draft M&I WSP, as modified by Alternative 1B of the 2005 EA. This existing draft policy is currently guiding Reclamation's operations of the CVP and the allocation of water to agricultural and M&I water service contractors and would continue to guide CVP allocations if none of the proposed action alternatives are chosen. The 2001 Draft M&I WSP, as modified by Alternative 1B of the 2005 EA, is available on Reclamation's website for the M&I WSP, at http://www.usbr.gov/mp/cvp/mandi/index.html[1].

[1] Specific link for the 2001 Draft M&I WSP is http://www.usbr.gov/mp/cvp/mandi/docs/2001_Draft_MI_Water_Shortage_Policy.pdf.

Because of the projected growth in population in the area of analysis, future M&I water demands, and PHS needs, would be greater than current demands, which would affect water withdrawals from various parts of the system as compared to existing conditions.

2.3.1 Water Allocation Methodology

The allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative is presented in Table 2-2. In years when the CVP water supplies are not adequate to provide water to all contractors, M&I water service contractor allocations are maintained at 100 percent of their Contract Total as the agricultural water service contractor allocations are reduced to 75 percent of their Contract Total in several incremental steps. Then, M&I water service contractor allocations are reduced to 75 percent of historical use (which may be adjusted, as discussed in Chapter 2.3.2) in several incremental steps as agricultural water service contractor allocations are reduced to 50 percent of Contract Total. The M&I water service contractor allocations are maintained at 75 percent of historical use until agricultural water service contractor allocations are reduced in incremental steps to 25 percent of Contract Total. Then, M&I water service contractor allocations are reduced in incremental steps to 50 percent of historical use until agricultural water service contract allocations are reduced in incremental steps to zero.

In years when the M&I water service contractor allocations are less than 75 percent of historical use, Reclamation would attempt to provide the unmet PHS needs, up to 75 percent of the M&I historical use, if the water is available. There are some years in which allocations to agricultural water service contractors are at or near zero. In those years, the increased deliveries for unmet PHS needs to M&I water service contractors would not be fully realized. M&I water service contractor deliveries may be reduced below 75 percent of historical use and below the unmet PHS needs when CVP water is not available.

For an M&I water service contractor to be eligible for the M&I allocation, the water service contract must reference the M&I WSP. In addition, the water service contractor must: 1) have developed and be implementing a water conservation plan that meets Central Valley Project Improvement Act (CVPIA) criteria; and, 2) be measuring such water consistent with Section 3405(b) of the CVPIA. The No Action Alternative assumes that Reclamation will incorporate a provision that references the M&I WSP in all new, renewed, and amended water service contracts, as appropriate.

Table 2-2. Alternative 1, No Action Alternative, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of contract total)	Allocation to M&I Water Service Contractors
1	100% to 75%	100% of Contract Total
2	70%	95% of historical use
3	65%	90% of historical use
4	60%	85% of historical use
5	55%	80% of historical use
6	50% to 25%	75% of historical use
7	20% [1]	The Maximum of: (1) 70% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
8	15% [1]	The Maximum of: (1) 65% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
9	10% [1]	The Maximum of: (1) 60% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
10	5% [1]	The Maximum of: (1) 55% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
11	0% [1]	The Maximum of: (1) 50% of M&I historical use or (2) Unmet PHS need up to 75% of historical use

[1] Allocations to agricultural water service contractors will be further reduced, if necessary, within the contract year to provide PHS needs to M&I water service contractors within the same contract year, provided CVP water is available.

2.3.2 Historical Use

An M&I water service contractor's historical use is determined by calculating the average quantity of CVP water put to beneficial use within the service area during the last three years of water deliveries that were unconstrained by the availability of CVP water. The historical use value for an M&I water service contractor is calculated by averaging the annual CVP water deliveries during the most recent three unconstrained years.

Reclamation recognizes that certain circumstances may require adjustment of the historical use, if requested by a contractor, for population growth, extraordinary water conservation measures, or use of non-CVP water supplies. Also, Reclamation may agree to adjust the historical use on the basis of unique circumstances, after consultation with the contractor. An example of a unique circumstance is the year following a drought year, in which a contractor may still be using extraordinary water conservation measures, or the converse, in which a contractor may be using more water than historically used in order to recharge groundwater.

The following adjustment factors are used to calculate the adjusted historical use, when an adjustment is requested, for each affected M&I water service contractor:

- ***Adjustment For Growth*** - An adjustment to the contractor's historical use quantity to account for demand increases within the contractor's service area due to (but not limited to) increases in population and the number or demand of industrial, commercial, and other entities the contractor serves, provided the contractor supplies required documentation to Reclamation.

- ***Adjustment For Extraordinary Water Conservation Measures*** - An adjustment to the contractor's historical use quantity to account for conservation measures that exceed applicable best management practices (BMPs), or suitable alternative, adopted by the California Urban Water Conservation Council. However, a water conservation measure considered extraordinary in one year may be a mandatory BMP in a subsequent year and thus would no longer be considered extraordinary.

- ***Adjusted For Non-CVP Water*** - An adjustment to the contractor's historical use quantity to account for water sources other than the CVP supplies used to satisfy M&I demand within the contractor's service area, subject to written documentation from the contractor that shows the extent to which use of the non-CVP water actually reduced the contractor's use of CVP water in other years. A contractor must show that the non-CVP water used in other years reduced the use of CVP water in these years. Non-CVP supplies may include surface water, groundwater, local storage, and other Reclamation-approved non-CVP supplies.

2.3.3 Unconstrained Years

An unconstrained year is considered to be a CVP water delivery year in which the M&I water supply final allocation is 100 percent. Constraints on the availability of CVP water may occur during any year. These CVP water supply allocation and delivery constraints may result from one or a combination of factors including hydrologic, regulatory, and operational constraints. Also, in some cases, these constraints may be localized as opposed to CVP-wide, which means that different CVP divisions may have different unconstrained years.

The unconstrained years used in the calculation of the historical use in this EIS for the M&I water service contractors are shown in Table 2-3. Data on historical use quantities was gathered in 2011; therefore; 2010 is the last unconstrained year used in the EIS analysis.

Table 2-3. Unconstrained Years Used in Calculation of the Historical Use

CVP Region or Division	Most Recent Unconstrained Years Used in EIS Analysis
American River [1]	2006, 2007, 2010
North of Delta	2006, 2007, 2010
South of Delta	2003, 2005, 2006

[1] Although 2009 was an unconstrained year for the American River Division, the late announcement of a full M&I allocation caused some contractors to use alternative supplies early in the year and reduced their use of CVP supplies.

2.3.4 Non-CVP Water

For M&I water service contractors that are subject to the M&I WSP, non-CVP water supplies used to satisfy M&I demand within the contractor's service area are subject to written documentation from the contractor that shows the extent to which use of the non-CVP water actually reduced the contractor's use of CVP water in other years. Non-CVP supplies may include surface water, groundwater, local storage, recycled water (subject to Reclamation approval), and other Reclamation-approved non-CVP supplies.

2.3.5 Public Health & Safety

During water shortage conditions, Reclamation will strive to deliver CVP water to M&I water service contractors at not less than their unmet PHS water supply level, provided that sufficient CVP water is available, if: 1) the Governor declares an emergency drought condition due to water shortage; or 2) Reclamation, in consultation with the contractor, determines that an emergency exists due to water shortage. At that time, the PHS level and unmet need would be determined by the contractor and reviewed by Reclamation.

The PHS needs will be calculated using the M&I water service contractor's domestic, commercial, institutional, and industrial demands and system losses, as shown in Table 2-4.

Table 2-4. Components of PHS Demand

M&I Demand Component	PHS Factor
Domestic (Residential)	Current population multiplied by 55 gallons per capita per day
Commercial & Institutional	80% of projected commercial & institutional water demand
Industrial	90% of projected industrial water demand
System Losses	10% of the subtotal of domestic, commercial and institutional, and industrial demands

The PHS water criteria in this analysis are used to estimate the water that is needed for consumption, for operation of necessary water and wastewater facilities, and to avoid economic disruption. M&I water service contractors are expected to first use their non-CVP supplies to meet their PHS demands. CVP water would then be used by the M&I water service contractor to meet the unmet need portion of their PHS demand. Unmet need is calculated as the difference between a contractor's PHS demand and its available non-CVP supplies. CVP water provided for PHS needs would be non-transferable.

If the M&I water service contractor deliveries would be less than the unmet need portion of PHS demand, Reclamation could make additional water available from CVP storage, if available, to assist the contractor. Reclamation would not reallocate water from agricultural contractors or environmental releases to meet unmet M&I PHS needs. The amount of water potentially available from storage would vary each year. The use of water from CVP storage could affect downstream temperature requirements. If such use would cause an adverse environmental impact, Reclamation would not operate the CVP system in that manner.

2.4 Alternative 2: Equal Agricultural and M&I Allocation

Under Alternative 2, Equal Agricultural and M&I Allocation, M&I water service contractors would receive the same allocation, as a percentage of Contract Total, as the agricultural water service contractors. This means that in years when the CVP water supplies are not adequate to provide water to all water service contractors, agricultural and M&I water service contractor allocations would be reduced by the same percentage.

This allocation methodology would provide a larger volume of CVP water to agricultural water service contractors than the No Action Alternative, as there would be no reductions to agricultural contractors to provide a larger volume of CVP water to M&I water service contractors. Deliveries to both north of Delta and south of Delta M&I contractors would be lower than under the No Action Alternative in order to provide an equal allocation to agricultural water service contractors.

Reclamation would benefit from a simplified allocation system that would be easier to implement and CVP water users would benefit by having a more comprehensible and simpler shortage allocation approach. This alternative will facilitate a tradeoff analysis that considers the potential effects associated with reduced CVP water made available for delivery to M&I water service contractors.

2.4.1 Water Allocation Methodology

In years when the CVP water supplies are not adequate to provide water to all water service contractors, M&I water service contractor allocations would be reduced at the same levels as agricultural water service contractor allocations. The reductions would be on a percentage basis of contract amount, reflective of the available CVP water supply for that respective year. The allocation of available CVP water supplies between M&I and agricultural water service contractors during water shortage conditions is presented in Table 2-5.

Table 2-5. Alternative 2, Equal Agricultural and M&I Allocation, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors (% of Contract Total)
1	100%	100%
2	95%	95%
3	90%	90%
4	85%	85%
5	80%	80%
6	75%	75%
7	70%	70%
8	65%	65%
9	60%	60%
10	55%	55%
11	50%	50%
12	45%	45%
13	40%	40%
14	35%	35%
15	30%	30%
16	25%	25%
17	20%	20%
18	15%	15%
19	10%	10%
20	5%	5%
21	0%	0%

2.4.2 Public Health & Safety

Alternative 2 would have no provisions for unmet PHS needs that would be made available by Reclamation from CVP water supplies. During water shortage conditions, M&I water service contractors would need to rely on available non-CVP supplies. In cases where an M&I water service contractor does not have sufficient non-CVP supplies to meet their PHS demands, they would need to rely on water transfers and water exchanges (with willing buyers and willing sellers) to make up the unmet portion of the PHS demand. This market driven system is in effect throughout California and has been used during previous water shortages. Reclamation is undertaking planning efforts and environmental compliance activities under the Long-Term Water Transfers Program to facilitate such water transfers (Reclamation and San Luis & Delta-Mendota Water Authority 2014).

2.5 Alternative 3: Full M&I Allocation Preference

Under Alternative 3, Full M&I Allocation Preference, M&I water service contractors would receive a 100 percent allocation as compared to the No Action Alternative and other action alternatives. Under this alternative, Reclamation would attempt to provide a 100 percent allocation to M&I water service contractors during water shortage conditions, to the extent that adequate CVP water supplies are available. This would be achieved by reducing allocations to agricultural water service contractors as needed to maximize the frequency of 100 percent allocations to the M&I water service contractors.

This allocation methodology would provide the lowest volume of CVP water to agricultural water service contractors compared to the No Action and other action alternatives. Also, this alternative will facilitate a tradeoff analysis that considers the potential effects associated with providing larger volumes of CVP water to M&I water service contractors.

2.5.1 Water Allocation Methodology

In years when the CVP water supplies are not adequate to provide the Contract Total to all water service contractors, M&I water service contractor allocations would be maintained at 100 percent of their contract total as agricultural water service contractor allocations would be reduced as needed to provide for the full allocation to the M&I water service contractors. In years when the agricultural water service contractor allocations have been reduced to zero and CVP water supplies are not adequate to provide a 100 percent allocation to the M&I water service contractors, then the allocation to the M&I water service contractors would be reduced and would be equal to the available CVP water supply. Under these low water supply conditions, the M&I water service contractor allocation could theoretically also be reduced to zero.

The allocation of available CVP water supplies between M&I and agricultural water service contractors during water shortage conditions is presented in Table 2-6.

Table 2-6. Alternative 3, Full M&I Allocation Preference, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors (% of Contract Total)
1	100%	100%
2	95%	100%
3	90%	100%
4	85%	100%
5	80%	100%
6	75%	100%
7	70%	100%
8	65%	100%
9	60%	100%
10	55%	100%
11	50%	100%
12	45%	100%
13	40%	100%
14	35%	100%

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors (% of Contract Total)
15	30%	100%
16	25%	100%
17	20%	100%
18	15%	100%
19	10%	100%
20	5%	100%
21[1]	0%	Between 100% to 0%

[1] Once agricultural water service contractor allocations have been reduced to zero and if CVP water supplies are not adequate to provide the full allocation to the M&I water service contractor allocations, then the allocation to the M&I water service contractors would be reduced and the M&I allocations would equal available CVP water supply.

2.5.2 Public Health & Safety

Alternative 3 would have no provisions for unmet PHS needs that would be made available by Reclamation from CVP water supplies. During water shortage conditions, M&I water service contractors would need to rely on available non-CVP supplies. In cases where an M&I water service contractor does not have sufficient non-CVP supplies to meet their PHS demands, they would need to rely on water transfers and water exchanges (with willing buyers and willing sellers) to make up the unmet portion of their PHS demand. This market driven system is in effect throughout California and has been used during previous water shortages. Reclamation is undertaking planning efforts and environmental compliance activities under the Long-Term Water Transfers Program to facilitate such water transfers (Reclamation and San Luis & Delta-Mendota Water Authority 2014).

2.6 Alternative 4: Updated M&I WSP

Alternative 4, Updated M&I WSP, is similar to the No Action Alternative. This alternative comprises the M&I WSP developed by Reclamation with stakeholder input received during the M&I WSP stakeholder workshops held between May 2010 and January 2011. Reclamation used this stakeholder workshop process and input to identify elements of the 2001 Draft M&I WSP (represented in the No Action Alternative) that could be improved. The Updated M&I WSP and its implementation guidelines are available on Reclamation's website for the M&I WSP, at http://www.usbr.gov/mp/cvp/mandi/index.html[2].

The modifications made to the current Draft M&I WSP that are reflected in the Updated M&I WSP include the following:

- Deleted reference to 1996 M&I Water Rate book: Reclamation deleted the reference to 1996 M&I Water Rate book. In lieu of the M&I water

[2] Specific link for the Updated M&I WSP is http://www.usbr.gov/mp/cvp/mandi/docs/Working_Draft_MI_CVP_WSP%202010-1021.pdf.

service contractor demand projections provided in the 1996 M&I Water Rate book, implementation of Alternative 4 would make use of the M&I water service contractor demand projections provided in the most recent Water Needs Assessment that Reclamation and the respective water contractors developed for the Long-Term CVP Water Service Contract renewals. This information would be used for reference and verification of the M&I water service contractor's CVP and non-CVP water demands and supplies during times of water shortages.

- Replaced the two tables in Terms and Conditions 4 and 5: Reclamation deleted two tables in Terms and Conditions 4 and 5 of the 2001 Draft M&I WSP and replaced these with Table 3-5 (Alternative 1B) from the 2005 EA. This was done strictly for clarification purposes only since Table 3-5 is already in effect based on the adoption of the recommendations from the 2005 EA and associated Findings of No Significant Impact. The information from this table would be used to determine allocation reductions to M&I water service contractors in proportion to agricultural contractor shortage allocations under future demand conditions.

- Amended the methodology used to make adjustments to contractor's historical use: At the M&I water service contractors' request, Reclamation modified the method that would be used to adjust an M&I water service contractor's historical use. Under the 2001 Draft M&I WSP, adjustments to historical use (when requested by a contractor) are determined by first averaging the CVP water deliveries in each of the three most recent unconstrained years and then adjusting the quotient using the factors and methodology described in Chapter 2.3.2, Historical Use. Under Alternative 4, each of the three most recent unconstrained years would be analyzed for adjustment by the factors described in Chapter 2.3.2 when requested by a contractor, and adjustments would be made accordingly, prior to calculation of the contractor's historical average. Also, adjustments for use of non-CVP water supplies would be based on documentation showing the extent to which use of the non-CVP water actually reduced the contractor's use of CVP water in the unconstrained historical years.

- Clarification of key terms: Reclamation expanded the definitions of the key terms and also defined terms not previously defined, to provide greater clarity on the intent and requirements of the key terms and conditions of the M&I WSP.

- Inclusion of recycled water as non-CVP supply: Reclamation expanded the definition of non-CVP supplies to include recycled water, subject to Reclamation approval.

2.6.1 Water Allocation Methodology

In years when the CVP water supplies are not adequate to provide the Contract Total to all water service contractors, M&I water service contractor allocations would be maintained at 100 percent of their Contract Total as agricultural water service contractor allocations would be reduced to 75 percent of their Contract Total in several incremental steps. M&I water service contractor allocation reductions would begin once agricultural contractor allocations are reduced to 75 percent of Contract Total. At this point, M&I water service contractor allocations would be reduced to 75 percent of their historical use in several incremental steps as agricultural water service contractor allocations would be reduced to 50 percent of their Contract Total. The M&I water service contractor allocations would be maintained at 75 percent of their historical use until agricultural water service contractor allocations would be reduced in incremental steps to 25 percent of their Contract Total. Then, M&I water service contractor allocations would be reduced in incremental steps to 50 percent of historical use until agricultural water service contractor allocations would be reduced in incremental steps to zero.

In years when the M&I water service contractor allocations are less than 75 percent of historical use, M&I water service contractors may request an adjustment to their allocation to provide at least the unmet need portion of their PHS demand, up to a maximum of 75 percent of the M&I water service contractor historical use. There are some years in which allocations to agricultural water service contractors are at or near zero. In those years, the increased allocations to M&I water service contractors would not be fully realized. Also, though this alternative would target a minimum M&I water service contractor allocation of 50 percent of historical use or unmet PHS need, whichever is greater, the increased allocation is not guaranteed and would only be made available to the extent that CVP water supplies are available.

The allocation of available CVP water supplies between M&I and agricultural water service contractors during water shortage conditions is presented in Table 2-7.

Table 2-7. Alternative 4, Updated M&I WSP, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors
1	100% - 75%	100% of contract total
2	70%	95% of historical use
3	65%	90% of historical use
4	60%	85% of historical use
5	55%	80% of historical use
6	50%-25%	75% of historical use [1]
7	20%	70% of historical use [1]

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors
8	15%	65% of historical use [1]
9	10%	60% of historical use [1]
10	5%	55% of historical use [1]
11	0%	50% of historical use [1]

[1] Subject to PHS considerations described in Implementation Guidelines. Depending on CVP water supply conditions and CVP operational constraints, it is possible for M&I deliveries to be less than the unmet PHS needs and to be reduced below 50 percent if CVP water availability is insufficient.

2.6.2 Historical Use

M&I water service contractor allocations during shortage conditions when agricultural water service contractor allocations are at or above 75 percent would be based on the M&I water service contractors' Contract Total. However, once agricultural contractor allocations would be reduced below 75 percent and M&I water service contractor shortage condition reductions begin, the M&I water service contractor reductions would be based on historical use rather than on Contract Total. The historical use for an eligible M&I water service contractor would be calculated using the same factors and methodology described in Chapter 2.3.2, Historical Use. However, under Alternative 4, each of the three most recent unconstrained years will be assessed for adjustment by the factors described in Chapter 2.3.2 when requested by a contractor, and adjustments will be made accordingly prior to calculation of the contractor's historical average. Adjusted historical use would not exceed the Contract Total.

2.6.3 Public Health & Safety

The PHS level would be calculated to reflect the contractor's domestic, commercial, institutional, and industrial demands and system losses using the factors and methodology described in Chapter 2.3.5, Public Health & Safety. The other provisions identified in the No Action Alternative that determine which M&I water service contractors are eligible for unmet PHS need deliveries also apply to Alternative 4.

Alternative 4 does not guarantee delivery of any unmet PHS needs. Rather, the unmet PHS needs identified in this alternative would be targets that Reclamation would try to meet provided that sufficient CVP water supplies are available; and provided that M&I water service contractors would first try to meet their PHS demands using their non-CVP supplies. In cases where an M&I water service contractor does not have access to sufficient non-CVP supplies to meet their PHS demands, Reclamation would try to meet their unmet portion of the PHS demands. Lastly, Alternative 4 includes a provision that would enable an M&I water service contractor to calculate its PHS demands, subject to Reclamation review and approval.

2.7 Alternative 5: M&I Contractor Suggested WSP

Alternative 5, M&I Contractor Suggested WSP, is similar to Alternative 4, Updated M&I WSP. This alternative was developed and recommended by several M&I water service contractors who participated in the M&I WSP workshops held between May 2010 and January 2011. The M&I Contractor Suggested WSP is available on Reclamation's website for the M&I WSP, at http://www.usbr.gov/mp/cvp/mandi/index.html[3].

The differences between Alternative 4 and Alternative 5 include the following:

- Attempts to provide a greater level of assurance that CVP water will be allocated to M&I water service contractors to supply the unmet portion of the PHS demands during water shortage conditions.
- Requires modification to CVP operations, i.e., would provide increased carryover in CVP storage facilities to reserve water in storage to meet the ensuing year anticipated unmet portion of the M&I water service contractors' PHS demands.
- Increases the upper limit of when water would be reallocated from the agricultural water service contractors to provide at least the unmet PHS demands from 75 percent of historical use (used in Alternative 4) to 95 percent of historical use. This means that in years when the M&I water service contractor allocations would be 95 percent of historical use or less, water would be reallocated from agricultural water service contractors to provide the greater of the allocation percentage of historical use or the PHS need.
- Adjusts historical use first by the use of non-CVP supplies, then population growth, and finally extraordinary water conservation measures, before the three years of adjusted historical use are averaged to calculate the overall adjusted historical use.
- Qualifies the use of non-potable supplies when considering non-CVP supplies for the determination of PHS unmet need. Non-potable non-CVP supplies would not be included as available non-CVP water satisfying PHS needs except to the extent that they are used to meet non-domestic uses of commercial, institutional, and industrial demands.

This alternative provides a greater level of assurance that CVP water will be allocated to M&I water service contractors to meet unmet PHS demands during water shortage years. This may mean that the water allocations to agricultural water service contractors would need to be reduced, and may require changing the

[3] Specific link for the M&I Contractor Suggested WSP is http://www.usbr.gov/mp/cvp/mandi/docs/2011/M&I%20Contractors'%20redline%20of%20USBR%20CVP%20MI%20Policy%20%2011-22-10%20-.pdf.

timing and frequency of releases from CVP reservoirs. This alternative will facilitate an analysis of the tradeoff between providing a greater allocation of CVP water to M&I water service contractors and a reduced allocation to agricultural contractors.

2.7.1 Water Allocation Methodology

In years when the CVP water supplies are not adequate to provide water to all water service contractors, M&I water service contractor allocations would be maintained at 100 percent of their Contract Total as agricultural water service contractor allocations would be reduced to 75 percent of their Contract Total in several incremental steps. M&I water service contractor allocation reductions would begin once agricultural contractor allocations would be reduced below 75 percent of Contract Total. At this point, M&I water service contractor allocations would be reduced to 75 percent of their historical use in several incremental steps as agricultural water service contractor allocations would be reduced to 50 percent of their Contract Total. The M&I water service contractor allocations would be maintained at 75 percent of their historical use until agricultural water service contractor allocations would be reduced in incremental steps to 25 percent of Contract Total. Then, M&I water service contractor allocations would be reduced in incremental steps to 50 percent until agricultural water service contractor allocations would be reduced in incremental steps to zero.

In years when the M&I water service contractor allocations are less than 100% of Contract Total, water would be reallocated from agricultural water service contractors to provide the greater of the M&I allocation percentage of historical use or PHS needs. The reallocation would be limited to the total amount allocated to agricultural water service contractors, if and when the water is available. There are some years in which allocations to agricultural water service contractors would be at or near zero. In those years, the increased allocations to M&I water service contractors would not likely be realized.

Similar to Alternative 4, this alternative would also target a minimum M&I water service contractor allocation of 50 percent of historical use or unmet PHS needs (whichever is greater). These deliveries are not guaranteed and would only be made available to extent that CVP water supplies are available.

The allocation of available CVP water supplies between M&I and agricultural water service contractors during shortage conditions is presented in Table 2-8.

Table 2-8. Alternative 5, M&I Contractor Suggested WSP, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract total)	Allocation to M&I Water Service Contractors
1	100% to 75%	100% of contract total
2	70%	95% of historical use [1]
3	65%	90% of historical use [1]
4	60%	85% of historical use [1]
5	55%	80% of historical use [1]
6	50%-25%	75% of historical use [1]
7	20%	70% of historical use [1]
8	15%	65% of historical use [1]
9	10%	60% of historical use [1]
10	5%	55% of historical use [1]
11	0%	50% of historical use [1]

[1] Subject to PHS considerations described in Implementation Guidelines. Depending on CVP water supply conditions and CVP operational constraints, it is possible for M&I deliveries to be less than the PHS delivery levels and to be reduced below 50 percent if CVP water availability is insufficient.

2.7.2 Historical Use

M&I water service contractor allocations during shortage conditions when agricultural water service contractor allocations would be at or above 75 percent of Contract Total would be based on the M&I water service contractor's Contract Total. However, once agricultural contractor allocations would be reduced below 75 percent of Contract Total and M&I water service contractor shortage condition reductions would begin, the M&I water service contractor allocations would be based on their historical use rather than Contract Total. The unadjusted, and adjusted when an adjustment is requested by an M&I contractor, historical use for an eligible M&I water service contractor would be calculated using the same factors described in Chapter 2.3.2, Historical Use. However, under this alternative, when an adjustment is requested, the historical use in each of the three most recent years of unconstrained CVP water supplies would be adjusted independently prior to averaging, and those adjustments are made in the following order: 1) non-CVP supplies; 2) population growth; and 3) extraordinary water conservation.

2.7.3 Public Health & Safety

The PHS level would be calculated to reflect the contractor's domestic, commercial, institutional, and industrial demands and system losses using the factors and methodology described in Chapter 2.3.5, Public Health & Safety. The other provisions identified in the No Action Alternative that determine which M&I water service contractors would be eligible for PHS deliveries also apply to Alternative 5.

Alternative 5 does not guarantee delivery of any PHS needs. Rather the PHS needs identified in this alternative would be targets that Reclamation would try to achieve provided that sufficient CVP water supplies are available and that M&I

water service contractors would first try to meet their PHS demands using their non-CVP supplies. In cases where an M&I water service contractor does not have access to sufficient non-CVP supplies, or none at all, to meet their PHS demands, Reclamation would try to meet the unmet portion of the PHS demands with CVP water.

Alternative 5 includes a provision that would enable an M&I water service contractor to calculate its PHS demands, subject to Reclamation review and approval.

2.7.4 CVP Operational Considerations

CVP carryover storage is primarily an outcome of the annual balancing of the requirements to manage storage and releases to make water available for other beneficial uses, including instream flows, water quality, water delivery and CVPIA purposes. Individual CVP storage reservoirs must be operated to provide reasonable assurance that minimum storage, instream flows, diversion pools, and hydroelectric power pools are able to be sustained. A key consideration for both Shasta and Folsom lakes is temperature management for anadromous fish downstream of the dams. The National Oceanic and Atmospheric Administration National Marine Fisheries Service 2009 Biological Opinion specifies carryover storage requirements for Shasta Lake that are to be met a certain percentage of the years. On the American River, the Flow Management Standard during fall spawning is determined in part based on storage in Folsom Lake at the end of September. These elements are currently considered in the determination of water allocations.

Alternative 5 may require the modification of priorities in terms of scheduling releases and calculating CVP carryover storage requirements. CVP and State Water Project storage facilities may be affected by Alternative 5 and storage targets and release objectives would be re-evaluated each year there is a water shortage condition. Reclamation may need to estimate the ensuing year M&I water service contractors' unmet PHS needs and retain sufficient carryover storage to increase the likelihood that sufficient CVP water supplies will be available in the ensuing year to meet these demands.

2.8 M&I Contractor Data Collection Effort

In order to analyze the potential effects of these alternatives, it was necessary for Reclamation to gather the following data for each contractor affected by the M&I WSP alternatives: contract amount; historical use over the years of unconstrained CVP supply used in this EIS (see Table 2-3); 2010 and 2030 population projections; 2010 and 2030 non-CVP supplies in normal, dry, and critical dry years; projected CVP M&I demand in 2030; and estimated 2010 and 2030 PHS demands.

The contract amounts and historical use data were provided by Reclamation. As the Water Needs Assessments had last been completed for most contractors in 2008, there was a need to update the information on demands, supplies, and population projections for the EIS analysis. To gather more accurate data, Reclamation reviewed the contractors' most recent Urban Water Management Plans from 2010, in most cases, for the contractors' supplies, population projections, and elements in the calculation of PHS demands (see Chapter 2.3.5). It was assumed for 2030 that all M&I water service contractors will use their full contract total (equivalent to build out conditions) and historical use is therefore equal to the contract total for the purposes of this analysis. For water service contractors with small amounts of M&I historical use, their 2030 M&I demand was estimated based on growth projections. A summary of this data and associated assumptions were made available for contractor review and verified with the contractors through the M&I WSP stakeholder workshop process. Appendix A, M&I Contractor Data Summary, contains the detailed contractor data, assumptions, and data sources.

In years when the M&I WSP is implemented and PHS allocations are being considered, Reclamation would make use of the most recent contractor information available on water demands, supplies, and population.

2.9 References

Reclamation and San Luis & Delta-Mendota Water Authority. 2014. *Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report*. September 2014.

Chapter 3 Resources Introduction

This chapter presents an overview of the impacts analysis for the Central Valley Project (CVP) Municipal and Industrial Water Shortage Policy (M&I WSP), including the organization of the impact analysis for the environmental resources affected by the project.

3.1 Resources Included in Analysis

Chapters 4 through 19 present an assessment of the environmental impacts associated with each of the alternatives being considered for the M&I WSP, which are described in Chapter 2, Description of Alternatives. Each resource area describes the affected environment for the region of the CVP service area potentially affected by the project alternatives. The chapters present the analyses of the impacts that would result from the No Action Alternative or implementation of the action alternatives. These chapters also present mitigation measures to reduce or eliminate the impacts, if necessary, as well as a description of potential cumulative effects associated with implementation of the M&I WSP and other related projects. The following chapters, by resource area, are:

4. Surface Water
5. Water Quality
6. Groundwater Resources
7. Geology and Soils
8. Air Quality
9. Greenhouse Gases and Climate Change
10. Aquatic Resources
11. Terrestrial Resources
12. Agricultural Resources
13. Socioeconomics
14. Environmental Justice

15. Indian Trust Assets
16. Recreation
17. Power
18. Flood Hydrology
19. Visual Resources

3.2 Resources Not Affected by the Project

Several environmental resources would not change as a result of implementation of the M&I WSP and are therefore not discussed further in this document. The resources not discussed further include:

- Hazards & Hazardous Materials
- Mineral Resources
- Noise
- Population and Housing
- Public Services and Utilities
- Transportation/Traffic
- Indian Sacred Sites
- Cultural Resources

Because the M&I WSP would not result in the disturbance of land, there would be no impacts to hazardous materials and mineral resources. The action alternatives would not require any construction activities; therefore, short- and long-term impacts to noise, population and housing, public services and utilities, and transportation/traffic would not occur.

For these reasons, no impacts to cultural resources will result from the action alternatives. Under Section 106 of the National Historic Preservation Act, the action alternatives are the type of activity that does not have the potential to effect historic properties and there are no further obligations under Section 106 [36 Code of Federal Regulations Sec. 800.3(a)(1)].

Analysis of Indian sacred sites would apply to impacts to sites on Federal lands and the only Federal land potentially affected by the alternatives is CVP reservoir facilities. Reservoir elevation changes from the action alternatives are minimal and within normal operating ranges. These changes would not impact Indian sacred sites or access to such sites.

3.3 Regions Not Affected by the Project

CalSim II was used to simulate CVP operations, including CVP allocations and deliveries to water service contractors. CalSim II is a planning model designed to simulate operations of CVP and State Water Project (SWP) reservoirs and water delivery systems. CalSim II simulates operations that represent water delivery policies, instream flow requirements, flood control operating criteria, and Sacramento-San Joaquin River Delta (Delta) outflow requirements. Operational requirements may be added to the model to help appropriately represent actual operations. CalSim II is the best available planning tool for modeling long-term CVP and SWP operations and is the primary system-wide water supply model used by the Bureau of Reclamation and California Department of Water Resources to conduct planning and impact analyses of potential projects and to compare various management strategies over varying hydrologic conditions. Appendix B, Water Operations Model Documentation, provides detailed documentation of the CalSim II modeling effort.

Based on the CalSim II modeling, there are only relatively small changes to Shasta and Trinity lakes storages, upper Sacramento River flows, and Lake Oroville storage as a result of the different agricultural and M&I water service contractor allocations in the alternatives. Different CVP allocations change deliveries throughout the system and change how CalSim II attempts to meets those deliveries, including changes in reservoir releases. Sometimes this can result in higher storage and sometimes in lower storage. The changes in storage and river flows are a reasonable response of a complex system to different CVP allocation procedures and may not necessarily be specific responses to the different allocation schemes of one alternative versus another. For this reason, CalSim II results are more appropriate for comparing alternatives using a long-term analysis rather than individual annual operations. Shasta and Trinity lakes and Lake Oroville do not show a monthly change in storage for an action alternative versus the No Action Alternative of greater than +/- one percent of total storage. Full model results are presented in Appendix B. Due to these minimal relative changes, reservoir storage for Shasta and Trinity lakes and Lake Oroville and upper Sacramento River flows are determined not to have a substantial impact and are not discussed in detail in this document. Reservoir storage and river flow changes of greater percent magnitude are discussed as appropriate in the following chapters.

3.4 Resource Analysis Organization

Each of the environmental resources addressed in the following chapters is discussed using a common organization, as follows:

3.4.1 Affected Environment

The Affected Environment subsection discusses the affected environment within a defined geographic area (i.e., Area of Analysis) relative to the M&I WSP, and includes an overview of pertinent environmental regulations (i.e., Regulatory Setting) and a description of the environmental setting (i.e., Existing Conditions).

3.4.1.1 Area of Analysis

This subsection defines and describes an area of analysis for each resource area. In some cases, the area of analysis consists of CVP facilities or nearby areas that would be affected directly by changes to CVP reservoir levels, such as for the analysis of recreation and flood hydrology impacts. More often, the area of analysis includes a broader scope. For example, Chapter 8, Air Quality, describes an area of analysis that encompasses both the Sacramento Valley and San Joaquin Valley Air Basins. In a few cases, the area of analysis is even more geographically broad, such as for socioeconomics.

3.4.1.2 Regulatory Setting

Each resource area is evaluated within the existing framework of Federal, State, and local laws, regulations, policies, and plans. For each resource area, the chapters briefly list the laws and regulations that are relevant and applicable to the affected environment, area of analysis, and analysis of impacts. Each resource area provides discussion on how the identified applicable laws, regulations, policies, and plans would be addressed through implementation of the alternatives.

3.4.1.3 Existing Conditions

The analysis of impacts requires a basis for comparison of conditions before and after alternative implementation. The Existing Conditions subsections describe the current environmental setting for each resource area.

3.4.2 Environmental Consequences

The Environmental Consequences subsection presents the analysis of impacts associated with implementation of each alternative. The subsection begins with an explanation of the assessment method(s) used to identify and address potential impacts and then presents whether mitigation for the impact is warranted. The analysis completed in this document uses a 20-year timeframe to evaluate long-term impacts.

3.4.2.1 Assessment Methods

The methods used to evaluate impacts are described for each resource area. In general, the impacts are identified that would result from implementation of each of the alternatives within the context of the environmental baseline and regulatory framework. A variety of data sources, models, documents, and various other types of research and analysis were used to predict the magnitude and context of the impacts. Appendices A through G contain detail on data calculations and modeling efforts.

3.4.2.2 Impact Discussion

Direct Effects The impacts of each alternative are discussed in Chapters 4 through 19 by resource area and alternative. Each resource area section is structured so that an italicized impact statement introduces potential changes that could occur from implementation of each alternative. A discussion of how the resource area would be affected by the impact then follows this initial statement.

Under the National Environmental Policy Act (NEPA), the basis of impact comparison for each of the action alternatives is the No Action Alternative, which is the projection of current conditions at the time modeling was developed to the most reasonable future conditions that could occur during the life of the proposed federal action without any action alternative being implemented. The impacts of the No Action Alternative are compared to existing conditions, as required since there are reasonably foreseeable differences between the two conditions.

Indirect Effects Both M&I and agricultural water service contractors would face different amounts of CVP deliveries under the action alternatives compared to the No Action Alternative. It is reasonable to assume that contractors may take a range of actions to lessen the effects of their CVP water shortages. These potential actions may include additional groundwater pumping or water transfers to increase water supplies, and crop idling to reduce water demands. For example, under Alternative 3, Full M&I Preference, agricultural water service contractors would receive lower CVP allocations than under the No Action Alternative. When less CVP water is being exported through the Delta to meet CVP demands, more pumping capacity would be available for potential water transfers.

These actions could in turn have adverse impacts. Since the M&I WSP does not include these activities as specific actions, potential impacts from these activities would be considered indirect effects. These effects are discussed qualitatively in the environmental consequences subsections as specific quantities of additional pumping, crop idling, or water transfers that contractors may undertake are based on a variety of factors and are not known at this time. These indirect effects are described in the following resources: Chapter 4, Surface Water; Chapter 6, Groundwater Resources; Chapter 7, Geology and Soils; Chapter 8, Air Quality; Chapter 9, Greenhouse Gases and Climate Change; Chapter 11, Terrestrial Resources; Chapter 12, Agricultural Resources; and Chapter 13, Socioeconomics.

3.4.3 Mitigation Measures

The Mitigation Measures subsection provides recommended mitigation measures based on the results and conclusions of the impacts analysis, if it is feasible to do so to reduce the level of the impact. Although adverse impacts associated with the No Action Alternative would continue, it is not necessary or appropriate to formulate mitigation measures or ascribe mitigation responsibility for these impacts. The analysis presented for the No Action Alternative has determined that some existing adverse conditions would continue for reasons not attributable to the M&I WSP alternatives; this provides information to be considered by decision-makers in evaluating the impacts that are attributable to the future preferred alternative.

3.4.4 Unavoidable Adverse Impacts

Unavoidable adverse impacts are those environmental consequences of an action that cannot be avoided, either by changing the nature of the action or through mitigation if the action is undertaken. This subsection includes a discussion of adverse impacts that cannot be avoided.

3.4.5 Cumulative Effects

The Cumulative Effects subsection addresses the impacts of the project in conjunction with reasonably foreseeable future projects (under NEPA) in or near the area. In general, the environmental impacts of the project may be individually minor, but collectively significant when considered in conjunction with other projects or other environmental effects of the project. Chapter 20 provides a more detailed explanation of how cumulative effects are addressed in this Environmental Impact Statement (EIS), and describes the other projects, which in conjunction with the proposed M&I WSP, form the basis of the cumulative projects.

3.5 Summary of Environmental Consequences

Table 3-1 summarizes the potential environmental impacts, including beneficial effects, for each alternative and identifies the magnitude and context of impacts with respect to certain resources. It was determined that no impacts or only minor impacts would occur to aquatic resources, terrestrial resources, environmental justice, Indian Trust Assets, Indian sacred sites, recreation, flood hydrology, and visual resources, so these resource areas are not included in Table 3-1. Potential effects discussion for all the resource areas is included within the respective chapters of the Draft EIS.

The potential resource impact discussions are organized by CVP division or unit, river system, hydrologic region, or modeling region, depending on the resource area.

3.5.1 Impact Comparison – No Action Alternative

The No Action Alternative represents a projection to 2030 of current conditions (2010) to the most reasonable future conditions that could occur without any action alternative being implemented. There are foreseeable differences between the future No Action Alternative and the existing conditions, as described below. Potential impacts of the future No Action Alternative are compared against existing conditions, and these impacts are presented in the second column (Alternative 1) of Table 3-1.

CalSim II was used to simulate CVP operations, including CVP allocations and deliveries to water service contractors. The CalSim II model was first set up to model existing conditions, i.e., to simulate how the Delta, its major tributaries, and the CVP/SWP operate at the current level of development, associated water demands, and existing operating criteria.

To model the No Action Alternative, the CalSim II incorporated how surface water operations may change in the future (2030) without implementation of any action alternative. Areas tributary to the Delta have experienced numerous physical and institutional changes over the decades, and are continuing to experience changes. However, reasonable assumptions must be made regarding these factors to estimate future conditions. Changes considered in the future No Action Alternative relative to existing conditions, which lead to the largest changes in the CVP/SWP system, include:

- Use of full Contract Totals for M&I water service contractor demand;
- Land use conversion from agricultural demand to urban demand, primarily in the American River Basin;
- Full San Joaquin River Restoration Program flows; and
- South Bay Aqueduct capacity expansion.

3.5.2 Impact Comparison – Action Alternatives

Under NEPA, the basis of impact comparison for each of the action alternatives is the No Action Alternative**.** This provides for an evaluation of potential impacts of future conditions under an action alternative compared to future conditions under the No Action Alternative.

As noted in Chapter 3.5.1, anticipated system changes between the existing conditions and No Action Alternative will likely yield potential environmental impacts associated with the modeled differences between existing and No Action conditions. These impacts are irrespective of any of the policy changes associated with the action alternatives. The potential impacts that can be attributed to each action alternative are the relative differences of impacts observed between each respective action alterative and the No Action Alternative. These potential impacts are shown in the third through sixth columns of Table 3-1.

Although not required for NEPA analysis, it may be informational for the reader to consider the potential impact of an action alternative compared to existing conditions. The modeled differences between the existing conditions and future No Action Alternative are common in all the Action Alternatives. Therefore, the associated potential impacts observed between existing conditions and future No Action Alternative conditions are also common under all the Action Alternatives. In general, the impacts of the action alternatives compared to the No Action Alternative build upon the impacts of the No Action Alternative compared to existing conditions.

Table 3-1. Potential Impacts Summary

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Chapter 4, Surface Water					
Changes to the M&I WSP could result in changes to CVP deliveries to north of Delta (NOD) agricultural (ag) and M&I CVP water service contractors.	NOD Ag: 23 thousand acre-feet (TAF) to 37 TAF less NOD M&I: 91 TAF to 189 TAF more	NOD Ag: 3 TAF to 27 TAF more NOD M&I: 21 TAF o 176 TAF less	NOD Ag: 2 TAF to 14 TAF less NOD M&I: 5 TAF to 76 TAF more	No change from the No Action Alternative.	No change from the No Action Alternative.
Changes to the M&I WSP could result in years that public health and safety (PHS) demand is not fully met in NOD CVP divisions.	Shasta/Trinity River Divisions: PHS demands not fully met in 10% of years Sacramento River Division: PHS demands met in all years American River Division: PHS demands met in all years	Shasta/Trinity River Divisions: PHS demands not fully met in 37% of years Sacramento River Division: PHS demands met in all years American River Division: PHS demands not fully met in 2% of years	Shasta/Trinity River Divisions: PHS demands not fully met in 1% of years Sacramento River Division: PHS demands met in all years American River Division: PHS demands met in all years	No change from the No Action Alternative.	Shasta/Trinity River Divisions: PHS demands met in all years Sacramento River Division: PHS demands met in all years American River Division: PHS demands met in all years
Changes to the M&I WSP could result in changes to the amount of unmet PHS demand in NOD CVP divisions.	Shasta/Trinity River Divisions: <1% of PHS demands unmet Sacramento River Division: PHS demands fully met American River Division: PHS demands fully met	Shasta/Trinity River Divisions: <1% to 14% of PHS demands unmet Sacramento River Division: PHS demands fully met American River Division: <1% of PHS demands unmet	Shasta/Trinity River Divisions: <1% of PHS demands unmet Sacramento River Division: PHS demands fully met American River Division: PHS demands fully met	No change from the No Action Alternative.	Shasta/Trinity River Divisions: PHS demands fully met Sacramento River Division: PHS demands fully met American River Division: PHS demands fully met

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes to the M&I WSP could result in changes to CVP deliveries to south of Delta (SOD) agricultural and M&I CVP water service contractors.	SOD Ag: 9 TAF to 109 TAF less SOD M&I: 20 TAF to 45 TAF more	SOD Ag: 35 TAF to 102 TAF more SOD M&I: 32 TAF to 78 TAF less	SOD Ag: 15 TAF to 71 TAF less SOD M&I: 17 TAF to 49 TAF more	No change from the No Action Alternative.	No change from the No Action Alternative.
Changes to the M&I WSP could result in years that PHS demand is not fully met in SOD CVP divisions.	Delta Division: PHS demands met in all years Cross Valley Canal Unit: PHS demands not fully met in 15% of years West San Joaquin Division: PHS demands not fully met in 85% of years San Felipe Division: PHS demands met in all years	Delta Division: PHS demands not fully met in 49% of years Cross Valley Canal Unit: PHS demands not fully met in 5% of years West San Joaquin Division: PHS demands not fully met in 90% of years San Felipe Division: PHS demands not fully met in 17% years	Delta Division: PHS demands met in all years Cross Valley Canal Unit: PHS demands not fully met in 19% of years West San Joaquin Division: PHS demands not fully met in 30% of years San Felipe Division: PHS demands met in all years	No change from the No Action Alternative.	Delta Division: PHS demands met in all years Cross Valley Canal Unit: PHS demands not fully met in 15% of years West San Joaquin Division: PHS demands met in all years San Felipe Division: PHS demands met in all years
Changes to the M&I WSP could result in changes to the amount of unmet PHS demand in SOD CVP divisions.	Delta Division: PHS demands fully met Cross Valley Canal Unit: <1% of PHS demands unmet West San Joaquin Division: <1% to 15% of PHS demands unmet San Felipe Division: PHS demands fully met	Delta Division: <1% of PHS demands unmet Cross Valley Canal Unit: <1% of PHS demands unmet West San Joaquin Division: <1% to 56% of PHS demands unmet San Felipe Division: 3% to 14% of PHS demands unmet	Delta Division: PHS demands fully met Cross Valley Canal Unit: <1% of PHS demands unmet West San Joaquin Division: <1% to 15% of PHS demands unmet San Felipe Division: PHS demands fully met	No change from the No Action Alternative.	Delta Division: PHS demands fully met Cross Valley Canal Unit: <1% of PHS demands unmet West San Joaquin Division: PHS demands fully met San Felipe Division: PHS demands fully met

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes to the M&I WSP could cause indirect water supply effects as CVP contractors secure alternative supplies or reduce water demands in response to reduced deliveries.	Potential increased use of surface water transfers and groundwater substitution by agricultural contractors due to decreased CVP deliveries.	Potential increased use of surface water transfers and groundwater substitution by M&I contractors above what would be anticipated under the No Action Alternative due to decreased CVP deliveries.	Potential increased use of surface water transfers and groundwater substitution by agricultural contractors above what would be anticipated under the No Action Alternative due to decreased CVP deliveries.	No change from the No Action Alternative.	Potential increased use of surface water transfers and groundwater substitution by agricultural contractors above what would be anticipated under the No Action Alternative due to decreased CVP deliveries.
Chapter 5, Water Quality					
Changes in salinity and bromide concentrations could affect water quality in the Delta Division.	Small changes in salinity and bromide concentrations from changes to river flows would not affect water quality.	Increase in electrical conductivity (EC) of 1.5 to 4.8% in April through June of critical years.	Increase in EC of 0.5 to 2.6% in July through September of critical years.	No change from the No Action Alternative.	Small changes from the No Action Alternative would not affect water quality.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Chapter 6, Groundwater					
M&I and/or agricultural water service contractors could supplement their surface water supplies through groundwater pumping.	Net change in pumping in the Sacramento River Region: up to 71 TAF less. Net change in groundwater pumping in the San Joaquin River Region: up to 50 TAF less. Net change in groundwater pumping in the Tulare Lake Region: range from 30 TAF less to 13 TAF more. Decreases in pumping due to increased pumping costs. Potential for increased groundwater pumping in San Francisco Bay/Central Coast Hydrologic Region due to reduced agricultural deliveries; however, no M&I PHS unmet need in this region.	Net change in groundwater pumping in the Sacramento River Region: up to 4 TAF less. Net change in groundwater pumping in the San Joaquin River Region: up to 32 TAF less. Net change in groundwater pumping in the Tulare Lake Region: up to 38 TAF less. Decreases in pumping due to increases in deliveries to agricultural contractors. Net change in groundwater pumping in the San Francisco Bay/Central Coast Hydrologic Region: up to 21 TAF more to meet M&I PHS needs.	Net change in groundwater pumping in the Sacramento River Region: up to 2 TAF more. Net change in groundwater pumping in the San Joaquin River Region: up to 21 TAF more. Net change in groundwater pumping in the Tulare Lake Region: up to 15 TAF more. Increases in pumping due to decreases in deliveries to agricultural contractors. Net change in groundwater pumping in the San Francisco Bay/Central Coast Hydrologic Region: up to 1.5 TAF less due to increased M&I deliveries.	No change from the No Action Alternative.	Net change in groundwater pumping in less than 1 TAF in all regions compared to the No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Increased groundwater pumping to supplement supply shortages may cause groundwater level declines that could lead to permanent land subsidence	No impact to the Sacramento River and San Joaquin River regions. Net increase in pumping could potentially increase subsidence in the Tulare Lake Region.	No impact to the Sacramento River, San Joaquin River, and Tulare Lake regions. Net increase in pumping could potentially increase subsidence in the San Francisco Bay/Central Coast Hydrologic Region.	Net increase in pumping could potentially increase subsidence in the Sacramento Valley, San Joaquin Valley, and Tulare Lake regions. No impact to the San Francisco Bay/Central Coast Hydrologic Region.	No change from the No Action Alternative.	Minor changes in pumping not expected to affect subsidence in all regions.
Chapter 7, Geology and Soils					
Reduced CVP deliveries to agricultural water service contractors could indirectly lead to fugitive dust if crop idling is implemented.	Possible increased fugitive dust from new barren land if crop idling implemented due to decreased deliveries to agricultural contractors.	No impacts due to increased deliveries to agricultural contractors.	Possible increased fugitive dust from new barren land if crop idling implemented due to decreased deliveries to agricultural contractors.	No change from the No Action Alternative.	No change from the No Action Alternative.
Chapter 8, Air Quality					
Changes in CVP deliveries to M&I and agricultural water service contractors could result in a change in emissions if more pumping is necessary to deliver water.	Possible increased emissions at powerplants because of increased CVP deliveries to M&I water service contractors.	Possible decreased emissions at powerplants because of decreased CVP deliveries to M&I water service contractors.	Possible increased emissions at powerplants because of increased CVP deliveries to M&I water service contractors.	No change from the No Action Alternative.	No change from the No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes in CVP deliveries to agricultural and M&I water service contractors in the Sacramento Valley Air Basin could affect agricultural production, leading to changes in emissions from groundwater pumping from agricultural contractors	• volatile organic compound (VOC): -4 tons per year (tpy) to -3 tpy • nitrogen oxides (NOx): -77 tpy to -54 tpy • carbon monoxide (CO): -101 tpy to -72 tpy • sulfur oxides (SOx): -25 tpy to -18 tpy • inhalable particulate matter (PM_{10}): -6 tpy to -4 tpy • fine particulate matter ($PM_{2.5}$): -6 tpy to -4 tpy Decreases in emissions due to decreases in pumping as a result of increased pumping costs.	• VOC: <1 tpy • NOx: -5 tpy to -1 tpy • CO: -7 tpy to -2 tpy • SOx: -2 tpy to <1 tpy • PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Decreases in emissions due to decreases in pumping as a result of increased deliveries to agricultural contractors.	• VOC: <1 tpy • NOx: <1 tpy to 2 tpy • CO: <1 tpy to 3 tpy • SOx: <1 tpy to 1 tpy • PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Small increases in emissions due to small increases in pumping as a result of decreases in deliveries to agricultural contractors.	No change from the No Action Alternative.	• VOC: <1 tpy • NOx: <1 tpy • CO: <1 tpy • SOx: <1 tpy • PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Minor changes to emissions and pumping compared to the No Action Alternative.
Changes in CVP deliveries to agricultural and M&I water service contractors in the Sacramento Valley Air Basin could affect agricultural production, leading to changes in fugitive dust emissions from land preparation and harvesting activities from agricultural contractors, as well as changes to windblown dust erosion.	• PM_{10}: 164 tpy to 233 tpy • $PM_{2.5}$: 25 tpy to 35 tpy Increases in emissions due to increases in land under production, as agricultural contractors make use of alternative water supplies or shift to less water intensive crops.	• PM_{10}: <1 tpy to 41 tpy • $PM_{2.5}$: <1 tpy to 6 tpy Increases in emissions due to increases in land under production as a result of increased CVP deliveries to agricultural contractors.	• PM_{10}: -26 tpy to <1 tpy • $PM_{2.5}$: -4 tpy to <1 tpy Decreased emissions due to decreased land under production as a result of decreased CVP deliveries to agricultural contractors.	No change from the No Action Alternative.	• PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Very minimal changes to emissions due to negligible changes in CVP deliveries.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes in CVP deliveries to agricultural and M&I water service contractors in the San Joaquin Valley Air Basin could affect agricultural production, leading to changes in emissions from groundwater pumping from agricultural contractors	• VOC: -5 tpy to <1 tpy • NOx: -87 tpy to +5 tpy • CO: -114 tpy to +6 tpy • SOx: -28 tpy to +1 tpy • PM_{10}: -7 tpy to <1 tpy • $PM_{2.5}$: -7 tpy to <1 tpy Decreases in emissions due to decreases in pumping as a result of increased pumping costs.	• VOC: -3 tpy to -2 tpy • NOx: -54 tpy to -38 tpy • CO: -71 tpy to -49 tpy • SOx: -18 tpy to -12 tpy • PM_{10}: -4 tpy to -3 tpy • $PM_{2.5}$: -4 tpy to -3 tpy Decreases in emissions due to decreases in pumping as a result of increased pumping costs.	• VOC: 1 tpy to 2 tpy • NOx: 14 tpy to 32 tpy • CO: 19 tpy to 42 tpy • SOx: 5 tpy to 10 tpy • PM_{10}: 1 tpy to 2 tpy • $PM_{2.5}$: 1 tpy to 2 tpy Increases in emissions due to increases in pumping as a result of decreases in deliveries to agricultural contractors.	No change from the No Action Alternative.	• VOC: <1 tpy • NOx: <1 tpy to 1 tpy • CO: <1 tpy to 1 tpy • SOx: <1 tpy • PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Minor changes to emissions and pumping compared to the No Action Alternative.
Changes in CVP deliveries to agricultural and M&I water service contractors in the San Joaquin Valley Air Basin could affect agricultural production, leading to changes in fugitive dust emissions from land preparation and harvesting activities from agricultural contractors, as well as changes to windblown dust erosion.	• PM_{10}: 26 tpy to 34 tpy • $PM_{2.5}$: -2 tpy to +4 tpy Increases in emissions due to increases in land under production, as agricultural contractors make use of alternative water supplies or shift to less water intensive crops.	• PM_{10}: -36 tpy to <1 tpy • $PM_{2.5}$: -15 tpy to <1 tpy Decreases in emissions due decreases in windblown dust erosion from the increase in land under production.	• PM_{10}: <1 tpy to 26 tpy • $PM_{2.5}$: <1 tpy to 10 tpy Increased emissions due to dust erosion from increased barren land as a result of decreased CVP deliveries to agricultural contractors.	No change from the No Action Alternative.	• PM_{10}: <1 tpy • $PM_{2.5}$: <1 tpy Very minimal changes to emissions due to negligible changes in CVP deliveries.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Changes in emissions that would occur from groundwater pumping and differences in irrigated acreages could exceed the general conformity de minimis thresholds.	Impact not applicable to the No Action Alternative.	Emissions from all pollutants except for PM_{10} in the Sacramento Metropolitan region would decrease compared to the No Action Alternative. PM_{10} emissions increase would not exceed general conformity de minimum thresholds.	Emissions from all pollutants would increase compared to the No Action Alternative. Emissions in the Sacramento Metropolitan region would not exceed the general conformity de minimis thresholds. NOx emissions in San Joaquin Valley would exceed the de minimis threshold and a general conformity determination would need to be developed if Alternative 3 is selected as the preferred alternative because the alternative could indirectly affect criteria pollutant emissions,	No change from the No Action Alternative.	Emission increases would be minimal compared to the No Action Alternative and general conformity de minimis thresholds would not be exceeded.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Chapter 9, Greenhouse Gases and Climate Change					
Changes in CVP deliveries to agricultural and M&I water service contractors in the area of analysis could affect agricultural production, leading to changes in greenhouse gas (GHG) emissions from groundwater pumping from agricultural contractors.	Change in GHG emissions compared to existing conditions: -30,044 metric tons carbon dioxide equivalent per year ($MTCO_2e$/yr) to -9,187 $MTCO_2e$/yr. Decreases in emissions due to decreases in pumping as a result of increased pumping costs.	Change in GHG emissions compared to the No Action Alternative: -10,894 $MTCO_2e$/yr to -7,506 $MTCO_2e$/yr. Decreases in emissions due to decreases in pumping as a result of increased deliveries to agricultural contractors.	Change in GHG emissions compared to the No Action Alternative: +2,715 $MTCO_2e$/yr to +5,753 $MTCO_2e$/yr. Increases in emissions due to increases in pumping as a result of decreases in deliveries to agricultural contractors.	No change from the No Action Alternative.	Change in GHG emissions compared to the No Action Alternative: +15 $MTCO_2e$/yr to +136 $MTCO_2e$/yr. Slight increases to emissions and pumping compared to the No Action Alternative.
Chapter 12, Agricultural Resources					
Changes in CVP deliveries to agricultural water service contractors could convert agricultural lands under the Williamson Act and other land resource programs to an incompatible use.	Minimal changes compared to existing conditions due to minor changes agricultural land use.	No conversion of agricultural land to incompatible uses compared to the No Action Alternative.	An adverse impact to the Tulare Lake Region by reducing agricultural acreage by 23,000 acres (approximately a 1% loss). Minimal loses to irrigated farmlands in the other regions for all year types.	No change from the No Action Alternative.	No change from the No Action Alternative.
Indirect effects could occur from implementation of the alternative.	Possible decrease in agricultural land in production north of the Delta and increase in agricultural land in production south of the Delta as a result of water transfers or crop idling.	None.	Possible decrease in agricultural land in production north of the Delta and increase in agricultural land in production south of the Delta as a result of water transfers or crop idling.	No change from the No Action Alternative.	No change from the No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Chapter 13, Socioeconomics					
Alternatives could result in economic effects to M&I water service contractors and the regional economy.	Sacramento Valley Region: In some years, minimal PHS needs would not be met, which could result in minimal adverse economic effects to the region if contractors implement options that increase costs. American River Region – all PHS needs would be met, which would result in positive economic effects for existing and new developments. San Joaquin Valley Region – PHS needs would not be met in multiple years for some contractors, which would result in short- and long-term adverse economic impacts. Bay Area Region – all PHS needs would be met, which would result in positive economic effects for existing and new developments.	Adverse impacts to regional economies due to decreased CVP deliveries to M&I contractors. *Average annual* impacts would be: Sacramento Valley Region Output: -$1.5 million Employment: -13 jobs Labor Income: -$0.46 million Value Added: -$0.93 million American River Region Output: -$6.7 million Employment: -52 jobs Labor Income: -$4.3 million Value Added: -$4.3 million San Joaquin Valley Region Output: -$5.5 million Employment: -43 jobs Labor Income: -$1.6 million Value Added: -$1.8 million Bay Area Region Output: -$5.4 million Employment: -37 jobs Labor Income: -$2.0 million Value Added: -$3.5 million	Positive effects to regional economies due to increased CVP deliveries to M&I contractors. *Average annual* impacts would be: Sacramento Valley Region Output: $0.75 million Employment: 6 jobs Labor Income: $0.24 million Value Added: $0.48 million American River Region Output: $3.8 million Employment: 30 jobs Labor Income: $1.3 million Value Added: $2.5 million San Joaquin Valley Region Output: $3.0 million Employment: 24 jobs Labor Income: $0.9 million Value Added: $1.8 million Bay Area Region Output: $6.4 million Employment: 44 jobs Labor Income: $2.4 million Value Added: $4.2 million	Same as No Action Alternative.	Similar to or less than No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Alternatives could result in economic effects to crop value of production and the regional economy.	Adverse impacts to agricultural value of production due to CVP water shortages in the Sacramento River, San Joaquin River, and Tulare Lake regions.	Positive effects to regional economies due to increased CVP deliveries to agricultural contractors: Effects in *critical* water years - Sacramento Valley Region Output: $52.3 million Employment: 402 jobs Labor Income: $18.4 million Value Added: $31.1 million San Joaquin River Region Output: -$7.5 million Employment: -55 jobs Labor Income: -$2.7 million Value Added: -$4.4 million Tulare Lake Region Output: $71.4 million Employment: 332 jobs Labor Income: $15.1 million Value Added: $27.8 million	Adverse Impacts to regional economies due to decreased CVP deliveries to agricultural contractors: Effects in *critical* water years - Sacramento Valley Region Output: -$23.6 million Employment: -185 jobs Labor Income: -$8.4 million Value Added: -$14.2 million San Joaquin River Region Output: $8.1 million Employment: 54 jobs Labor Income: $3.0 million Value Added: $4.9 million Tulare Lake Region Output: -$72.8 million Employment: -502 jobs Labor Income: -$21.1 million Value Added: -$36.6 million	Same as No Action Alternative.	Similar to or less than No Action Alternative.
Alternatives could change groundwater pumping costs for agricultural water service contractors.	CVP water shortages could increase pumping costs for agricultural water service contractors.	Pumping costs would decrease by $2.4 million in San Joaquin Region and $1.5 million in Tulare Lake Region.	Pumping costs would increase by $1.3 million in San Joaquin River Region and $0.8 million in Tulare Lake Region.	Same as No Action Alternative.	Similar to or less than No Action Alternative.

Impact	Alternative 1: No Action	Alternative 2: Equal Agricultural and M&I Allocation	Alternative 3: Full M&I Allocation Preference	Alternative 4: Updated M&I WSP	Alternative 5: M&I Contractor Suggested WSP
Implementation of cropland idling water transfers could result in indirect economic effects.	Adverse impacts - cropland idling transfers could result in reductions in value of output, employment, labor income and value added in Sacramento Valley counties where cropland idling could occur.	Adverse impacts - cropland idling transfers could result in reductions in value of output, employment, labor income and value added in Sacramento Valley counties where cropland idling could occur.	Adverse impacts - cropland idling transfers could result in reductions in value of output, employment, labor income and value added in Sacramento Valley counties where cropland idling could occur.	Same as No Action Alternative.	Similar to or less than No Action Alternative.
Chapter 17, Power					
Changes in CVP deliveries may cause changes in power generation from hydroelectric power generation facilities by changing reservoir releases or by changing reservoir storage (as represented by changes in reservoir elevations).	There would be an adverse impact in the amount of power generated by Folsom and Nimbus powerplants as a result of a reduction in monthly flows of up to 39%. In addition, monthly changes in storage at San Luis Reservoir would vary between 23% less to 17% more and therefore adversely impact the amount of power generated.	Minimal reductions to the amount of power generated at the Folsom and Nimbus powerplants, as a result of changes in flows between 2% less and 17% more as compared to the No Action Alternative. Power generated at the San Luis Reservoir powerplants would slightly change as compared to the No Action Alternative as a result of changes in storage between 5% less and 10% more.	Decrease in the amount of power generated at the Folsom and Nimbus powerplants as a result of an up to 10% decrease in flows in the American River. Storage at the San Luis Reservoir would change between 3% less and 10% more, compared to the No Action Alternative, and therefore minimal decrease the amount of power generated from the San Luis Reservoir powerplants.	No change from No Action Alternative.	No change from No Action Alternative.

This page left blank intentionally.

Chapter 4
Surface Water

This chapter discusses how and when surface water supplies are delivered to water users in specific Central Valley Project (CVP) divisions, the management of surface water, and how the Municipal and Industrial Water Shortage Policy (M&I WSP) would affect water service contractors in the area of analysis. The subsections discuss existing water supplies, including source and management, analyzes effects of the alternatives, and presents a discussion of cumulative effects and a comparative analysis of the alternatives.

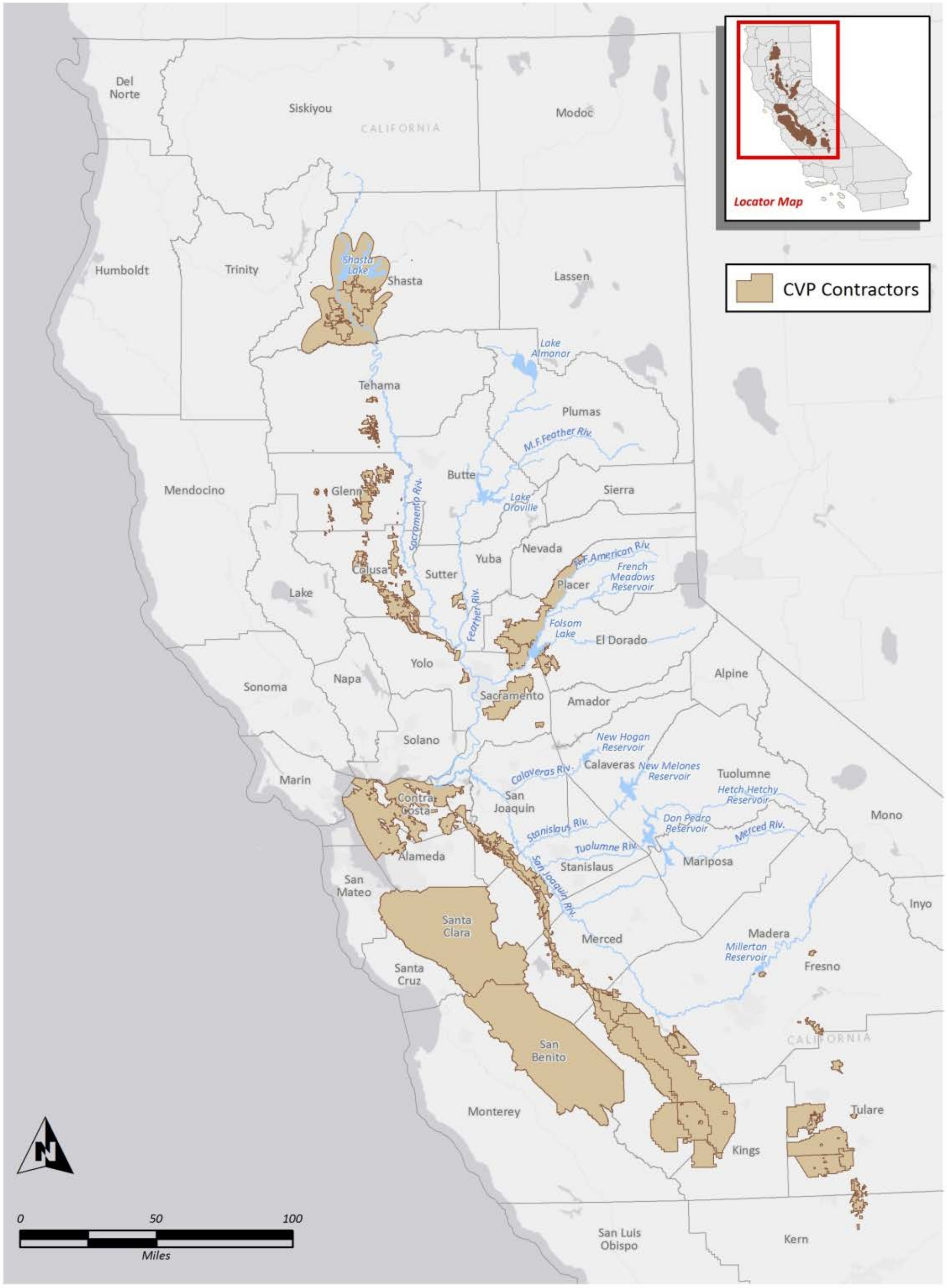
4.1 Affected Environment

This section provides an overview of the regulatory setting associated with surface water and provides a description of the water bodies with the potential to be affected by the action alternatives.

4.1.1 Area of Analysis

The evaluation of potential effects on surface water supply and management from the implementation of the M&I WSP includes CVP Divisions north and south of the Sacramento-San Joaquin River Delta (Delta) in the following area of analysis (see Figure 4-1):

- North of Delta
  - Shasta and Trinity River Divisions;
  - Sacramento River Division;
  - American River Division;
- Delta Division
- South of Delta
  - Cross Valley Canal Unit;
  - West San Joaquin Division; and
  - San Felipe Division.



Source: Reclamation 2005, Reclamation 2011.

Figure 4-1. Surface Water Area of Analysis

4.1.2 Regulatory Setting

The following section describes the applicable water laws, rules, regulations, and policies that influence the operation and comparative performance of the alternatives.

4.1.2.1 Federal

River and Harbors Act of 1899 Section 10 of the Rivers and Harbors Act of 1899 regulates alteration of (and prohibits unauthorized obstruction of) any navigable waters of the United States (U.S.). Under the reauthorization of the Rivers and Harbor Act of 1937, the Bureau of Reclamation (Reclamation) took responsibility for the operation of the CVP. The Act authorized $12 million for construction of the CVP and made the improvement of navigation, regulation, and flood protection on the San Joaquin and Sacramento Rivers the first priority. Reclamation's primary purpose of supplying water for M&I use and irrigation was designated as the second priority and power generation was designated as last priority. Reclamation currently manages the dams, reservoirs, canals, and other infrastructure connected with the CVP and administers the water contracts.

Central Valley Project Improvement Act On October 30, 1992, Public Law 102-575 was signed into law. This law included Title 34, the Central Valley Project Improvement Act (CVPIA), which amended previous authorizations of the CVP. The CVPIA mandated changes in management of the CVP, requiring fish and wildlife protection, restoration, and mitigation as project purposes equal to that of agricultural irrigation, M&I supplies, and power generation.

Section 3404(c) Long-Term Water Service Contracts In accordance with CVPIA Section 3404(c), Reclamation is renegotiating long-term water service contracts. As many as 113 CVP water service contracts located within the Central Valley of California may be renewed using this authorization.

Section 3406(b)(2) Section 3406(b)(2) of the CVPIA mandates that 800,000 acre-feet (AF) of water be dedicated to the fish, wildlife, and habitat restoration purposes of the CVPIA. This water is intended to meet the legal obligations of the CVP under both State of California (State) and Federal law pertaining to wildlife and habitat.

Federal Endangered Species Act (ESA) The coordinated long-term operation of the CVP and State Water Project (SWP) is currently subject to the terms and conditions of Biological Opinions (BOs) issued by the U.S. Fish and Wildlife Service (USFWS) in 2008 and the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) in 2009, pursuant to Section 7 of the ESA. These BOs control operation of the CVP and SWP Delta pumps and consequently deliveries to CVP and SWP contractors. In 2011, these BOs were remanded by court order to the federal fish and wildlife agencies for revision. The revised BOs are to be issued by December 1, 2014 (USFWS) and February 1, 2017 (NOAA Fisheries) with the possibility of two one-year extensions if satisfactory progress is demonstrated to the court.

Coordinated Operations Agreement for the CVP and SWP The CVP and SWP are operated by Reclamation and the California Department of Water Resources (DWR) under the terms of a 2004 Coordinated Operations Agreement (COA). The COA provides procedures for the split of responsibility between the two agencies for meeting Delta standards, defines how water that is not captured for storage will be shared and establishes a mechanism for the exchange of water between the CVP and SWP.

4.1.2.2 State

Water Rights in California As granted by the Water Commission Act of 1914 and the California Water Code, the State Water Resources Control Board (SWRCB) issues and administers permits and licenses for California's surface water.

A water right is a legal entitlement that permits water to be diverted from a specified source and put it to beneficial use. The exercise of most water rights requires a license or permit from the SWRCB. The SWRCB has the responsibility to ensure that the State's waters are put to the best possible use, that water is not wasted, and that the environment is not harmed by the use of the water. Water right permits outline the amounts, conditions, and construction timetables for the proposed water project. Approval from the SWRCB is required for any change in purpose, place of use, or point of diversion (SWRCB 2014). Reclamation has water right permits for the CVP that include requirements for the protection of beneficial uses in the Sacramento Valley and Delta. In addition, Reclamation has settlement agreements with the Sacramento River Settlement Contractors; and exchange agreements with the San Joaquin River Exchange Contractors to deliver CVP supplies in exchange for water they would have otherwise taken pursuant to a prior right.

4.1.2.3 Regional/Local

Urban Water Management Planning Act The Urban Water Management Planning Act (California Water Code §10610 et seq.) requires urban water suppliers to report, describe, and evaluate water deliveries and use, water supply sources, water use efficiency and water demand management measures. The Urban Water Management Planning Act directs water agencies in carrying out their long-term resource planning responsibilities to ensure adequate water supplies are available to meet existing and future demands. Urban water suppliers are required to assess current demands and supplies over a 20-year planning horizon and consider various drought scenarios. The Urban Water Management Planning Act also requires water shortage contingency planning and drought response actions to be included in an Urban Water Management Plan (UWMP). UWMPs are to be prepared every five years by urban water suppliers with 3,000 or more service connections or supplying 3,000 or more AF per year (AFY) of water (DWR 2011).

4.1.3 Existing Conditions

Water supplies in California come from either groundwater or surface water. This chapter will focus on the movement of surface water supplies from their sources to their users[1]. Within California, lakes, rivers, and reservoirs receive their water from precipitation, runoff, and groundwater springs, which are at their highest flow during the rainy season (typically October through April). While water users need water year-round, water needs are highest during the summer because of high temperatures and agricultural irrigation needs. This imbalance between the timing of runoff and the highest water demand period is exacerbated by the differences in precipitation and demand between northern California and southern California.

Because of the uneven distribution of water supply and water demand statewide, a system of aqueducts and canals transports water to users. As discussed in Chapter 1, the Federal and State governments constructed the CVP and State Water Project (SWP), respectively, in part to store and transport water.

There are 271 water contracts, 88 of which are water service contracts, with Reclamation for the delivery of CVP water. CVP water allocations for agricultural, environmental/refuges, and M&I users vary based on factors such as hydrology, runoff forecast, prior water right commitments, reservoir storage, required water quality releases, required environmental releases, and operational limitations. Each year Reclamation determines the amount of water that can be allocated to each CVP water service contractor based on conditions for that year. In most cases, these allocations are expressed as a percentage of the contract total (for contracts that allow use of both agricultural and M&I water) or historical use (for M&I only contracts). Table 4-1 summarizes CVP allocations, as percentages of contract amount, allocated to agricultural and M&I water service contractors north and south of the Delta from 2000 through 2014[2]. Water shortages lead to reduced water allocations especially in the southern portion of the CVP.

Table 4-1. CVP Allocation Percentages 2000 through 2014

Year	Year Type	Agriculture (Ag)[1]		Municipal and Industrial	
		North of Delta (%)	South of Delta (%)	North of Delta (%)	South of Delta (%)
2000	AN	100	65	100	90
2001	D	60	49	85	77
2002	D	100	70	100	95
2003	AN	100	75	100	100
2004	BN	100	70	100	95
2005	AN	100	90	100	100
2006	W	100	100	100	100

[1] See Chapter 6 for information on groundwater resources.
[2] The allocations shown in Table 4-1 reflect major changes to CVP operations between 2007 and 2009 as a result of the Wanger guidelines and USFWS and NOAA Fisheries BOs.

Year	Year Type	Agriculture (Ag)[1]		Municipal and Industrial	
		North of Delta (%)	South of Delta (%)	North of Delta (%)	South of Delta (%)
2007	D	100	50	100	75
2008	C	40	40	75	75
2009	D	40	10	100	60
2010	BN	100	45	100	75
2011	W	100	80	100	100
2012	BN	100	40	100	75
2013	D	75	20	100/75[2]	70
2014	D[3]	0	0	50[4]	50[4]

Source: Reclamation 2014, DWR 2014

Notes:

[1] Includes water service contracts, does not include Sacramento River Settlement and San Joaquin River Exchange Contractors

[2] In 2013, American River contractors received 75 percent of contract amount.

[3] Calculated utilizing May 1, 2014 50 percent exceedance forecast for Sacramento River unimpaired runoff

[4] Historical use applied to allocations.

Key:
C = Critical
D = Dry
BN = Below Normal
AN = Above Normal
W = Wet

As shown in Table 4-1, south of Delta (SOD) agricultural contractors experience severe reductions in CVP allocations in most years. In 2009 and 2014, their deliveries were reduced to 10 percent and 0 percent of contract amounts, respectively..

4.1.3.1 North of Delta

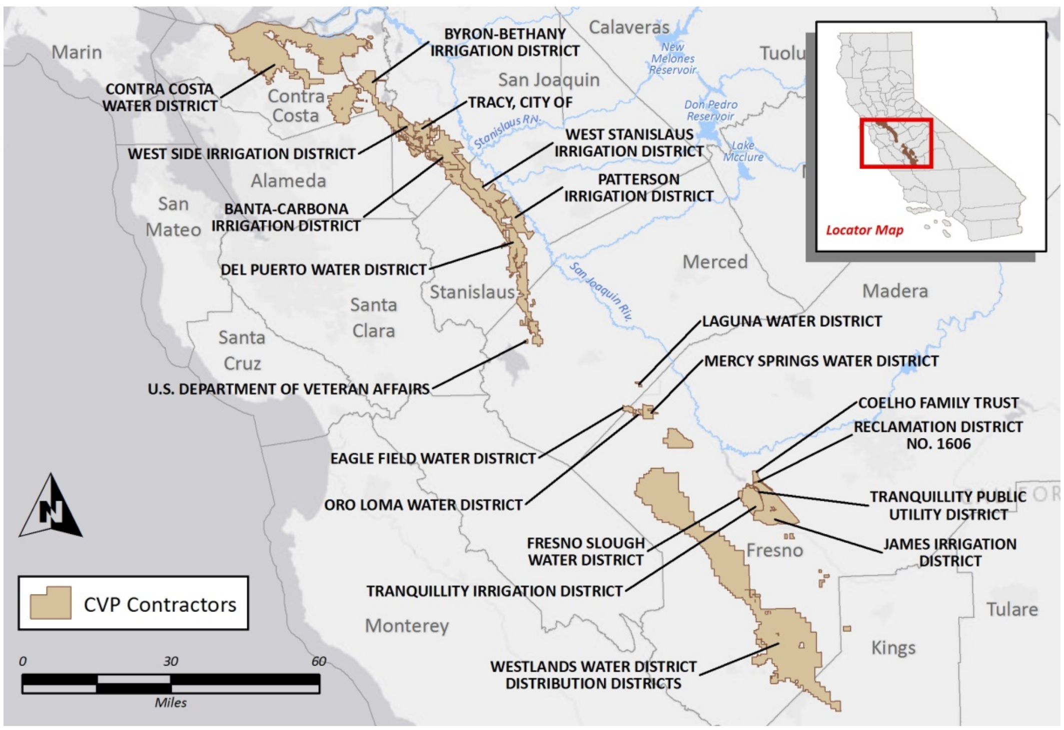
North of the Delta, there are 42 water service contractors across three CVP divisions that deliver water to agricultural water service contractors, M&I water users, or both agricultural and M&I water users. The contractors serving agricultural water users and the contractors serving both agricultural and M&I water users hold contracts with Reclamation for 486,998 AF and serve over 158,000 acres of productive agricultural lands (Reclamation 2008). The most recent CVP Water Needs Assessments indicated that historical (mid-1990s) north of Delta (NOD) agricultural water use totaled over 373 TAF per year (Reclamation 2008).

The NOD CVP Divisions and the M&I water supply used by the contractors in these divisions are described below.

Shasta and Trinity River Divisions Shasta Division and Trinity River Division water service contractors are listed in Table 4-2 and indicated in Figure 4-2. These contractors are located in the upstream portions of the Sacramento and Trinity rivers. Reclamation releases water from Shasta Lake as needed to meet downstream requirements, or CVP contractor water demands. Shasta Lake is managed for flood control, water supply, recreation, fish and wildlife enhancement, power, and salinity control.

Table 4-2. Shasta Division and Trinity River Division Water Service Contractors

Contractor	M&I	Agriculture
Bella Vista Water District	X	X
Centerville Community Services District	X	-
City of Redding	X	-
City of Shasta Lake	X	-
Clear Creek Community Services District	X	X
Mountain Gate Community Services District	X	-
Shasta Community Services District	X	-
Shasta County Water Agency	X	-
U.S. Forest Service (Shasta)	X	-



Source: Reclamation 2005, Reclamation 2011.

Figure 4-2. Shasta Division and Trinity River Division Water Service Contractors

Reclamation manages the Trinity River Division to store and regulate water in the Trinity River, as well as divert water to the Sacramento River Basin through Whiskeytown Lake and ultimately into to the Sacramento River at Keswick

Reservoir. Figure 4-3 shows the M&I historical use,[3,4] projected 2030 public health and safety (PHS) demand[5], the portion of that demand met by CVP deliveries[6] in critically dry water years, and contract quantity (including both agricultural and M&I uses) for CVP water service contractors in the Shasta and Trinity River divisions. All but one of the Shasta Division and Trinity River Division contractors have taken delivery of M&I water during the historical use period. All contractors are assumed to have M&I water demands in 2030 (see Appendix A).

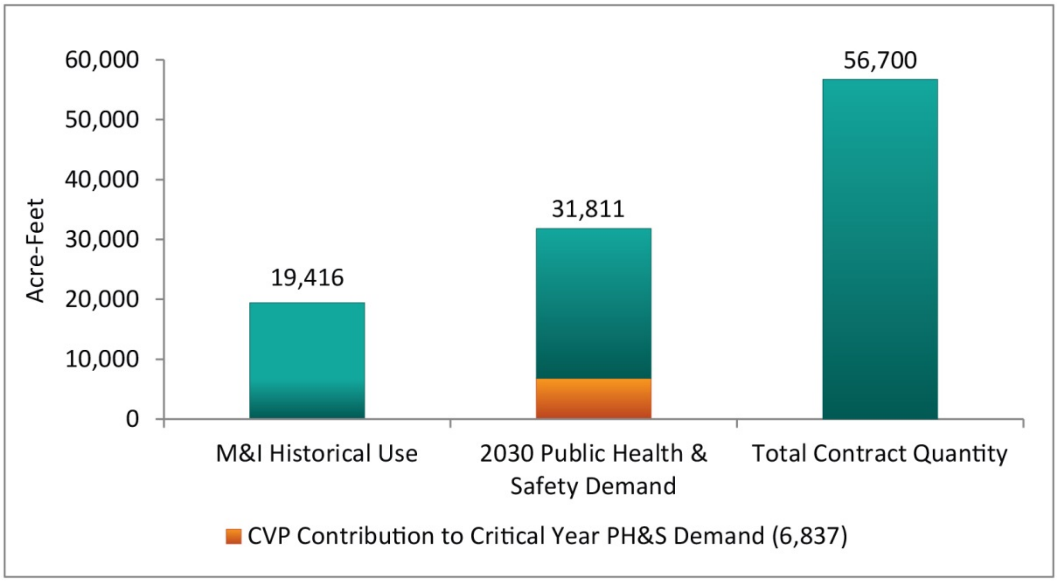


Figure 4-3. Shasta Division and Trinity River Divisions CVP Contract Quantity and M&I Historical Use

Sacramento River Division Sacramento River Division CVP water service contractors are listed in Table 4-3 and shown in Figure 4-4. These contractors receive CVP water that is stored in Shasta Lake[7], upstream from their service areas. The Tehama-Colusa Canal and Corning Canal divert water from the Sacramento River for delivery to CVP water service contractors in Tehama, Glenn, Colusa, and Yolo counties.

---

[3] Historical use is calculated using the average quantity of CVP water put to beneficial use within the CVP service area during the last three years of water deliveries that were unconstrained by the availability of CVP water. Additional detail on the unconstrained years used for this calculation is presented in Chapter 2.3.3 and Table 2-3.

[4] Years used to calculate historical use in the Shasta Division and the Trinity River Division - 2006, 2007, 2010

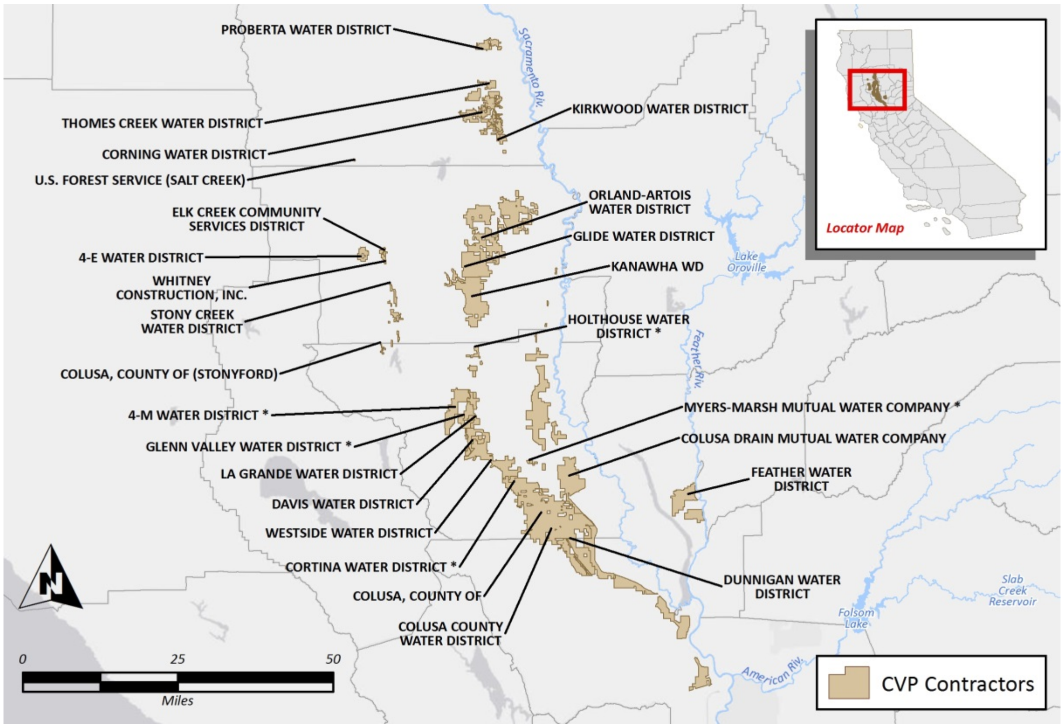
[5] Appendix A, M&I Contractor Data Summary, contains the detailed contractor data, assumptions, and data sources.

[6] As noted in Chapter 2.3.5, CVP supplies are considered secondary or supplemental for the purpose of identifying unmet contractor PHS need. CVP supplies are provided to satisfy PHS demands after the contractor has utilized all other available non-CVP supplies.

[7] Reclamation operates the CVP as an integrated project; water allocated may actually come from Shasta Lake or the Trinity River Division.

Table 4-3. Sacramento River Division Water Service Contractors

Contractor	M&I	Ag
4-E Water District	-	X
4-M Water District	X	X
Colusa County Water District	X	X
Colusa Drain Mutual Water Company	-	X
Corning Water District	X	X
Cortina Water District	X	X
County of Colusa	X	X
County of Colusa (Stonyford)	X	X
Davis Water District	X	X
Dunnigan Water District	X	X
Elk Creek Community Services District	X	-
Feather Water District	-	X
Glenn Valley Water District	X	X
Glide Water District	X	X
Holthouse Water District	X	X
Kanawha Water District	X	X
Kirkwood Water District	X	X
La Grande Water District	X	X
Myers-Marsh Mutual Water Company	X	X
Orland-Artois Water District	X	X
Proberta Water District	X	X
Stony Creek Water District	X	X
Thomes Creek Water District	X	X
U.S. Forest Service (Salt Creek)	X	-
Westside Water District	X	X
Whitney Construction, Incorporated	X	-



Source: Reclamation 2005, Reclamation 2011.

Figure 4-4. Sacramento River Division Water Service Contractors

Figure 4-5 shows the M&I historical use[8], projected 2030 PHS demand[9], and contract quantity (including both agricultural and M&I uses) for CVP water service contractors in the Sacramento River Division. In critically dry water years contractors would not rely on CVP deliveries to meet PHS demand given their ability to access sufficient non-CVP supplies to meet these demands. Only five of the Sacramento River Division contractors have taken delivery of M&I water during the historical use period; therefore, only those five have projected M&I water demands in 2030 (see Appendix A).

[8] Years used to calculate historical use in the Sacramento River Division - 2006, 2007, 2010
[9] Appendix A, M&I Contractor Data Summary, contains the detailed contractor data, assumptions, and data sources.

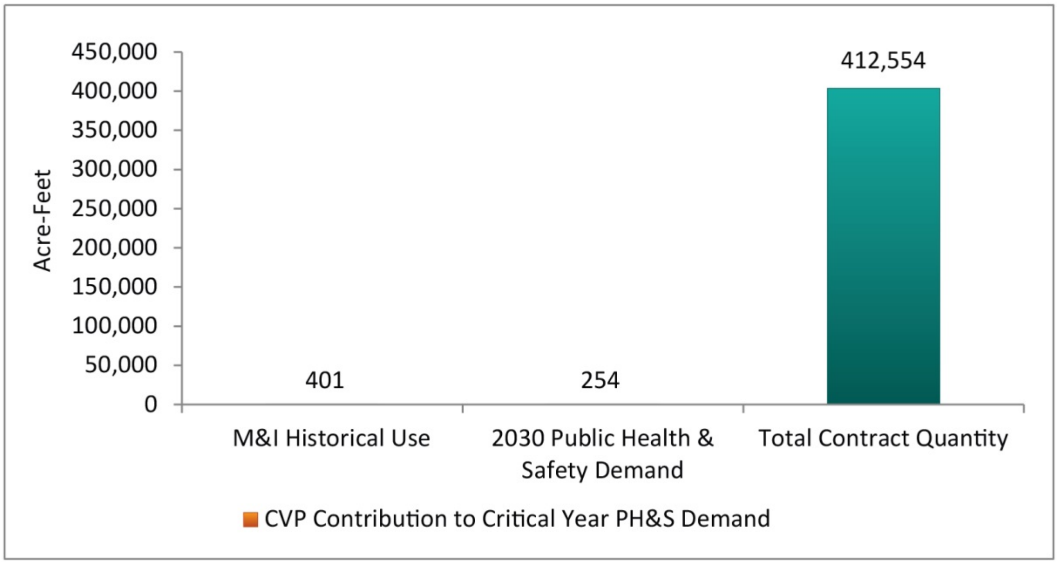


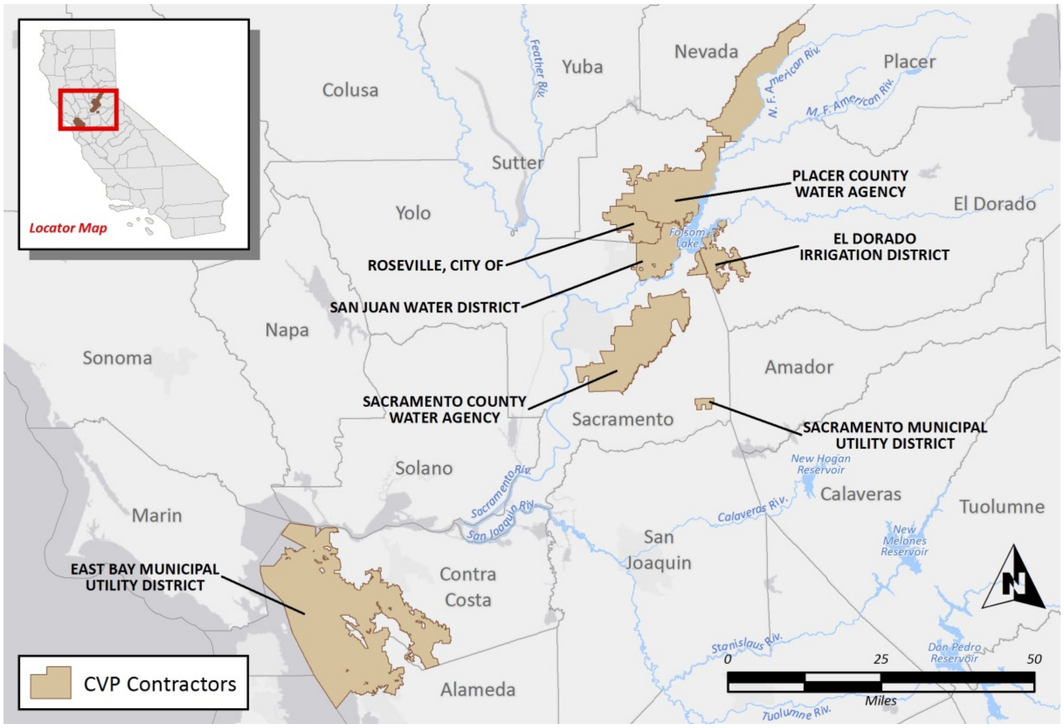
Figure 4-5. Sacramento River Division CVP Contract Quantity and M&I Historical Use

American River Division The American River Division CVP water service contractors are listed in Table 4-4 and indicated in Figure 4-6. Figure 4-7 shows the M&I historical use[10], projected 2030 PHS demand[11], the portion of that demand met by CVP deliveries in critically dry water years, and contract quantity (including both agricultural and M&I uses) for CVP contractors in the American River Division. As indicated in Figure 4-7, the division's 2030 PHS demand exceeds the total CVP contract quantity, but of the total demand, the majority is provided by non-CVP supplies available to contractors in the division. All but one of the American River Division contractors have taken delivery of M&I water during the historical use period. All contractors are assumed to have M&I water demands in 2030 (see Appendix A).

Table 4-4. American River Division Water Service Contractors

Contractor	M&I	Ag
City of Roseville	X	-
City of Sacramento	X	-
East Bay Municipal Utility District	X	-
El Dorado Irrigation District	X	-
Placer County Water Agency	X	-
Sacramento County Water Agency	X	-
Sacramento Municipal Utility District	X	-
San Juan Water District	X	-

[10] Years used to calculate historical use in the American River Division - 2007, 2009, 2010.
[11] Appendix A, M&I Contractor Data Summary, contains the detailed contractor data, assumptions, and data sources.



Source: Reclamation 2005, Reclamation 2011.

Figure 4-6. American River Division Water Service Contractors

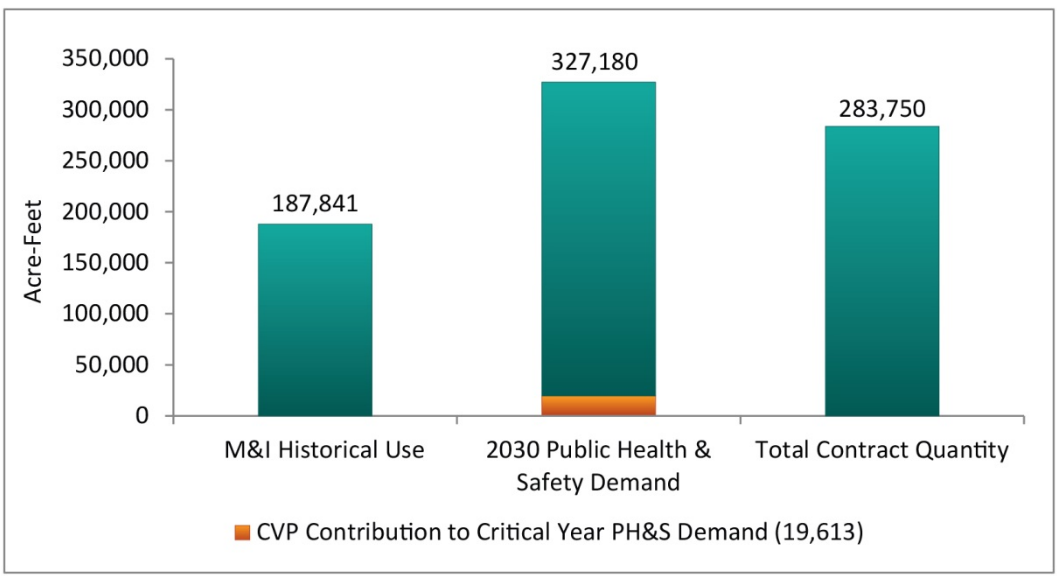


Figure 4-7. American River Division CVP Contract Quantity and M&I Historical Use

Folsom Dam was built by the U.S. Army Corps of Engineers, but is operated by Reclamation. Built as a multipurpose project, Folsom Lake (and Dam) functions primarily as a flood control structure; however, Folsom Lake also provides for irrigation and M&I water supply, electrical power generation, recreation, preservation of the American River fishery, and downstream control of saltwater intrusion in the Delta. Nimbus Dam regulates releases from the Folsom Powerplant and creates Lake Natoma.

4.1.3.2 Delta and South of Delta

In the Delta and south of the Delta there are 31 water service contractors across three CVP Divisions and one unit that deliver water to agricultural water users, M&I water users, or both agricultural and M&I water users. The contractors serving agricultural water users and the contractors serving both agricultural and M&I water users hold water service contracts with Reclamation for more than 2,087,288 AF and serve over 978,000 acres of productive agricultural lands (Reclamation 2008).

The Delta, West San Joaquin, and San Felipe divisions and the M&I water supply used by the contractors in these divisions are described below.

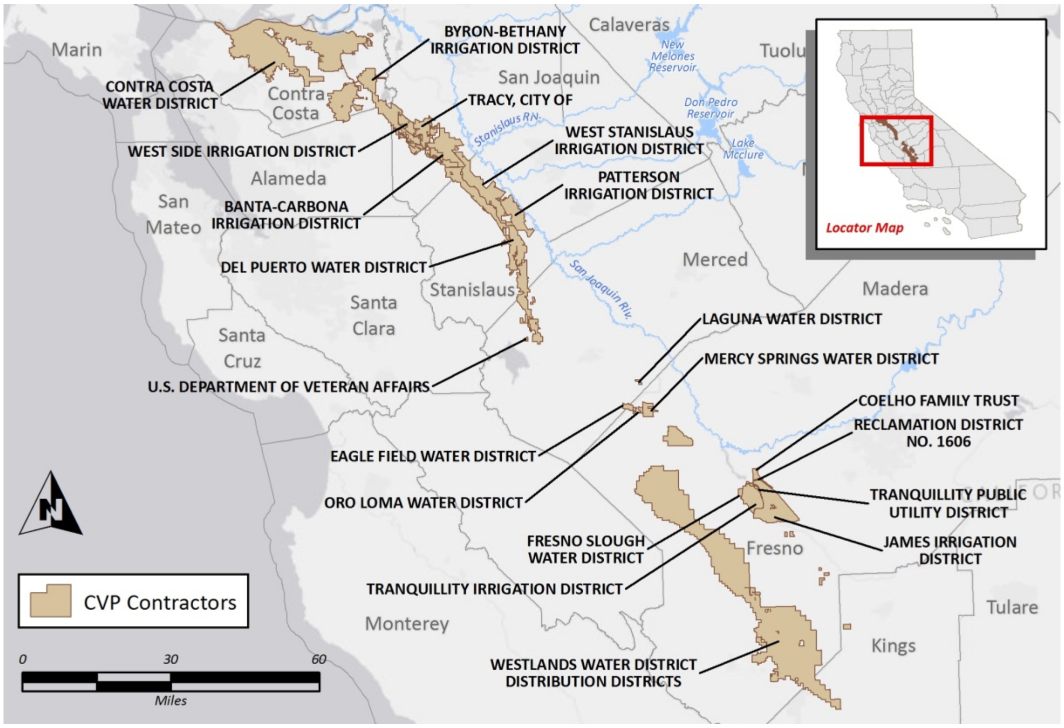
Delta Division The Delta Division CVP water service contractors are listed in Table 4-5 and indicated in Figure 4-8. Figure 4-9 shows the M&I historical use[12], projected 2030 PHS demand[13], the portion of that demand met by CVP deliveries in critically dry water years, and contract quantity (including both agricultural and M&I uses) for CVP contractors in the Delta Division. Only five of the Delta Division contractors have taken delivery of M&I water during the historical use period; therefore, only those five have projected M&I water demands in 2030 (see Appendix A).

Table 4-5. Delta Division Water Service Contractors

Contractor	M&I	Ag
Banta-Carbona Irrigation District	X	X
Byron-Bethany Irrigation District	X	X
City of Tracy	X	X
Coelho Family Trust	X	X
Contra Costa Water District	X	-
Del Puerto Water District	X	X
Eagle Field Water District	X	X
Fresno Slough Water District	X	X
James Irrigation District	X	X
Laguna Water District	X	X
Mercy Springs Water District	X	X
Oro Loma Water District	X	X
Pajaro Valley Water Management Agency, Westlands Water District	X	X
Patterson Irrigation District	X	X
Reclamation District No. 1606	X	X
Tranquillity Irrigation District	X	X

[12] Years used to calculate historical use in the Delta Division - 2003, 2005, 2006.
[13] Appendix A, M&I Contractor Data Summary, contains the detailed M&I contractor data, assumptions, and data sources.

Contractor	M&I	Ag
Tranquillity Public Utility District	X	X
U.S. Department of Veteran Affairs	X	-
West Side Irrigation District	-	X
West Stanislaus Irrigation District	X	X
Westlands Water District Distribution Districts	X	X



Source: *Reclamation 2005, Reclamation 2011.*

Figure 4-8. Delta Division Water Service Contractors

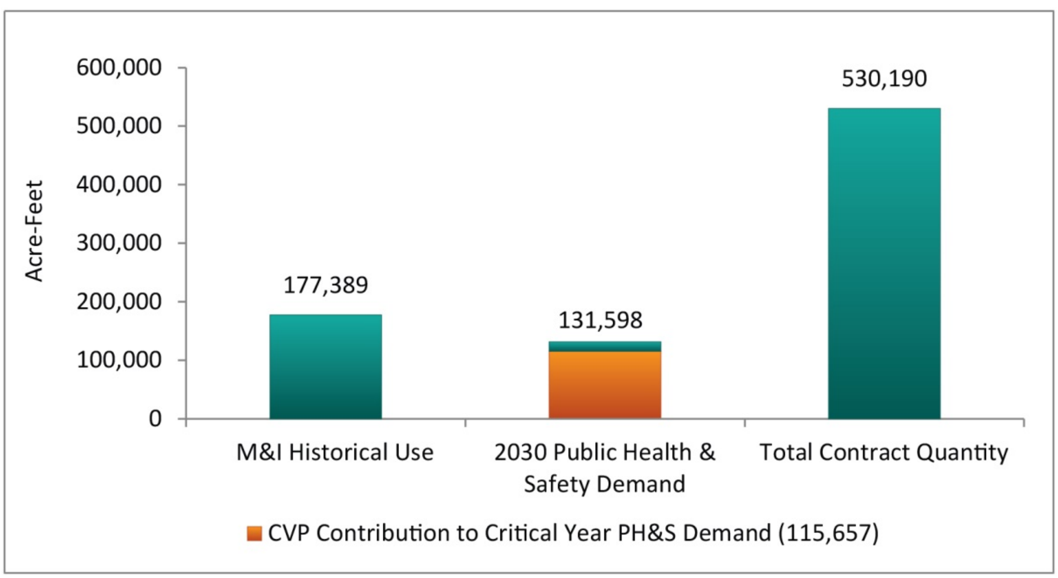


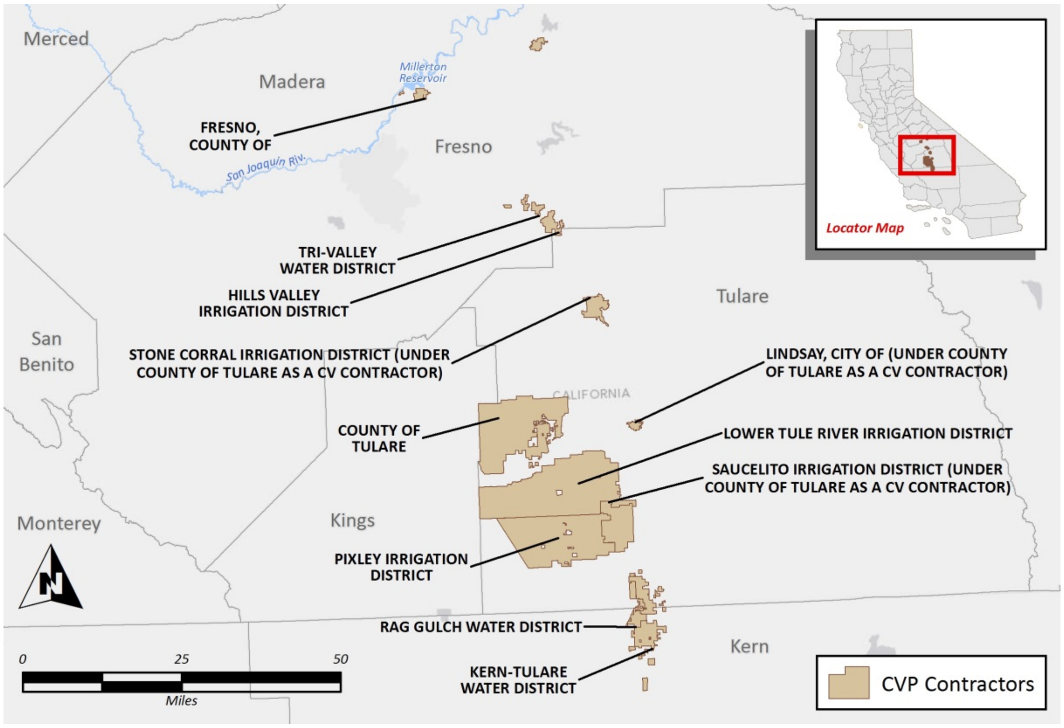
Figure 4-9. Delta Division CVP Contract Quantity and M&I Historical Use

Cross Valley Canal Unit The Cross Valley Canal Unit connects the California Aqueduct to the Kern County Water Agency and the Friant Kern Canal. The Cross Valley Canal Unit CVP water service contractors are listed in Table 4-6 and indicated in Figure 4-10. The Cross Valley Canal conveys CVP supplies to the contractors listed in Table 4-6 and is used to provide Kern County Water Agency users and contractors in the Friant Division with access to CVP water via exchange or groundwater banking from California Aqueduct contractors during droughts (Reclamation 2007). Figure 4-11 shows the M&I historical use[14], projected 2030 PHS demand[15], the portion of that demand met by CVP deliveries in critically dry water years, and contract quantity (including both agricultural and M&I uses) for CVP contractors in the Cross Valley Canal Unit. Only two of the Cross Valley Canal contractors have taken delivery of M&I water during the historical use period; therefore, only those two have projected M&I water demands in 2030 (see Appendix A).

Table 4-6. Cross Valley Canal Unit Water Service Contractors

Contractor	M&I	Ag
County of Fresno	X	X
County of Tulare	X	X
Hills Valley Irrigation District (includes Rag Gulch Water District)	X	X
Kern-Tulare Water District	X	X
Lower Tule River Irrigation District	-	X
Pixley Irrigation District	X	X
Tri-Valley Water District	X	X

[14] Years used to calculate historical use in the Cross Valley Canal Unit - 2003, 2005, 2006.
[15] Appendix A, M&I Contractor Data Summary, contains the detailed contractor data, assumptions, and data sources.



Source: Reclamation 2005, Reclamation 2011.

Figure 4-10. Cross Valley Canal Unit Water Service Contractors

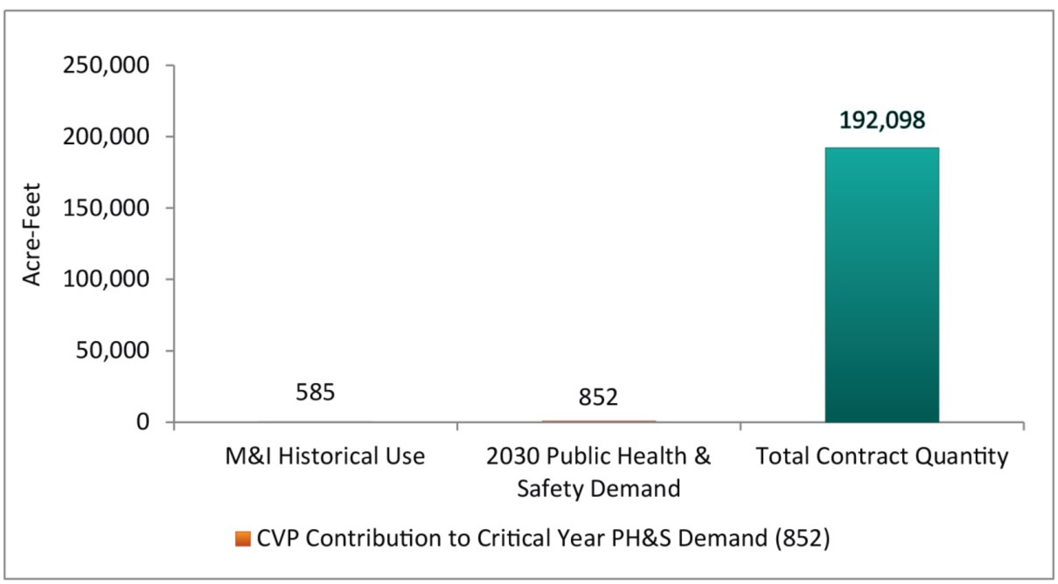
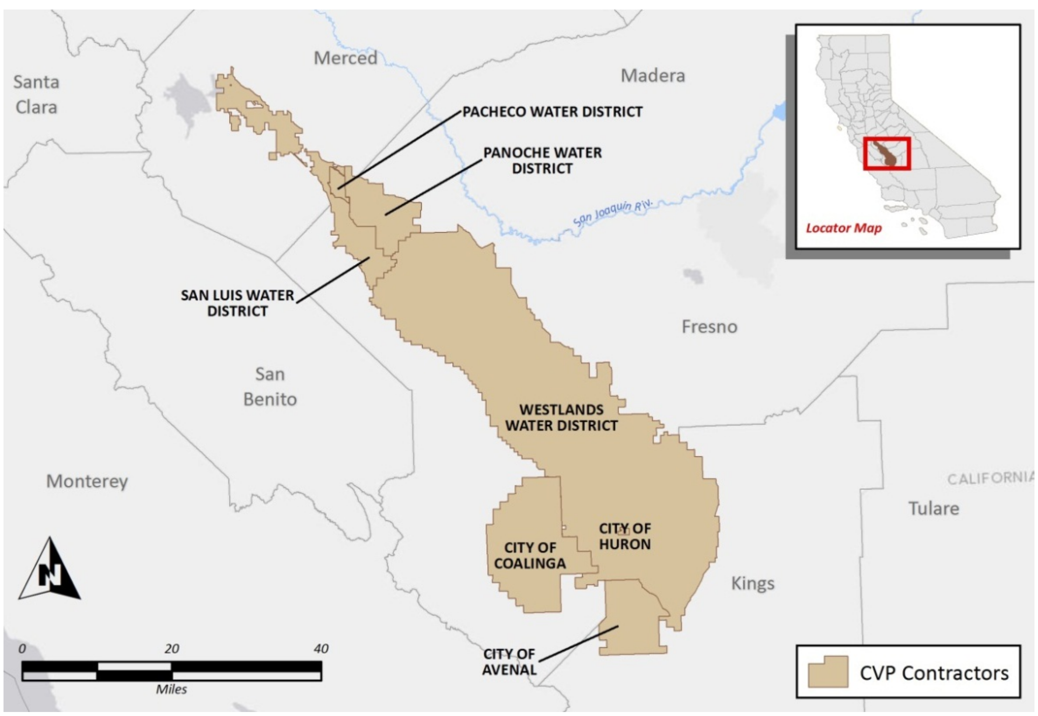


Figure 4-11. Cross Valley Canal Unit CVP Contract Quantity and M&I Historical Use

West San Joaquin Division West San Joaquin Division CVP water service contractors are listed in Table 4-7 and indicated in Figure 4-12. These contractors receive CVP deliveries from the San Luis Canal from supplies conveyed directly from the Delta and supplies stored in San Luis Reservoir, a jointly owned CVP/SWP facility. Figure 4-13 shows the M&I historical use[16], projected 2030 PHS demand[17], the portion of that demand met by CVP deliveries in critically dry water years, and contract quantity (including both agricultural and M&I uses) for CVP contractors in the West San Joaquin Division. All of the West San Joaquin Division contractors have taken delivery of M&I water during the historical use period; therefore, all have projected M&I water demands in 2030 (see Appendix A).

Table 4-7. West San Joaquin Division Water Service Contractors

Contractor	M&I	Ag
City of Avenal	X	-
City of Coalinga	X	-
City of Huron	X	-
Pacheco Water District	X	X
Panoche Water District	X	X
San Luis Water District	X	X
State of California	X	-
Westlands Water District	X	X



Source: Reclamation 2005, Reclamation 2011.

Figure 4-12. West San Joaquin Division Water Service Contractors

[16] Years used to calculate historical use in the West San Joaquin Division - 2003, 2005, 2006.
[17] Appendix A, M&I Contractor Data Summary, contains the detailed contractor data, assumptions, and data sources.

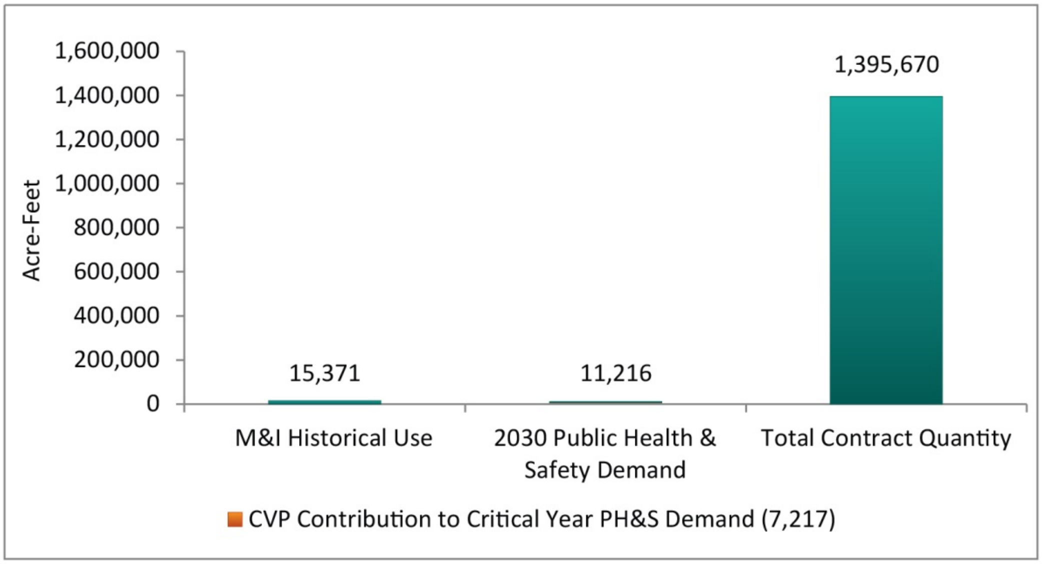


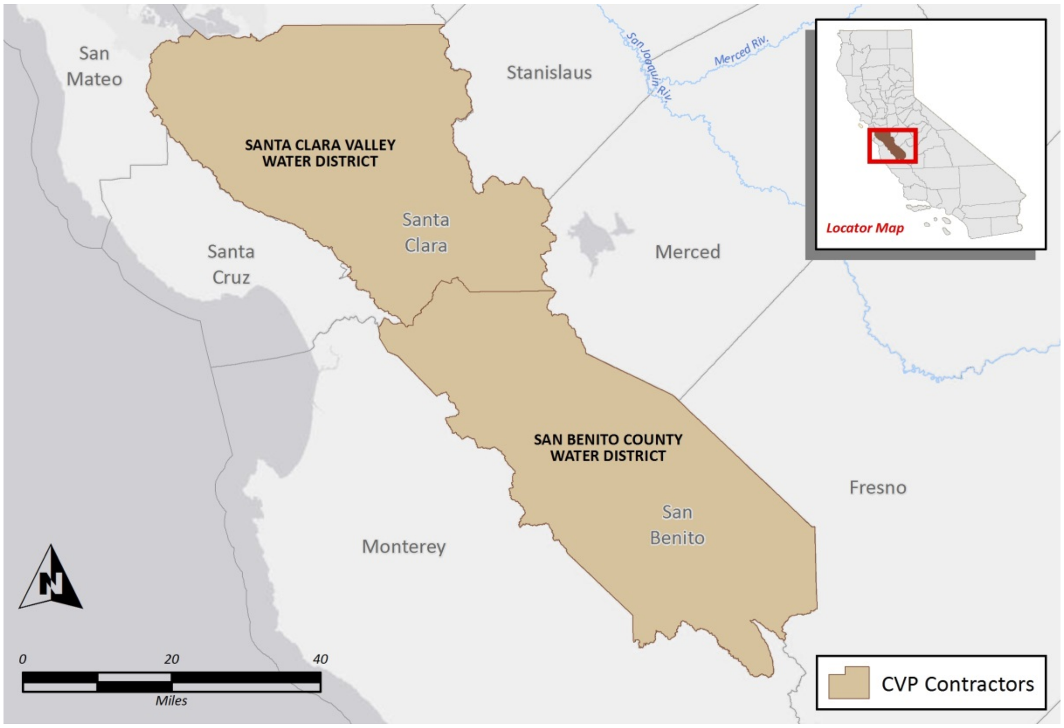
Figure 4-13. West San Joaquin Division CVP Contract Quantity and M&I Historical Use

San Felipe Division San Felipe Division CVP water service contractors are listed in Table 4-8 and indicated in Figure 4-14. They receive CVP deliveries from San Luis Reservoir conveyed through the Pacheco Tunnel to water users in Santa Clara County and San Benito County. Figure 4-15 shows the M&I historical use[18], projected 2030 PHS demand[19], and contract quantity (including both agricultural and M&I uses) for CVP contractors in the San Felipe Division. In critically dry water years, contractors would not rely on CVP deliveries to meet PHS demand given their ability to access sufficient non-CVP supplies to meet these demands. Both San Felipe Division contractors have taken delivery of M&I water during the historical use period; therefore, both have projected M&I water demands in 2030 (see Appendix A).

Table 4-8. San Felipe Division Water Service Contractors

Contractor	M&I	Ag
San Benito County Water District	X	X
Santa Clara Valley Water District	X	X

[18] Years used to calculate historical use in the San Felipe Division - 2003, 2005, 2006.
[19] Appendix A, M&I Contractor Data Summary, contains the detailed contractor data, assumptions, and data sources.



Source: Reclamation 2005, Reclamation 2011.

Figure 4-14. San Felipe Division Water Service Contractors

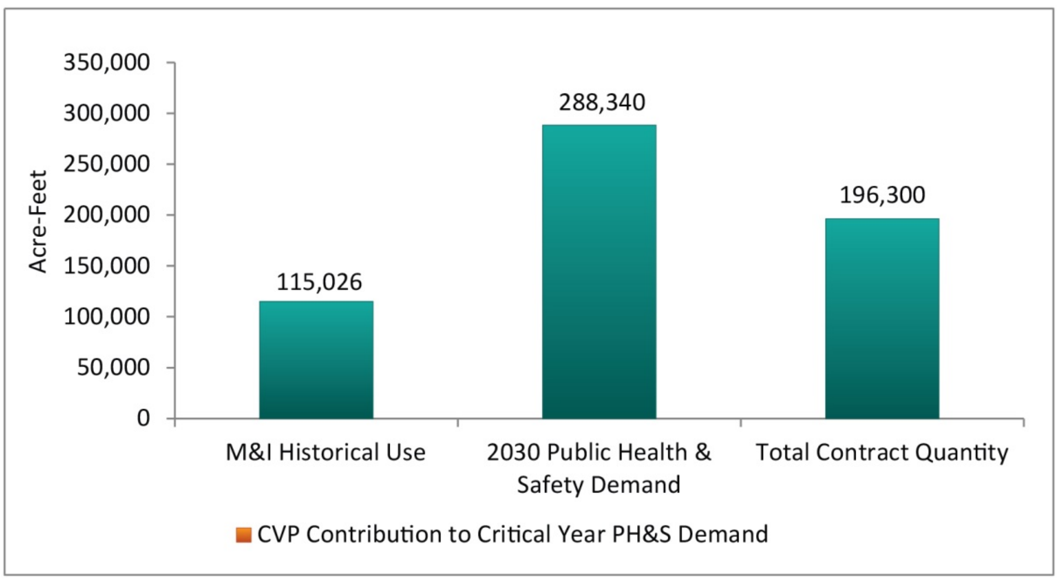


Figure 4-15. San Felipe Division CVP Contract Quantity and M&I Historical Use

4.2 Environmental Consequences

These sections describe the environmental consequences associated with each alternative.

4.2.1 Assessment Methods

This section describes the assessment methods used to analyze potential water supply effects of the alternatives, including the No Action Alternative. This section estimates the potential effects of alternative implementation using comparative results from the CalSim II model. The CalSim II model has many limitations due to its very coarse and simplified representation of operations of the CVP and SWP; however; the results remain useful for comparative purposes. When using CalSim II results comparatively, the difference between the two simulations is of principal importance rather than the individual results themselves. Most potential errors or uncertainties affecting the “no-action” simulation will also affect the “action” simulation in a similar manner; as a result, the effect of errors and uncertainties on the difference between the simulations is reduced. However, not all limitations are fully eliminated by the comparative analysis approach; small differences between the alternatives and the bases of comparison are not considered to be indicative of an effect of the alternative. See Appendix B, Water Operations Model Documentation, for a description of the assumptions, methods, limitations, and results of the CalSim II model.

The water supply analysis uses CalSim II modeling results to determine effects between the No Action and action alternatives. CalSim II provides monthly output for each year during the modeled period (water years 1922-2003). This data was compiled to show results by Sacramento Valley Water Year Type based on the 40-30-30 index (wet, above normal, below normal, dry, and critical), and then averaged over the entire period.

The analysis presented in this section for each alternative indicates modeled agricultural and M&I deliveries to CVP water service contractors north of the Delta and south of the Delta, and includes an evaluation of each alternative’s capacity to deliver sufficient water to meet M&I contractor PHS needs within each potentially affected CVP division.

The evaluation of deliveries for PHS needs utilizes 2030 population projections and projected 2030 demands by customer type for each contractor (where available). The future PHS demand is then calculated using Reclamation’s PHS formula[20] [21]. This calculated PHS demand is then compared against modeled CalSimII deliveries and, when available, data on each district’s non-CVP supplies to identify any unmet PHS need.

[20] PHS demand = (Population * 55 gpd) + (80% of Historic/Forecasted Commercial & Institutional Demand) + (90% of Historic/Forecasted Industrial) + (10% for system losses)

[21] Appendix A, M&I Contractor Data Summary, contains the detailed contractor data, assumptions, and data sources.

The analysis presented in this chapter assumes that any unmet PHS need in these CVP divisions could result in water availability impacts for the CVP water service contractors in these divisions. In many cases the contractors may have other non-CVP water supplies to offset PHS needs. The potential indirect effect of utilizing these alternative sources of water is analyzed for each alternative in this chapter; and Chapter 6 presents an analysis of how the potential use of groundwater to offset these shortages could impact the aquifers relied on by CVP contractors.

4.2.2 Alternative 1: No Action

4.2.2.1 North of Delta

Allocation of available CVP water supplies between M&I and agricultural water service contractors during shortage conditions under the No Action Alternative would result in reduced CVP deliveries to NOD agricultural CVP water service contractors and increased CVP deliveries to NOD M&I CVP water service contractors compared to existing conditions. As indicated in Tables 4-9 through 4-12, under the No Action Alternative, the total NOD agricultural water service contractor deliveries will decrease between 37 TAF in below normal water years to 23 TAF in wet water years, and M&I water service contractor deliveries will be increased by 91 TAF in critically dry water years to 189 TAF in wet water years when compared to existing conditions. This change is primarily driven by increases in M&I water demands in all water years under the No Action Alternative due to the projected future population growth.

Table 4-9. CVP Deliveries to NOD Agricultural Water Service Contractors Under the No Action Alternative (thousand acre-feet [TAF])

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4	0	0	0	0	1	20	44	62	74	59	25	288
AN	3	0	0	0	0	0	22	42	61	72	56	24	282
BN	5	0	0	0	0	1	18	30	37	45	36	14	186
D	4	0	0	0	0	1	12	20	26	30	24	9	126
C	2	0	0	0	0	1	4	5	7	8	7	3	37
All	4	0	0	0	0	1	16	30	42	50	39	16	197

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-10. Difference Between CVP Deliveries to NOD Agricultural Water Service Contractors Under the No Action Alternative Compared to Existing Conditions (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1	0	0	0	0	0	-3	-3	-3	-4	-4	-4	-23
AN	-1	0	0	0	0	0	-3	-3	-4	-4	-4	-4	-24
BN	-1	0	0	0	0	-1	-5	-6	-6	-8	-6	-4	-37
D	-1	0	0	0	0	0	-4	-5	-7	-8	-6	-3	-35
C	-1	0	0	0	0	-1	-3	-3	-4	-5	-4	-2	-24
All	-1	0	0	0	0	0	-4	-4	-5	-6	-5	-3	-28

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-11. CVP Deliveries to NOD M& Water Service Contractors Under the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	27	19	15	14	14	10	28	40	50	65	60	42	384
AN	26	19	14	13	14	11	31	40	52	68	63	44	396
BN	26	18	14	13	14	14	32	42	50	62	51	33	368
D	23	17	13	12	14	16	38	45	51	45	34	31	339
C	19	15	14	12	13	24	41	45	46	29	25	21	304
All	25	18	14	13	14	14	33	42	50	55	48	35	362

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-12. Difference Between CVP Deliveries to NOD M&I Water Service Contractors Under the No Action Alternative Compared to Existing Conditions (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	13	9	5	5	5	5	15	22	27	33	31	19	189
AN	12	10	4	4	6	5	16	21	27	32	31	19	186
BN	9	6	3	3	4	6	16	21	25	24	21	18	158
D	9	6	3	3	4	6	16	21	24	9	15	15	131
C	4	4	3	2	2	8	17	19	17	8	6	1	91
All	10	7	4	4	4	6	16	21	25	22	22	15	156

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Shasta and Trinity River Divisions *Allocation of available CVP water supplies between M&I and Agricultural water service contractors during shortage conditions under the No Action Alternative would maintain PHS deliveries for Shasta Division and Trinity River Division water service contractors*. Under the No Action Alternative, Shasta Division and Trinity River Division water service contractors' PHS demands are met in all but 10 percent of the 81 modeled water years. In those years, the volume of PHS demand not met would be less than 1 percent of the Division's 31,811-AF PHS demand.

Sacramento River Division *Allocation of available CVP water supplies between M&I and Agricultural water service contractors during shortage conditions under the No Action Alternative would maintain PHS deliveries for Sacramento River Division water service contractors*. Under the No Action Alternative, Sacramento River Division water service contractors' PHS demands are met in all of the modeled water years.

American River Division *Allocation of available CVP water supplies to M&I water service contractors under the No Action Alternative would maintain PHS deliveries for American River Division water service contractors*. Under the No Action Alternative, American River Division water service contractors' PHS demands are met in all of the modeled water years.

4.2.2.2 Delta and South of Delta Divisions

Allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative would result in reduced CVP deliveries to Delta and SOD agricultural water service contractors and increased CVP deliveries to Delta and SOD water service contractors. Under the No Action Alternative, M&I water demands are projected to increase throughout the CVP. Delta exports would decrease during dry years because additional water would be delivered north of the Delta. These reduced exports would be divided between M&I and agricultural water service contractors. As indicated in Tables 4-13 through 4-16, the total Delta and SOD agricultural water service contractor deliveries would decrease and M&I water service contractor deliveries would increase. This change is primarily driven by the No Action Alternative's operation with projected future population growth and the associated increases in M&I water demands in all water years.

Table 4-13. CVP Deliveries to SOD Agricultural Water Service Contractors Under the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	34	25	37	64	74	64	94	142	231	288	187	62	1,303
AN	24	18	27	46	54	46	74	109	177	220	147	48	989
BN	30	22	33	57	66	29	49	78	126	157	112	34	793
D	23	17	25	44	51	21	40	62	100	124	76	27	611
C	14	10	15	27	31	9	13	20	31	33	16	9	227
All	26	20	29	50	58	38	60	91	147	182	119	40	861

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-14. Difference Between CVP Deliveries to SOD Agricultural Water Service Contractors Under the No Action Alternative Compared to Existing Conditions (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-2	-2	-1	-3	-2	-1	-2	-2	-4	-4	-1	-4	-27
AN	-2	-2	-2	-4	-4	1	0	1	2	3	-2	-1	-9
BN	-2	-2	-2	-4	-3	-1	-1	-1	-2	-2	-2	-2	-25
D	-2	-1	-1	-3	-3	-5	-6	-8	-12	-15	-13	-5	-73
C	-3	-2	-3	-6	-6	-4	-6	-10	-16	-26	-23	-5	-109
All	-2	-2	-2	-4	-3	-2	-3	-4	-6	-8	-7	-3	-46

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-15. CVP Deliveries to SOD M&I Water Service Contractors Under the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	17	15	16	4	4	5	13	21	25	27	23	19	189
AN	16	13	14	3	4	4	12	19	22	24	19	17	168
BN	17	14	15	4	4	4	10	17	20	22	20	16	164
D	15	13	14	3	4	4	10	16	19	21	17	15	152
C	14	12	13	3	4	3	8	13	15	15	12	12	123
All	16	14	15	4	4	4	11	18	21	23	19	16	164

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-16. Difference Between CVP Deliveries to SOD M&I Water Service Contractors Under the No Action Alternative Compared to Existing Conditions (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	4	3	4	1	1	1	3	5	6	7	6	4	45
AN	4	3	3	1	1	1	3	5	5	6	3	4	40
BN	4	3	4	1	1	1	2	4	5	5	5	4	38
D	3	3	3	1	1	1	2	4	4	5	4	3	34
C	3	2	3	1	1	1	1	2	3	1	1	2	20
All	4	3	3	1	1	1	3	4	5	5	4	4	37

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Delta Division *Allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative would maintain PHS deliveries for Delta Division water service contractors*. Under the No Action Alternative, Delta Division water service contractors' PHS demands are met in all of the modeled water years.

Cross Valley Canal Unit *Allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative would not maintain PHS deliveries for Cross Valley Canal Unit water service* *contractors in all water years.* As indicated in Figure 4-16, under Alternative 2, Cross Valley Canal Unit water service contractors' PHS demands are not fully met in 15 percent of the 81 modeled water years. In those years, the volume of PHS demand not met is less than 1 percent of the Division's 131,598-AF total PHS demand.

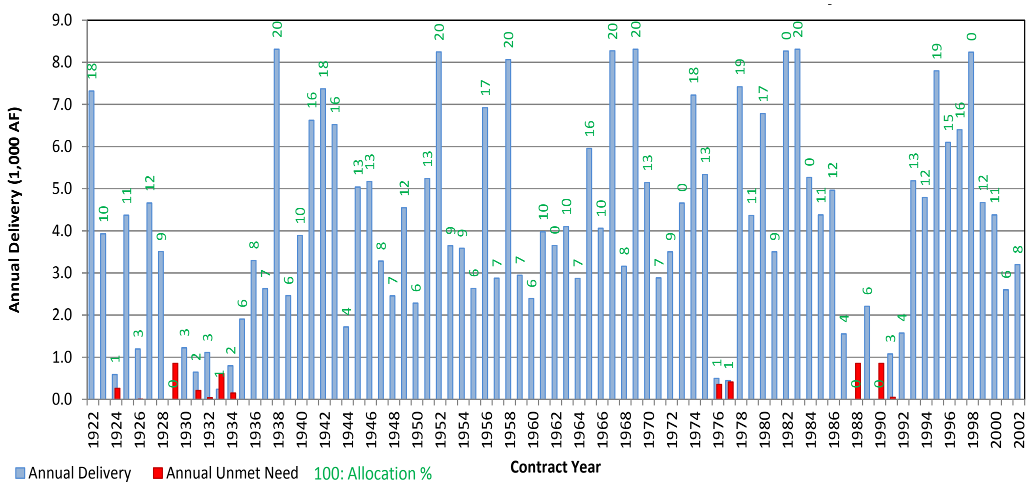


Figure 4-16. Cross Valley Canal Unit CVP Deliveries and Unmet PHS Need Under the No Action Alternative

West San Joaquin Division *Allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative would not maintain PHS deliveries for West San Joaquin Division water service contractors in all water years.* As indicated in Figure 4-17, under the No Action Alternative, West San Joaquin Division water service contractors' PHS demands are not fully met in 85 percent of the 81 modeled water years. One CVP M&I contractor in the West San Joaquin Division is entirely reliant on CVP deliveries and has no non-CVP supplies to supplement CVP deliveries. As a result, in those years, the volume of PHS demand not met for that particular contractor ranges from less than 1 percent to 15 percent of the Division's 11,216-AF total PHS demand.

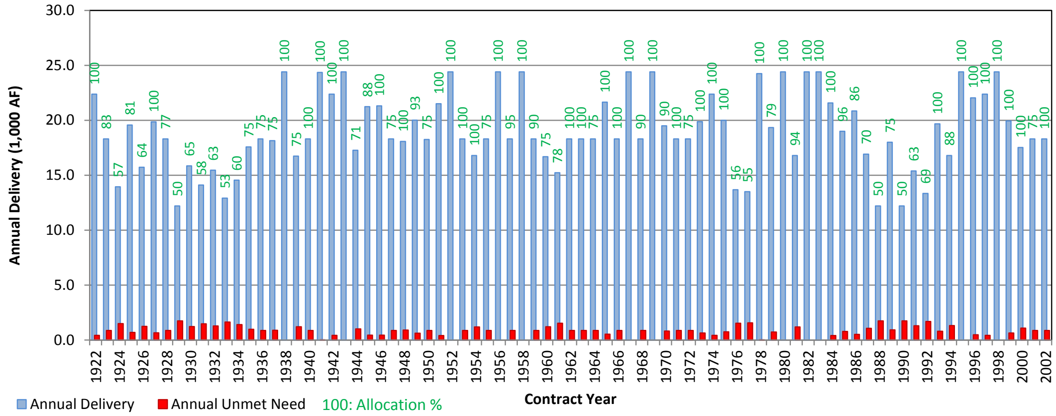


Figure 4-17. West San Joaquin Division CVP Deliveries and Unmet PHS Need Under the No Action Alternative

San Felipe Division *Allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative would maintain PHS deliveries for San Felipe Division water service contractors.* Under the No Action Alternative, San Felipe Division CVP water service contractors' PHS demands are met in all of the modeled water years.

4.2.2.3 Indirect Effects

Allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative would cause CVP agricultural water service contractors to seek alternative water supplies or reduce water demand through crop idling. Agricultural water service contractors would seek alternate water supplies if CVP deliveries are reduced under the No Action Alternative. Chapter 3 discusses potential actions that could be taken. Indirect water supply effects could result from surface water transfers between willing sellers and willing buyers in the form of improved water supply conditions for the buyers.

4.2.3 Alternative 2: Equal Agricultural and M&I Allocation

4.2.3.1 North of Delta

Equal allocation of available CVP water supplies between M&I and agricultural water service contractors, based on percentage of contract amount, under Alternative 2 would result in increased CVP deliveries to NOD agricultural water CVP service contractors and decreased CVP deliveries to NOD M&I CVP water service contractors as compared to the No Action Alternative. As indicated in Tables 4-17 and 4-18, in the future under Alternative 2, total CVP deliveries to NOD agricultural water service contractors would increase by between 3 TAF in wet water years to 27 TAF in critically dry water years, and CVP deliveries to NOD M&I water service contractors would decrease by 21 TAF in wet water years to 176 TAF in critically dry water years when compared to the No Action Alternative. The larger reduction in CVP deliveries to NOD M&I water service contractors, relative to CVP deliveries to NOD agricultural water service contractors, would be caused in part by larger allocations to agricultural water service contractors south of the Delta where the total agricultural water service contract volume is larger than the NOD M&I water service contract volume.

Table 4-17. Difference Between CVP Deliveries to NOD Agricultural Water Service Contractors Under Alternative 2 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	1	0	0	1	0	0	3
AN	0	0	0	0	0	0	0	1	1	1	1	0	4
BN	0	0	0	0	0	1	2	2	3	3	2	1	14
D	0	0	0	0	0	0	2	4	5	5	4	2	22
C	1	0	0	0	0	1	3	4	5	6	5	2	27
All	0	0	0	0	0	0	2	2	2	3	2	1	13

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-18. Difference Between CVP Deliveries to NOD M&I Water Service Contractors Under Alternative 2 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-3	-3	-2	-2	-2	0	-1	-1	-2	-3	-2	-2	-21
AN	-6	-5	-3	-4	-4	1	-1	-2	-2	-5	-2	-1	-34
BN	-5	-5	-3	-2	-3	-1	-5	-7	-8	-25	-18	-9	-93
D	-5	-4	-3	-3	-4	-3	-8	-10	-13	-21	-16	-17	-105
C	-7	-8	-9	-6	-7	-7	-16	-26	-34	-21	-19	-16	-176
All	-5	-4	-3	-3	-3	-2	-5	-8	-10	-13	-10	-9	-76

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Shasta and Trinity River Divisions *Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would not maintain PHS deliveries for Shasta Division and Trinity River Division water service contractors in all water years*. As indicated in Figure 4-18, under Alternative 2, Shasta Division and Trinity River Division water service contractors' PHS demands are not fully met in 37 percent of the 81 modeled water years. In those years, the volume of PHS demand not met ranges from less than 1 percent to 14 percent of the Division's 31,811-AF total PHS demand.

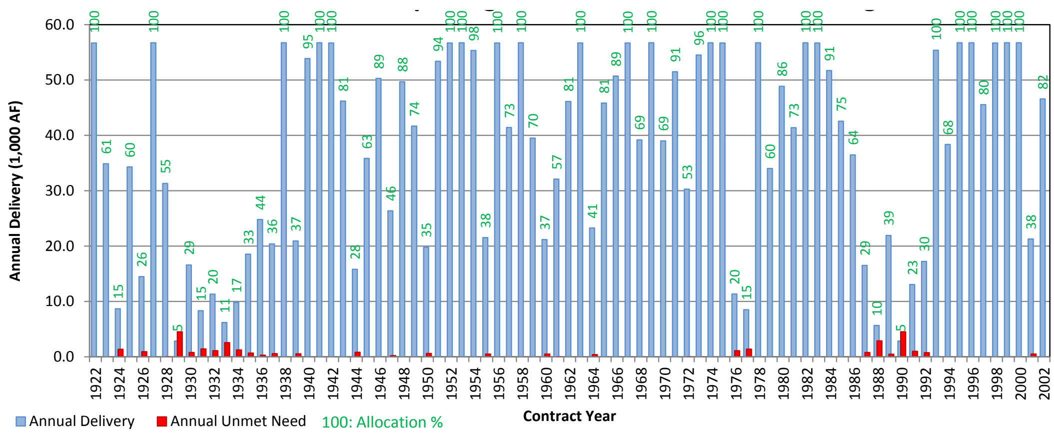


Figure 4-18. Shasta and Trinity River Division CVP Deliveries and Unmet PHS Need Under Alternative 2

Sacramento River Division *Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would maintain PHS deliveries for Sacramento River Division water service contractors*. Under Alternative 2, Sacramento River Division water service contractors' PHS demands are met in all of the modeled water years.

American River Division *Equal allocation of available CVP water supplies to M&I water service contractors under Alternative 2 would not maintain PHS deliveries for American River Division water service contractors in all water years*. American River Division water service contractors have access to non-CVP supplies that range from approximately 736 TAF in normal water years to 517 TAF in critically dry water years. These non-CVP supplies may not, in all years, reduce the contractors' need to utilize CVP supplies to meet PHS demand, as indicated in Figure 4-19. Under Alternative 2, American River Division water service contractors' PHS demands are not fully met in 2 percent of the 81 modeled water years. In those years, the volume of PHS demand not met is less than 1 percent of the Division's 327,180-AF total PHS demand.

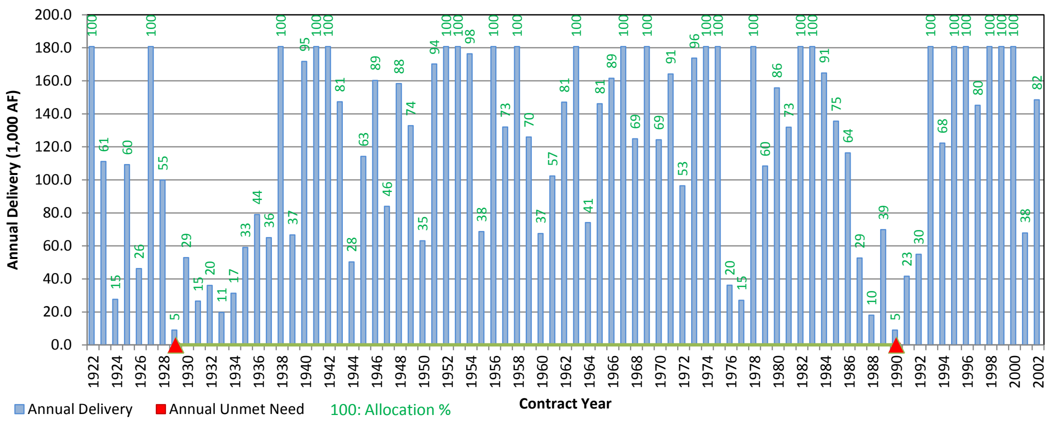


Figure 4-19. American River Division CVP Deliveries and Unmet PHS Need Under Alternative 2

4.2.3.2 Delta and South of Delta Divisions

Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would result in increased CVP deliveries to Delta and SOD agricultural CVP water service contractors and decreased CVP deliveries to Delta and SOD M&I CVP water service contractors. As indicated in Tables 4-19 and 4-20, in the future under Alternative 2, total CVP deliveries to Delta and SOD agricultural water service contractors would increase by between 35 TAF in wet water years to 132 TAF in critically dry water years, and CVP deliveries to M&I water service contractors would be decreased by 32 TAF in wet water years to 78 TAF in critically dry water years when compared to the No Action Alternative. Similar to the reduction in CVP deliveries to NOD M&I water service contractors, this reduction in CVP deliveries to SOD M&I water service contractors is driven in part by increases in allocations to agricultural contractors south of the Delta and increases in Delta outflow related to increased carriage water requirements resulting from increased Delta export, and increases in spills and higher flows under the Lower American River Flow Management Standard.

Table 4-19. Difference Between CVP Deliveries to SOD Agricultural Water Service Contractors Under Alternative 2 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	1	1	1	2	3	8	3	3	5	6	1	1	35
AN	2	2	3	5	5	10	1	4	6	7	5	2	51
BN	2	1	2	3	4	13	6	5	9	11	8	2	66
D	2	1	2	4	4	15	9	11	18	22	15	5	109
C	4	3	4	7	8	8	10	15	24	28	17	7	132
All	2	1	2	4	4	11	5	7	11	14	8	3	73

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-20. Difference Between CVP Deliveries to SOD M&I Water Service Contractors Under Alternative 2 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-4	-3	-4	-1	-1	-1	-2	-3	-4	-4	-3	-3	-32
AN	-5	-5	-5	-1	-1	-1	-3	-5	-6	-7	-4	-5	-48
BN	-5	-4	-4	-1	-1	-1	-4	-7	-8	-9	-8	-6	-60
D	-6	-5	-5	-1	-1	-2	-5	-7	-9	-10	-8	-7	-66
C	-7	-6	-6	-2	-2	-2	-5	-9	-10	-11	-9	-8	-78
All	-5	-4	-5	-1	-1	-1	-4	-6	-7	-7	-6	-5	-53

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Delta Division *Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would not maintain PHS deliveries for Delta Division water service contractors in all water years.* As indicated in Figure 4-20, under Alternative 2, Delta Division water service contractors' PHS demands are not fully met in 49 percent of the 81 modeled water years. In those years, the volume of PHS demand not met is less than 1 percent of the Division's 131,598-AF total PHS demand.

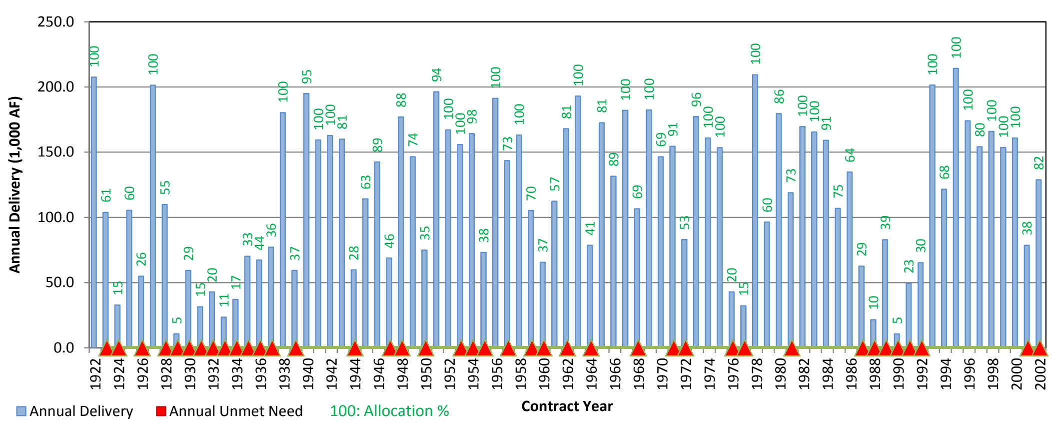


Figure 4-20. Delta Division CVP Deliveries and Unmet PHS Under Alternative 2

Cross Valley Canal Unit *Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would not maintain PHS deliveries for Cross Valley Canal Unit water service contractors in all water years.* As indicated in Figure 4-21, under Alternative 2, Cross Valley Canal Unit water service contractors' PHS demands are not fully met in 5 percent of the 81 modeled water years. In those years, the volume of PHS demand not met is less than 1 percent of the Division's 131,598-AF total PHS demand.

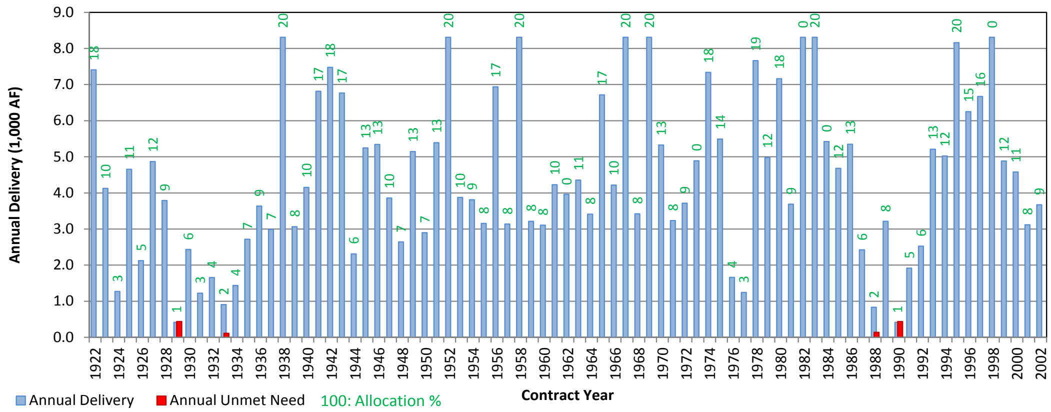


Figure 4-21. Cross Valley Canal Unit CVP Deliveries and Unmet PHS Under Alternative 2

West San Joaquin Division *Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would not maintain PHS deliveries for West San Joaquin Division water service contractors in all water years.* Similar to the No Action Alternative, as indicated in Figure 4-22, under Alternative 2, West San Joaquin Division water service contractors' PHS demands are not fully met in 90 percent of the 81 modeled water years. In those years, the volume of PHS demand not met ranges from less than 1 percent to 56 percent of the Division's 11,216-AF total PHS demand.

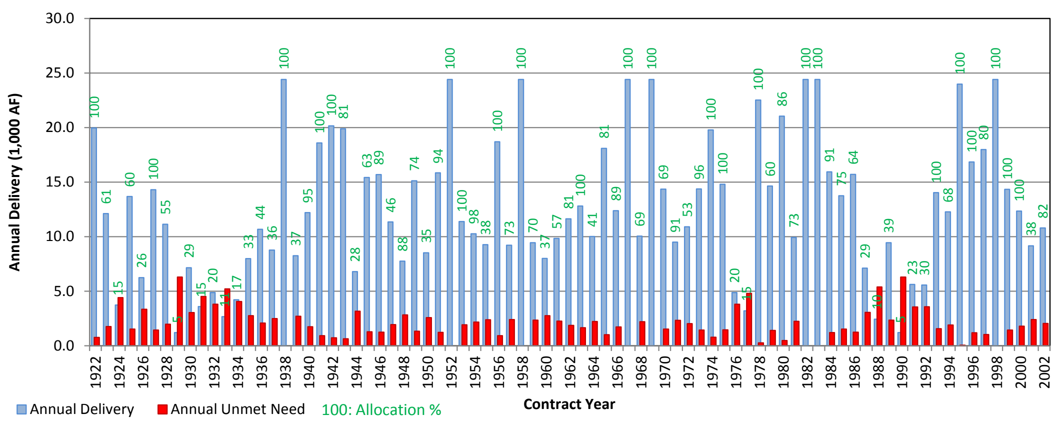


Figure 4-22. West San Joaquin Division CVP Deliveries and Unmet PHS Need Under Alternative 2

San Felipe Division *Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would not maintain PHS deliveries for San Felipe Division water service contractors in all water years.* As indicated in Figure 4-23, under the No Action Alternative, San Felipe Division water service contractors' PHS demands are not fully met in 17 percent of the 81 modeled water years. In those years, the volume of PHS demand not met ranges from 3 percent to 14 percent of the Division's 288,340-AF total PHS demand.

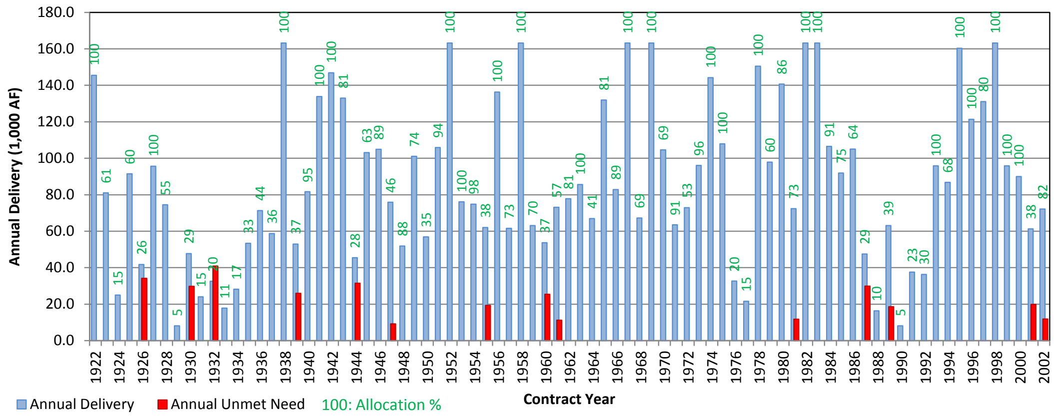


Figure 4-23. San Felipe Division CVP Deliveries and Unmet PHS Need Under Alternative 2

4.2.3.3 Indirect Effects

Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would cause M&I water service contractors to seek alternative water supplies. M&I water service contractors would seek alternate water supplies if CVP deliveries are reduced under Alternative 2 when compared to the No Action Alternative. Chapter 3 discusses potential actions that could be taken. Indirect water supply effects could result from surface water transfers between willing sellers and willing buyers in the form of improved water supply conditions for the buyers.

4.2.4 Alternative 3: Full M&I Allocation Preference

4.2.4.1 North of Delta

The M&I allocation preference of Alternative 3 would result in decreased CVP deliveries to NOD agricultural water service contractors and increased CVP deliveries to NOD M&I CVP water service contractors. As indicated in Tables 4-21 and 4-22, delivering 100 percent of contract total to M&I water service contractors (when available) would reduce the total NOD agricultural water service contractor deliveries by between 2 TAF in above normal water years to 14 TAF in dry and critically dry water years, and increase M&I water service contractor deliveries by 5 TAF in wet water years to 76 TAF in dry water years compared to the No Action Alternative.

Table 4-21. Difference Between CVP Deliveries to NOD Agricultural Water Service Contractors Under Alternative 3 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	0	0	0
AN	0	0	0	0	0	0	0	0	0	0	0	0	-2
BN	0	0	0	0	0	0	-1	-1	-1	-1	-1	0	-5
D	0	0	0	0	0	0	-1	-2	-3	-3	-3	-1	-14
C	0	0	0	0	0	0	-2	-2	-3	-3	-2	-1	-14
All	0	0	0	0	0	0	-1	-1	-1	-1	-1	0	-6

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-22. Difference Between CVP Deliveries to NOD M&I Water Service Contractors Under Alternative 3 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	1	1	0	0	0	0	0	0	0	0	0	0	5
AN	1	1	1	1	1	1	1	1	1	1	2	2	12
BN	2	1	1	1	1	3	4	4	5	10	10	6	48
D	2	1	1	1	1	4	5	7	8	26	16	6	76
C	3	2	1	1	2	3	5	6	6	16	12	7	63
All	2	1	1	1	1	2	3	3	4	10	7	4	37

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Shasta and Trinity River Divisions *The M&I allocation preference of Alternative 3 would maintain PHS deliveries for Shasta Division and Trinity River Division water service contractors.* Under Alternative 3, Shasta Division and Trinity River Division water service contractors' PHS demands are fully supplied in all but 1 percent of the 81 modeled water years. In this year, the volume of PHS demand not met is less than 1 percent of the Division's 31,811-AF total PHS demand.

Sacramento River Division *The M&I allocation preference of Alternative 3 would maintain PHS deliveries for Sacramento River Division water service contractors in all water years*. Under Alternative 3, Sacramento River Division water service contractors' PHS demands are met in all of the modeled water years.

American River Division *The M&I allocation preference of Alternative 3 would maintain PHS deliveries for American River Division water service contractors in all water years*. Under Alternative 3, American River Division water service contractors' PHS demands are met in all of the modeled water years.

4.2.4.2 Delta and South of Delta

The M&I allocation preference of Alternative 3 would result in decreased CVP deliveries to Delta and SOD agricultural CVP water service contractors and increased CVP deliveries to Delta and SOD M&I CVP water service contractors. As indicated in Tables 4-23 and 4-24, in the future under Alternative 3, total CVP deliveries to Delta and SOD agricultural water service contractors would decrease by between 15 TAF in wet water years to 71 TAF in dry water years, and total CVP deliveries to M&I water service contractors would increase by 17 TAF in wet water years to 49 TAF in dry water years compared to the No Action Alternative.

Table 4-23. Difference Between CVP Deliveries to SOD Agricultural Water Service Contractors Under Alternative 3 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-1	-1	-1	-2	-2	-1	-1	-1	-2	-2	-2	0	-15
AN	-2	-1	-1	-3	-3	-1	-1	-1	-2	-2	-1	-1	-19
BN	-1	-1	-1	-2	-2	-2	-2	-4	-6	-8	-6	-2	-36
D	-1	-1	-1	-2	-3	-4	-6	-9	-14	-19	-7	-4	-71
C	-2	-1	-2	-4	-4	-4	-5	-8	-12	-14	-9	-3	-70
All	-1	-1	-1	-2	-3	-2	-3	-4	-7	-9	-5	-2	-39

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-24. Difference Between CVP Deliveries to SOD M&I Water Service Contractors Under Alternative 3 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	3	2	2	1	1	0	1	1	2	2	1	1	17
AN	2	3	3	1	1	1	2	3	4	5	2	3	31
BN	3	3	3	1	1	2	3	5	6	7	6	5	44
D	3	3	3	1	1	2	4	6	7	8	7	5	49
C	4	3	4	1	1	1	3	4	5	6	4	4	40
All	3	3	3	1	1	1	2	4	4	5	4	3	34

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Delta Division *The M&I allocation preference of Alternative 3 would maintain PHS deliveries for Delta Division water service contractors in all water years*. Under Alternative 3, Delta Division water service contractors' PHS demands are met in all of the modeled water years.

Cross Valley Canal Unit *The M&I allocation preference of Alternative 3 would not maintain PHS deliveries for Cross Valley Canal Unit water service contractors in all water years*. As indicated in Figure 4-24, under Alternative 3, Cross Valley Canal Unit water service contractors' PHS demands are not fully met in 19 percent of the 81 modeled water years. In those years, the volume of

PHS demand not met is less than 1 percent of the Division's 131,598-AF total PHS demand.

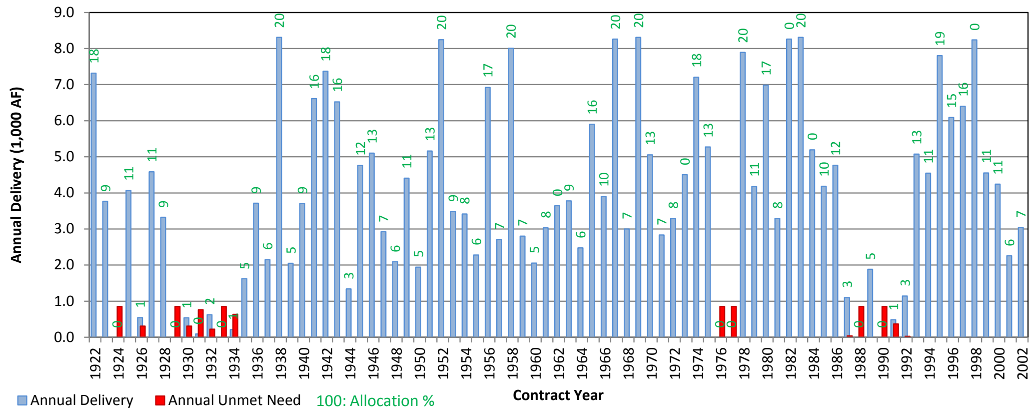


Figure 4-24. Cross Valley Canal Unit CVP Deliveries and Unmet PHS Need Under Alternative 3

West San Joaquin Division *The M&I allocation preference of Alternative 3 would not maintain PHS deliveries for West San Joaquin Division water service contractors in all water years*. Similar to the No Action Alternative and as indicated in Figure 4-25, under Alternative 3, West San Joaquin Division water service contractors' PHS demands are not fully met in 30 percent of the 81 modeled water years. In those years, the volume of PHS demand not met ranges from less than 1 percent to 15 percent of the Division's 11,216-AF total PHS demand.

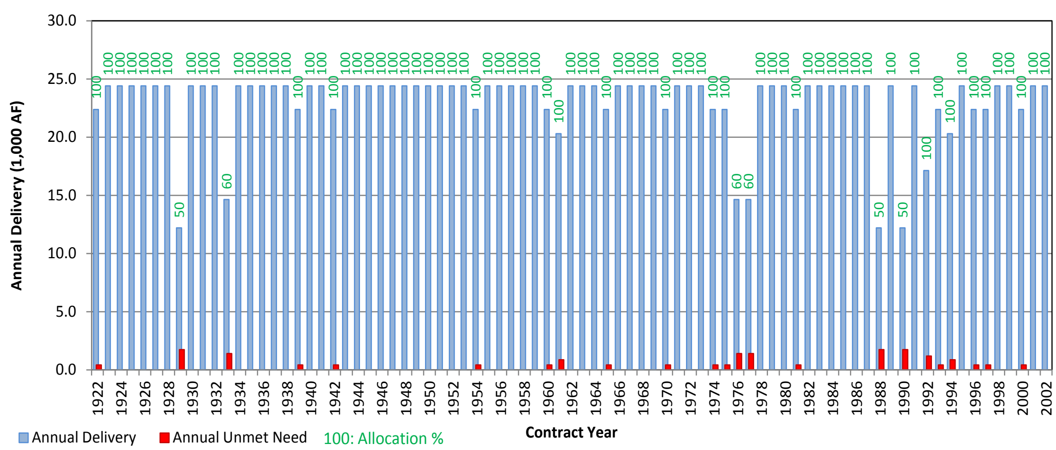


Figure 4-25. West San Joaquin Division CVP Deliveries and Unmet PHS Need Under Alternative 3

San Felipe Division *The M&I allocation preference of Alternative 3 would maintain PHS deliveries for San Felipe Division water service contractors in all* *water years*. Under Alternative 3, San Felipe CVP water service contractors' PHS demands are met in all of the modeled water years.

4.2.4.3 Indirect Effects

The M&I allocation preference of Alternative 3 would cause CVP agricultural water service contractors to seek alternative water supplies or reduce water demand through crop idling. Agricultural water service contractors would seek alternate water supplies if CVP deliveries are reduced under Alternative 3 when compared to the No Action Alternative. Chapter 3 discusses potential actions that could be taken. Indirect water supply effects could result from surface water transfers between willing sellers and willing buyers in the form of improved water supply conditions for the buyers.

4.2.5 Alternative 4: Updated M&I WSP

Implementation of the Updated M&I WSP under Alternative 4 would not change water allocations to agricultural and M&I water service contractors. Allocations under Alternative 4 are similar to those under the No Action Alternative, with the exception of how historical use is calculated as detailed in Chapter 2.6.2. Shortage allocation methodology for both agricultural and M&I water service contractors would be the same as under the No Action Alternative; therefore, effects to allocations generated by Alternative 4 would be identical to the effects to allocations of the No Action Alternative.

4.2.6 Alternative 5: M&I Contractor Suggested WSP

4.2.6.1 North of Delta

Implementation of the M&I Contractor Suggested WSP under Alternative 5 would not change CVP deliveries to NOD agricultural and M&I water service contractors. As indicated in Tables 4-25 and 4-26, under Alternative 5, total CVP deliveries to NOD agricultural and M&I CVP water service contractors would be similar to the No Action Alternative.

Table 4-25. Difference Between CVP Deliveries to NOD Agricultural Water Service Contractors Under Alternative 5 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	0	0	0
AN	0	0	0	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0
All	0	0	0	0	0	0	0	0	0	0	0	0	0

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-26. Difference Between CVP Deliveries to NOD M&I Water Service Contractors Under Alternative 5 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	0	0	0
AN	0	0	0	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0
All	0	0	0	0	0	0	0	0	0	0	0	0	0

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Shasta and Trinity River Divisions *Implementation of the M&I Contractor Suggested WSP under Alternative 5 would maintain PHS deliveries for Shasta Division and Trinity River Division water service contractors*. Under Alternative 5, Shasta Division and Trinity River Division water service contractors' PHS demands are met in all of the modeled water years.

Sacramento River Division *Implementation of the M&I Contractor Suggested WSP under Alternative 5 would maintain PHS deliveries for Sacramento River Division water service contractors in all water years*. Under Alternative 5, Sacramento River Division water service contractors' PHS demands are met in all of the modeled water years.

American River Division *Implementation of the M&I Contractor Suggested WSP under Alternative 5 would maintain PHS deliveries for American River Division water service contractors in all water years*. Under Alternative 5, American River Division water service contractors' PHS demands are met in all of the modeled water years.

4.2.6.2 Delta and South of Delta

Implementation of the M&I Contractor Suggested WSP under Alternative 5 would not change CVP deliveries to Delta and SOD agricultural and M&I water service contractors. As indicated in Tables 4-27 and 4-28, under Alternative 5 total CVP deliveries to Delta and SOD agricultural and M&I CVP water service contractors would be similar to the No Action Alternative. Approximately 1,000 AF of additional CVP water would be made available for delivery to SOD agricultural and M&I water service contractors in all but wet water years when compared to the No Action Alternative.

Table 4-27. Difference Between CVP Deliveries to SOD Agricultural Water Service Contractors Under Alternative 5 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	0	0	0
AN	0	0	0	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	0	0	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	0	0	0	0
C	0	0	0	0	0	0	0	0	0	0	0	0	0
All	0	0	0	0	0	0	0	0	0	0	0	0	0

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 4-28. Difference Between CVP Deliveries to SOD M&I Water Service Contractors Under Alternative 5 Compared to the No Action Alternative (TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	0	0	0	0	0	0	0	0	0	0	0	0	0
AN	0	0	0	0	0	0	0	0	0	0	0	0	1
BN	0	0	0	0	0	0	0	0	0	0	0	0	1
D	0	0	0	0	0	0	0	0	0	0	1	0	1
C	0	0	0	0	0	0	0	0	0	0	0	0	1
All	0	0	0	0	0	0	0	0	0	0	0	0	1

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Delta Division *Implementation of the M&I Contractor Suggested WSP under Alternative 5 would maintain PHS deliveries for Delta Division water service contractors in all water years*. Under Alternative 5, Delta Division water service contractors' PHS demands are met in all of the modeled water years.

Cross Valley Canal Unit *Implementation of the M&I Contractor Suggested WSP under Alternative 5 would not maintain PHS deliveries for Cross Valley Canal Unit water service contractors in all water years*. As indicated in Figure 4-26, under Alternative 5, Cross Valley Canal Unit water service contractor's PHS demands are not fully met in 15 percent of the 81 modeled water years. In those years, the volume of PHS demand not met is less than 1 percent of the Division's 131,598-AF total PHS demand.

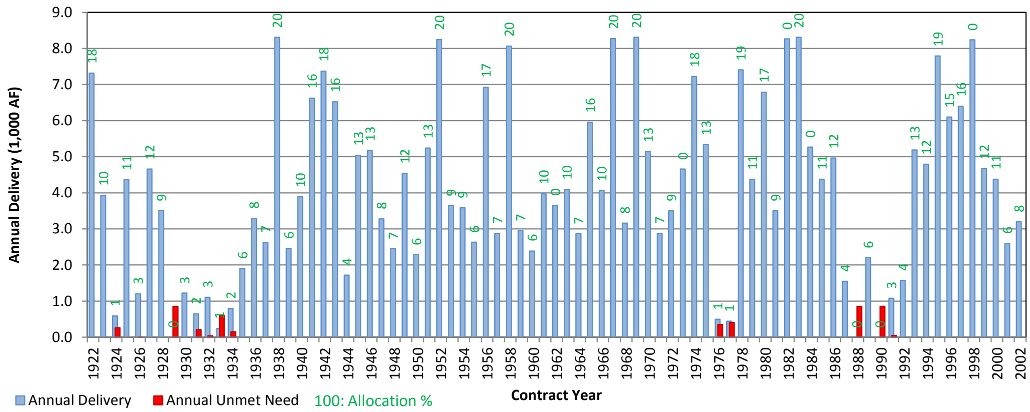


Figure 4-26. Cross Valley Canal Unit CVP Deliveries and Unmet PHS Need Under Alternative 5

West San Joaquin Division *Implementation of the M&I Contractor Suggested WSP under Alternative 5 would maintain PHS deliveries for West San Joaquin Division water service contractors in all water years*. Under Alternative 5, West San Joaquin Division water service contractors' PHS demands are met in all of the modeled water years.

San Felipe Division *Implementation of the M&I Contractor Suggested WSP under Alternative 5 would maintain PHS deliveries for San Felipe Division water service contractors in all water years*. Under Alternative 5, San Felipe water service contractors' PHS demands are met in all of the modeled water years.

4.2.6.3 Indirect Effects

Implementation of the M&I Contractor Suggested WSP under Alternative 5 would cause CVP agricultural water service contractors to seek alternative water supplies or reduce water demand through crop idling. Agricultural water service contractors would seek alternate water supplies if CVP deliveries are reduced under Alternative 5 when compared to the No Action Alternative. Chapter 3 discusses potential actions that could be taken. Indirect water supply effects could result from surface water transfers between willing sellers and willing buyers in the form of improved water supply conditions for the buyers.

4.3 Mitigation Measures

As noted in Chapter 4.2, reduced water allocations to water users as a result of implementation of the alternatives evaluated in this EIS are likely to result in actions by the CVP water service contractors to secure alternate water supplies. Any additional mitigation beyond the steps likely to be taken by these CVP contractors is limited given limited water supply conditions in California.

4.4 Unavoidable Adverse Impacts

As noted in Chapter 4.2, under all of the action alternatives PHS demands are not fully met in some of the modeled water years.

4.5 Cumulative Effects

The timeline for the surface water cumulative effects analysis extends from 2010 through 2030, a 20-year period. The relevant geographic study area for the cumulative effects analysis is the same area of analysis as shown in Figure 4-1. The following section analyzes the cumulative effects using the project method, which is further described in Chapter 20, Cumulative Effects Methodology. Chapter 20 describes the projects included in the cumulative condition. Growth and development trends in the area of analysis are factored into the PHS demand evaluation completed in Chapter 4.2 and this cumulative analysis.

The cumulative analysis for surface water considers projects and conditions that could affect water supply deliveries within the area of analysis.

4.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Equal allocation of available CVP water supplies between M&I and agricultural water service contractors under Alternative 2 would result in increased CVP deliveries to agricultural water service contractors, decreased CVP deliveries to M&I water service contractors, and increased unmet PHS demand in the Shasta/Trinity River, American River, Delta, West San Joaquin, and San Felipe divisions and the Cross Valley Canal Unit.

The equal allocation of agricultural and M&I supplies under Alternative 2 would generate changes to surface water deliveries to CVP water service contractors in the form of increased agricultural deliveries, decreased M&I deliveries, and increases in unmet PHS demands in the Shasta/Trinity River, American River, Delta, West San Joaquin, and San Felipe divisions and the Cross Valley Canal Unit when compared to the No Action Alternative.

The other projects identified with the potential to contribute to the cumulative water supply condition include the Bay Delta Conservation Plan (BDCP), Los Vaqueros Reservoir Expansion Project, the Shasta Lake Water Resources Investigation, Upper San Joaquin River Basin Storage Investigation, San Luis Reservoir Low Point Improvement Project, South Bay Aqueduct Improvement and Enlargement Project, North Bay Aqueduct Alternate Intake Project, In-Delta Storage Program, North-of-the-Delta Offstream Storage Investigation, Long Term Water Transfers, changes to the SWRCB Water Quality Control Plan for San Joaquin River flows, and the Franks Tract Project. These projects have the potential to impact surface water availability. The BDCP alternatives 1, 2, 3, 4, 5 and 9 would not result in reductions in CVP deliveries with the exception of slight reductions in critically dry water years, but alternatives 6, 7 and 8 could potentially result in reduced CVP deliveries. Changes to the SWRCB Water Quality Control Plan for San Joaquin River flows could result in reduced surface water diversions on the Stanislaus, Tuolumne, and Merced rivers but would not result in substantially reduced Delta exports given the increases in lower San Joaquin River flow. The Los Vaqueros Reservoir Expansion Project, Shasta Lake Water Resources Investigation, Upper San Joaquin Storage Investigation, In-Delta Storage Program, and North-of-the-Delta Offstream Storage Investigation are evaluating potential storage increase options that would increase CVP water supply availability. Long Term Water Transfers would establish a mechanism for willing sellers of water upstream of the Delta to transfer their water to SOD and San Francisco Bay Area buyers from 2015 to 2024. This program would not increase CVP water supplies but would help to facilitate the transfer of supplies to buyers in need of a supplemental water supply. The Franks Tract Project would install flow control gates at Threemile Slough and/or West False River to improve water quality and move fish to better habitat and improve operational reliability of the SWP and CVP.

The cumulative projects described above would, with the exception of three BDCP Alternatives in all water years and the remaining in critically dry water years and the potential changes to the SWRCB Water Quality Control Plan for San Joaquin River flows, either generate additional CVP supplies or facilitate improvements in the movement of CVP supplies. Therefore, implementation of Alternative 2 in combination with these cumulative projects would not result in an adverse cumulative effect on water supply. Implementation of Alternative 2 in combination with the changes to the SWRCB Water Quality Control Plan would also not be anticipated to result in an adverse cumulative effect on water supply given the plan’s limited effect on Delta exports. However implementation of Alternative 2, in combination with the three BDCP Alternatives previously described (6, 7, and 8), would result in an adverse cumulative effect on M&I water supplies for CVP water service contractors and would lead to increases in unmet PHS demands for CVP water service contractors with M&I use in the Shasta/Trinity River, American River, Delta, West San Joaquin, and San Felipe divisions and the Cross Valley Canal Unit.

4.5.2 Alternative 3: Full M&I Allocation Preference

Use of the Full M&I Allocation Preference under Alternative 3, would result in decreased CVP deliveries to agricultural water service contractors, increased CVP deliveries to M&I water service contractors and reduced unmet PHS demand in the Shasta/Trinity River and West San Joaquin Divisions.

The Full M&I Allocation Preference under Alternative 3 would generate changes to surface water deliveries to CVP water service contractors in the form of reduced agricultural deliveries, increased M&I deliveries and reductions in unmet PHS demands in the Shasta/Trinity River and West San Joaquin Divisions and the Cross Valley Canal Unit when compared to the No Action Alternative.

The cumulative projects described under Alternative 2, including the BDCP, Los Vaqueros Reservoir Expansion Project, the Shasta Lake Water Resources Investigation, Upper San Joaquin Storage Investigation, San Luis Reservoir Low Point Improvement Project, South Bay Aqueduct Improvement and Enlargement Project, North Bay Aqueduct Alternate Intake Project, In-Delta Storage Program, North-of-the-Delta Offstream Storage Investigation, Long Term Water Transfers, changes to the SWRCB Water Quality Control Plan for San Joaquin River flows, and the Franks Tract Project would have the same potential to impact cumulative surface water availability under Alternative 3.

The cumulative projects previously described would, with the exception of three BDCP Alternatives, either generate additional CVP supplies or facilitate improvements in the movement of CVP supplies. Therefore, implementation of Alternative 3 in combination with these cumulative projects would not result in an adverse cumulative effect on water supply. Implementation of Alternative 3, in combination the three BDCP Alternatives previously described (6, 7, and 8), would result in an adverse cumulative effect on agricultural water supplies for CVP water service contractors.

4.5.3 Alternative 4: Updated M&I WSP

Implementation of the Updated M&I WSP under Alternative 4 would not change CVP deliveries to NOD agricultural and M&I water service contractors or change unmet PHS demand for CVP M&I water service contractors when compared to the No Action Alternative.

Allocations under Alternative 4 are similar to those under the No Action Alternative, with the exception of how historic use is calculated. The allocation methodology for both agricultural and M&I water service contractors would be the same as under the No Action Alternative; therefore, water supply effects generated by Alternative 4 would be identical to the water supply effects of the No Action Alternative.

The cumulative projects described under Alternative 2, including the BDCP, Los Vaqueros Reservoir Expansion Project, the Shasta Lake Water Resources Investigation, Upper San Joaquin Storage Investigation, San Luis Reservoir Low Point Improvement Project, South Bay Aqueduct Improvement and Enlargement Project, North Bay Aqueduct Alternate Intake Project, In-Delta Storage Program, North-of-the-Delta Offstream Storage Investigation, Long Term Water Transfers, changes to the SWRCB Water Quality Control Plan for San Joaquin River flows, and the Franks Tract Project would have the same potential to impact cumulative surface water availability under Alternative 4.

The cumulative projects previously described would, with the exception of three BDCP Alternatives, either generate additional CVP supplies or facilitate improvements in the movement of CVP supplies. Therefore, implementation of Alternative 4 in combination with these cumulative projects would not result in an adverse cumulative effect on water supply. The implementation of Alternative 4 would not contribute to any adverse cumulative effect on CVP water supply potentially resulting from the three BDCP Alternatives previously described (6, 7 and 8).

4.5.4 Alternative 5: M&I Contractor Suggested WSP

Implementation of the M&I Contractor Suggested WSP under Alternative 5 would not change CVP deliveries to agricultural and M&I water service contractors but would reduce unmet PHS demand in the Cross Valley Canal Unit.

The M&I contractor suggested allocation approach under Alternative 5 would not generate changes to surface water deliveries to NOD and SOD CVP agricultural and M&I water service contractors, with the exception of a small reduction in the amount of unmet PHS demand in the Cross Valley Canal Unit when compared to the No Action Alternative.

The cumulative projects previously described under Alternative 2, including the BDCP, Los Vaqueros Reservoir Expansion Project, the Shasta Lake Water Resources Investigation, Upper San Joaquin Storage Investigation, San Luis Reservoir Low Point Improvement Project, South Bay Aqueduct Improvement and Enlargement Project, North Bay Aqueduct Alternate Intake Project, In-Delta Storage Program, North-of-the-Delta Offstream Storage Investigation, Long Term Water Transfers, changes to the SWRCB Water Quality Control Plan for San Joaquin River flows, and the Franks Tract Project would have the same potential to impact cumulative surface water availability under Alternative 5.

The cumulative projects previously described would, with the exception of three BDCP Alternatives, either generate additional CVP supplies or facilitate improvements in the movement of CVP supplies. Therefore, implementation of Alternative 5 in combination with these cumulative projects would not result in an adverse cumulative effect on water supply. The implementation of Alternative 5 would not contribute to any adverse cumulative effect on CVP water supply potentially resulting from the three BDCP Alternatives previously described (6, 7, and 8).

4.6 References

DWR. 2011. Guidebook to Assist Urban Water Suppliers to Prepare a 2012 Urban Water Management Plan. Accessed on: 01/22/2013. Available: http://www.water.ca.gov/urbanwatermanagement/docs/2010FinalUWMPGuidebook_linked.pdf.

______. 2014. *2014 Water Year Forecast as of May 1, 2014*. Accessed on: 09/11/2014. Available: http://cdec.water.ca.gov/cgi-progs/iodir/wsi.

Reclamation. 2005. *Hydrologic features shapefile - hydro24ca.shp*. U.S. Bureau of Reclamation, MPGIS Service Center in coordination with the California Department of Water Resources. Accessed on: 01/22/2013. Available: http://atlas.ca.gov/download.html#/casil/inlandWaters.

______. 2007. *Friant-Kern/Cross Valley Canals Intertie Construction Project Draft Environmental Assessment*. Accessed on: 01/22/2013. Available: http://www.usbr.gov/mp/nepa/documentShow.cfm?Doc_ID=2860.

______. 2008. *Water Needs Assessment.* Available: http://www.usbr.gov/mp/cvp/mandi/docs/2010/contractor_water_needs_assessments_contract_renewals.pdf.

______. 2011. *Federal CVP water district boundary shapefile - wdfed24.shp.* U.S. Bureau of Reclamation, MPGIS Service Center in coordination with the California Department of Water Resources. Accessed on: 01/22/2013. Available: http://atlas.ca.gov/xml/orig/USBureauRecMidPacificRegionGIS/.

______. 2014. *Summary of Water Supply Allocations.* Accessed on: 09/11/2014. Available: http://www.usbr.gov/mp/cvo/vungvari/water_allocations_historical.pdf.

SWRCB. 2014. *Statutory Water Rights Law and Related Water Code Sections*. Accessed on: 10/17/2014. Available: http://www.swrcb.ca.gov/laws_regulations/docs/wrlaws.pdf.

Chapter 5
Water Quality

This chapter presents the existing water quality within the area of analysis and discusses potential effects on water quality from the proposed alternatives.

5.1 Affected Environment

This section provides an overview of the regulatory setting associated with water quality standards and provides a description of the water bodies with the potential to be affected by the action alternatives.

5.1.1 Area of Analysis

Changes to the allocations of the Central Valley Project (CVP) municipal and industrial (M&I) and agricultural water service contractors during water shortage conditions could affect water quality in portions of the Shasta and Trinity River, Sacramento River, American River, Delta, and West San Joaquin divisions. Figure 5-1 shows the regional area of analysis.

5.1.2 Regulatory Setting

The following section describes the applicable water quality laws, rules, regulations, and policies that influence the operation and comparative performance of the alternatives.

5.1.2.1 Federal

Federal Safe Drinking Water Act The Federal Safe Drinking Water Act (SDWA) was enacted in 1974 to protect the quality of drinking water in the United States (U.S.). This law focuses on all waters actually or potentially designated for drinking use, whether from above ground or underground sources. The SDWA authorized the U.S. Environmental Protection Agency (USEPA) to establish safe standards of purity for specified contaminants and required all owners or operators of public water systems to comply with primary (health-related) standards. State governments, which assume this power from the USEPA, also encourage attainment of secondary standards (nuisance-related). Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are currently regulated by the USEPA through primary and secondary maximum contaminant levels (MCLs). As directed by the SDWA amendments of 1986, the USEPA has been expanding its list of primary MCLs. MCLs have been proposed or established for approximately 100 contaminants.

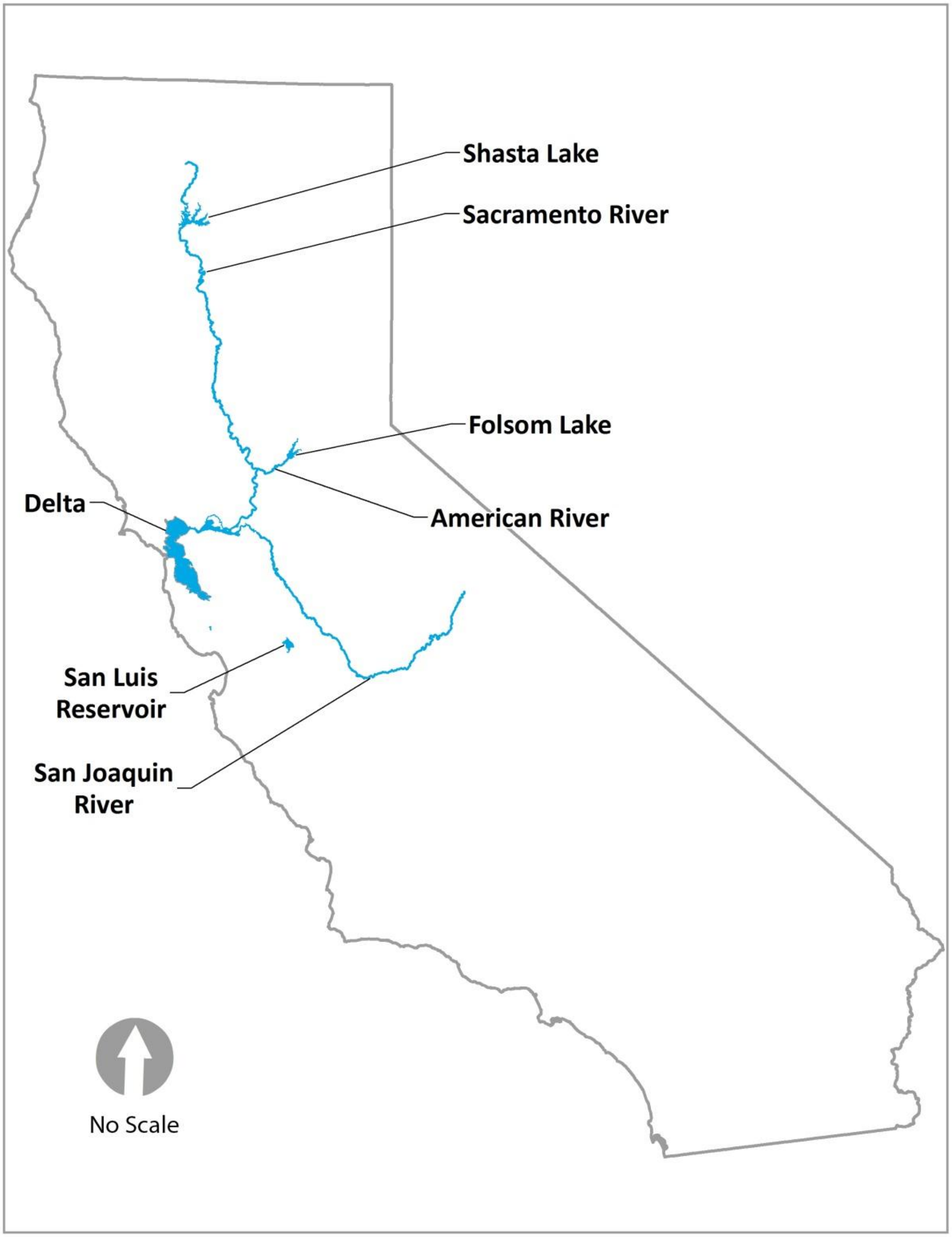


Figure 5-1. Water Quality Area of Analysis

Federal Clean Water Act Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as the Clean Water Act (CWA). The CWA established the basic structure for regulating discharges of pollutants into the waters of the U.S.

It gave the USEPA the authority to implement pollution control programs such as setting wastewater standards for industrial and municipal dischargers. The CWA also continued requirements to set water quality standards for all known contaminants in surface waters. The CWA made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions (USEPA 2002a).

Section 303(d) of the 1972 CWA requires states, territories and authorized tribes to develop a list of water quality-impaired segments of waterways. The 303(d) list includes water bodies that do not meet water quality standards for the specified beneficial uses of that waterway, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water bodies on their 303(d) lists and implement a process, called Total Maximum Daily Loads (TMDLs), to meet water quality standards (USEPA 2002b). Within California, TMDL implementation is through regional Basin Plans.

5.1.2.2 State

The California Porter-Cologne Water Quality Act The California Porter-Cologne Water Quality Act (Porter-Cologne Act) was enacted in 1969 and established the State Water Resources Control Board (SWRCB). The Porter-Cologne Act defines water quality objectives as the limits or levels of water constituents that are established for reasonable protection of beneficial uses. Unlike the CWA, the Porter-Cologne Act applies to both surface and groundwater. The Porter-Cologne Act requires that each of nine semi-autonomous Regional Water Quality Control Boards (RWQCBs) establish water quality objectives, while acknowledging that water quality may be changed to some degree without unreasonably affecting beneficial uses. Beneficial uses, together with the corresponding water quality objectives, are defined as standards, per Federal CWA regulations. Therefore, the regional plans provide the regulatory framework for meeting State and Federal requirements for water quality control. Changes in water quality are only allowed if the change is consistent with the most restrictive beneficial use designation identified by the State, does not unreasonably affect the present or anticipated beneficial uses, and does not result in water quality less than that prescribed in the water quality control plans (Central Valley RWQCB 1998).

State Water Resources Control Board Decision 1641 SWRCB Decision-1641 presents the current water right requirements to implement the Sacramento-San Joaquin River Delta (Delta) flow-dependent objectives. In SWRCB Decision-1641, the SWRCB assigned responsibilities to the Bureau of Reclamation and California Department of Water Resources (DWR) for meeting these requirements. These responsibilities require that the CVP and the State Water Project (SWP) be operated to protect water quality, and that DWR and/or Reclamation will ensure that the flow dependent water quality objectives are met in the Delta (SWRCB 1999).

5.1.2.3 Regional/Local

Regional Water Quality Control Plans The California Water Code (Section 13240) requires the preparation and adoption of water quality control plans (Basin Plans), and the Federal CWA (Section 303) supports this requirement. According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment for the waters within a specified area of beneficial uses to be protected, water quality objectives to protect those uses, and an implementation program needed for achieving the objectives. State law also requires that Basin Plans conform to the policies set forth in the Water Code, beginning with Section 13000, and any State policy for water quality control. The Basin Plans are regulatory references for meeting the state and federal requirements for water quality control (40 Code Federal Regulations 131.20). One significant difference between the State and Federal programs is that California's basin plans also establish standards for groundwater in addition to surface water (Central Valley RWQCB 1998).

Basin Plans are adopted and amended by nine RWQCBs under a structured process involving full public participation and state environmental review. Basin Plans and amendments thereto do not become effective until approved by the SWRCB. Regulatory provisions must be approved by the Office of Administrative Law. Adoption or revision of surface water standards is subject to the approval of the USEPA.

Basin Plans complement other water quality control plans adopted by the SWRCB, such as the Water Quality Control Plans (WQCP) for Temperature Control and Ocean Waters. The SWRCB and the RWQCBs maintain each Basin Plan in an updated and readily available edition that reflects the current water quality control programs.

Several different regional water quality control plans govern water bodies within the M&I Water Shortage Policy (WSP) area of analysis.

- The WQCP for the Central Valley Region RWQCB covers an area including the entire Sacramento and San Joaquin river basins, involving an area bound by the crests of the Sierra Nevada on the east and the Coast Range and Klamath Mountains on the west. The area covered in this WQCP extends some 400 miles, from the California-Oregon border to the headwaters of the San Joaquin River.
- The WQCP for the Tulare Lake Basin comprises the drainage area of the San Joaquin Valley south of the San Joaquin River.
- The WQCP for the San Francisco Bay Basin covers all or major portions of Alameda, Contra Costa, Marin, Napa, San Mateo, San Francisco, Santa Clara, Solano, and Sonoma counties.

- The WQCP for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary establishes water quality objectives for water bodies within the region in order to protect beneficial uses. The WQCP includes beneficial uses to be protected, water quality objectives, and a program to help achieve the water quality objectives. This plan supplements other water quality control plans, by the SWRCB and RWQCBs, relevant to the Bay-Delta Estuary watershed. These other plans and policies establish water quality standards and requirements for parameters such as toxic chemicals, bacterial contamination, and other factors which have the potential to adversely affect beneficial uses or cause nuisance conditions (SWRCB 1995).

5.1.3 Existing Conditions

The following section describes the existing water quality conditions within the study area.

5.1.3.1 Shasta and Trinity River Divisions

The Shasta and Trinity River divisions include a number of community service districts, water agencies, and cities in northern California that receive water from the major reservoirs. The Trinity River Division is located on the Trinity River, approximately 25 miles North of Redding and includes Whiskeytown Lake, the Clear Creek Tunnel, Lewiston Lake, Spring Creek Reservoir, and Trinity River and Reservoir. The Shasta Division is located on the Sacramento River approximately 10 miles north of Redding and includes the upper portion of the Sacramento River, Keswick Reservoir, and Shasta Lake. Both divisions catch the headwaters of the network of CVP waterways and channel the water southward (Reclamation 2012a).

Certain water bodies in the Shasta and Trinity River divisions are listed as water quality limited (impaired) for one or more of the constituents of concern. Table 5-1 presents the 303(d) listed water bodies within the area of analysis and information about the constituents of concern contributing to their impairment. Some water quality constituents are also of concern with respect to drinking water.

Table 5-1. 303(d) Listed Water Bodies within the Shasta and Trinity River Divisions and Associated Constituents of Concern

Name	Constituent	Potential Sources	Estimated Area Affected	Proposed TMDL Completion Year
Clear Creek (below Whiskeytown Lake)	Mercury	Resource Extraction	18 miles	2021
Cottonwood Creek	E.Coli Unknown Toxicity	Source Unknown Source Unknown	29 miles 29 miles	2021 2021
Keswick Reservoir	Cadmium Copper Zinc	Resource Extraction Resource Extraction Resource Extraction	135 acres 135 acres 135 acres	2020 2020 2020
Shasta Lake	Mercury Cadmium Copper Zinc	Resource Extraction Resource Extraction Resource Extraction Resource Extraction	27,335 acres 20 acres 20 acres 20 acres	2021 2020 2020 2020
Sacramento River (Keswick Dam to Cottonwood Creek)	Unknown toxicity	Source Unknown	15 miles	2019
Whiskeytown Lake	Mercury	Resource Extraction	98 Acres	2021
Trinity Lake	Mercury	Atmospheric Deposition Resource Extraction Natural Sources Source Unknown	15,985 acres	2019
Trinity River Hydrologic Unit, Upper Hydrologic Area	Sedimentation/ Siltation	Natural Sources Habitat Modification Hydromodification Resource Extraction	570 miles	2001

Source: SWRCB 2010.

There are only relatively small changes to Shasta and Trinity lakes and Lake Oroville as a result of the different agricultural and M&I water service contractor allocations in the alternatives. The changes in storage are a reasonable response of a complex system to different CVP allocation procedures and may not necessarily be specific responses to the different allocation schemes of one alternative versus another. Shasta and Trinity lakes never show a monthly change in storage for an alternative versus the No Action Alternative of more than +/- one percent of total storage. This is further discussed in Appendix B, Water Operations Model Documentation. Due to these minimal changes, water quality in Shasta and Trinity lakes is not discussed in further detail in this chapter.

In the Trinity Division, major concerns are sedimentation being carried into the waterways and Mercury contamination from abandoned mines. Based on Mercury, a fish consumption advisory exists for the east fork of the Trinity River (OEHHA 2014). Mercury is a lesser threat to drinking water quality because it generally does not appear in the water column, but tends to enter lake and river sediment where it eventually enters the food chain.

5.1.3.2 Sacramento River Division

This includes the Sacramento River and surrounding districts. Tehama, Glenn, and Colusa counties are the primary recipients of water from the unit, but the Tehama-Colusa Canal extends into Yolo County. The Sacramento Canals Unit consists of Red Bluff Diversion Dam, Funks Dam, Corning Pumping Plant, Tehama-Colusa Canal, and Corning Canal. Also included in the Sacramento River Division is the Black Butte Unit, consisting of Black Butte Dam and Lake (Reclamation 2012b).

Certain water bodies in the Sacramento River Division are listed as water quality limited (impaired) for one or more of the constituents of concern. Table 5-2 presents the 303(d) listed water bodies within the area of analysis and information about the constituents of concern contributing to their impairment. Some water quality constituents are also of concern with respect to drinking water.

The 303(d) list indicates that certain segments of the Sacramento River contain several constituents of concern, including dieldrin, mercury, polychlorinated biphenyls (PCBs), and unknown toxicity (see Table 5-2); however, the water quality in the Sacramento River is generally of high quality and concentrations of undesirable constituents are generally low.

Table 5-2. 303(d) Listed Water Bodies within the Sacramento River Division and Associated Constituents of Concern

Name	Constituent	Potential Sources	Estimated Area Affected	Proposed TMDL Completion Year
Sacramento River	Chlordane	Agriculture	16 miles	2021
	Dichlorodiphenyltrichloroethane (DDT)	Agriculture	98 miles	2021
	Dieldrin	Agriculture	98 miles	2021
	Mercury	Resource Extraction	114 miles	2021
	PCBs	Source Unknown	98 miles	2021
	Unknown Toxicity	Source Unknown	114 miles	2019
Black Butte Reservoir	Mercury	Resource Extraction	4,507 acres	2020

Source: SWRCB 2010.

Sacramento River above Bend Bridge near Red Bluff The Sacramento River sampling site above Bend Bridge near Red Bluff is approximately 52 miles downstream of Shasta Dam. Stream flow at this site is greatly influenced by managed releases from Shasta Lake and, during the rainy season, by storm water runoff. There are no artificial levees at this location; therefore, the stream channel and floodplain are in a natural, undisturbed state. The drainage basin area at this site is 9,100 square miles and includes much of northern California. Land cover in the area is mainly forestland; cropland, pasture, and rangeland cover most of the remaining land area. Mining operations take place or have taken place in the Klamath Mountains and water quality effects from mining activities are likely to be detected at this location (United States Geological Survey [USGS] 2002). Table 5-3 presents data for the general water quality parameters.

Table 5-3. Water Quality Parameters Sampled on the Sacramento River Near Red Bluff

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)[2]	7.5	8.4	7.9
Turbidity (NTU)[1]	3	355	39
Dissolved Oxygen (mg/L)[1]	8.2	12	11
Total Organic Carbon (mg/L)[1]	0.9	3.2	1.6
Total Nitrogen (mg/L)[2]	0.02	0.59	0.09
Total Phosphorus (mg/L)[2]	0.02	0.4	0.04
Electrical Conductivity (µS/cm)[2]	103	148	122

Sources:

[1] USGS 2002: A total of 27 samples were collected over a three-year period 1996-1998).

[2] DWR 2014: sample period 2006-2009, samples taken slightly further downstream below Red Bluff Diversion Dam

Key: NTU = Nephelometric Turbidity Units, mg/L = milligrams per liter; µS/cm = micro siemens per centimeter

Sacramento River at Freeport The Sacramento River sampling site at Freeport is the furthest downstream monitoring site reported on the Sacramento River. Therefore, water quality samples at this site reflect the impacts of land use upstream. Agriculture is the predominant land use in the area. Table 5-4 presents the general water quality data for samples collected at Freeport.

Table 5-4. Water Quality Parameters Sampled[1] at Sacramento River at Freeport

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7	8.1	7.7
Turbidity (NTU)	12	368	54
Dissolved Oxygen (mg/L)	6.5	12.2	9.7
Total Organic Carbon (mg/L)	0.3	3.7	1.7
Total Nitrogen (mg/L)	0.058	0.26	0.13
Total Phosphorus (mg/L)	0.01	0.04	0.017
Electrical Conductivity (µS/cm)	51	166	124

Sources: USGS 2002

[1] A total of 31 samples were collected over a three-year period (1996-1998).

5.1.3.3 American River Division

The American River Division encompasses portions of Sacramento, San Joaquin, Placer, and El Dorado counties. The Folsom Unit consists of Folsom Lake and Lake Natoma on the American River. Folsom South Canal provides water for municipal and industrial use in Sacramento and San Joaquin Counties (Reclamation 2012c).

Certain water bodies in the American River Division are listed as water quality limited (impaired) for one or more of the constituents of concern. Table 5-5 presents the 303(d) listed water bodies within the area of analysis and information about the constituents of concern contributing to their impairment. Some water quality constituents are also of concern with respect to drinking water.

Table 5-5. 303(d) Listed Water Bodies within the American River Division and Associated Constituents of Concern

Name	Constituent	Potential Sources	Estimated Area Affected	Proposed TMDL Completion Year
American River, North Fork (North Fork Dam to Folsom Lake)	Mercury	Resource Extraction	71 Miles	2019
American River, South Fork (below Slab Creek Reservoir to Folsom Lake)	Mercury	Resource Extraction	37 Miles	2021
Folsom Lake	Mercury	Resource Extraction	11064 Acres	2019
Lake Natoma	Mercury	Resource Extraction	485 Acres	2019

Source: SWRCB 2010.

Table 5-6 presents general water quality data for Folsom Lake. Table 5-7 presents water quality data on the American River below Folsom Dam.

Table 5-6. Water Quality Parameters Sampled at Folsom Lake

Water Quality Parameter	Minimum	Maximum	Average
PH (standard units)	5.8	8.5	7.1
Turbidity (NTU)	1	68	1.2
Dissolved Oxygen (mg/L)	7.0	14	10.3
Total Organic Carbon (mg/L)	2	3.5	N/A
Total Nitrogen (mg/L)	N/A	N/A	N/A
Total Phosphorus (mg/L)	N/A	N/A	N/A
Electric Conductivity (μS/cm)	19	123	52

Source: Larry Walker Associates 1999

Table 5-7. Water Quality Parameters Sampled at the American River below Folsom Dam

Water Quality Parameter	Minimum[1]	Maximum[1]	Average[1]
Nitrate and Nitrite as N (mg/L)	<0.050	0.230	0.13
Total Phosphorus as P (mg/L)	<0.050	0.1	<0.05
Total Dissolved Solids (mg/L)	20	91	47.5
Mercury (dissolved) (µg/L)	<0.005	0.01	<0.005

Source: LSA Associates, Inc. 2003
[1] Sampling Dates: 2/16/1999, 5/18/1999, 8/24/1999, 11/8/1999, 3/6/2000, 5/15/2000, 8/16/2000, 11/7/2000

Water in the lower American River is generally considered to be of good quality. Table 5-8 presents general water quality data for the lower American River.

Table 5-8. Water Quality Parameters Sampled on the Lower Fork American River[1] (American River at WTP)

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	5.9	9.3	7.4
Turbidity (NTU)	0.7	146	4.5
Dissolved Oxygen (mg/L)	5.2	12.95	9.5
Total Organic Carbon (mg/L)	0.7	3.0	1.7
Total Nitrogen (mg/L)	0.01	0.19	0.05
Total Phosphorus (mg/L)	0.01	0.1	0.02
Electrical Conductivity (µS/cm)	40	95	60

Sources: DWR 2013
[1] Samples collected 01/2006 – 12/2012

5.1.3.4 Delta Division

This includes the Delta region where the Sacramento and San Joaquin Rivers come together, including part of the Bay Area. The Delta Division provides for transport of water through the central portion of the Central Valley. The main features of the division are the Delta Cross Channel, Contra Costa Canal, and Delta-Mendota Canal (Reclamation 2012d).

Certain water bodies in the Delta Division are listed as water quality limited (impaired) for one or more of the constituents of concern. Table 5-9 presents the 303(d) listed water bodies within the area of analysis and information about the constituents of concern contributing to their impairment. Some water quality constituents are also of concern with respect to drinking water.

Table 5-9. 303(d) Listed Water Bodies within the Delta Division and Associated Constituents of Concern

Name	Constituent	Potential Sources	Estimated Area Affected	Proposed TMDL Completion Year
Sacramento-San Joaquin Delta[1]	Chlorpyrifos	Urban Runoff/Storm Sewers Agricultural Return Flows	42,011 Acres	2007 (completed)
	Chlordane	Agriculture	6,795 acres	2011
	DDT	Agriculture	42,011 acres	2011
	Diazinon	Agriculture Urban Runoff/Storm	42,011 acres	2007 (completed)
	Dieldrin	Agriculture	6,795 acres	2011
	Electrical Conductivity	Agriculture	20,819 acres	2019
	Group A Pesticides	Agriculture	42,011 acres	2011
	Invasive Species	Source Unknown	42,011 acres	2019
	Mercury	Resource Extraction	42,011 acres	2008
	PCBs	Source Unknown	6,795 acres	2019
	Unknown Toxicity	Source Unknown	42,011 acres	2019

Source: SWRCB 2010.

Notes:

[1] Delta Waterways include the central portion, eastern portion, export area, northern portion, northwestern portion, southern portion, and western portion

Water quality in the Delta Region is governed in part by Delta hydrodynamics, which are highly complex. The following paragraphs provide a brief description of the hydrodynamic conditions in the Delta, to serve as a context for the descriptions of potential environmental consequences of the M&I WSP. Thereafter follows a discussion of general water quality in the Delta and water quality constituents of concern with respect to drinking water.

The principal factors affecting Delta hydrodynamic conditions are: 1) river inflows from the San Joaquin and Sacramento River systems; 2) daily tidal inflows and outflows through the San Francisco Bay; and, 3) export pumping from the south Delta through the SWP Banks Pumping Plant and CVP Jones Pumping Plant. Because tidal inflows are approximately equivalent to tidal outflows during each daily tidal cycle, tributary inflows and export pumping are the principal variables that define the range of hydrodynamic conditions in the Delta. Freshwater flows into the Delta from three major sources: the Sacramento River, the San Joaquin River, and the eastside streams (CALFED 2000).

Water that enters the Delta via the Sacramento River flows by various routes to the export pumps in the southern Delta. Some of this flow is drawn to the SWP and CVP pumps through interior Delta channels, facilitated by the CVP's Delta Cross Channel. Water that does not travel into the Central Delta continues towards the San Francisco Bay. Under certain conditions, additional Sacramento

River waters flow into the Central and South Delta. The Sacramento River waters flow through Threemile Slough, around the western end of Sherman Island and up the San Joaquin River towards the export pumps. When freshwater outflow is relatively low, water with a higher salt concentration enters the Central and South Delta as tidal inflow from the San Francisco Bay. When SWP and CVP exports cause flow from the Sacramento River to move toward the pumps, then "reverse flow" occurs in the lower San Joaquin River and water of a lower quality is drawn towards the export pumps. Prolonged reverse flow has the potential to adversely affect water quality in the Delta and at the export pumps by increasing salinity (SWRCB 1997, Entrix 1996, CALFED 2000).

Delta Water Quality The existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon. The main source of constituents of concern, according to the 2010 303(d) listing is agriculture. Urban runoff and resource extraction also are potential sources of some constituents.

Table 5-10 presents water quality data at selected stations within the Delta. Salinity and Bromide concentrations are of specific concern because it can adversely affect municipal, industrial, agricultural, and recreational uses; therefore these constituents are further discussed below.

Table 5-10. Water Quality Data for Selected Stations within the Delta

Location	Mean Total Dissolved Solids (mg/L)	Mean Electrical Conductivity (µS/cm)	Mean Bromide, Dissolved (mg/L)	Mean Dissolved Organic Carbon (mg/L)	Mean Chloride, Dissolved (mg/L)
Sacramento River at Hood	92.4	155	0.015	2.1	6.1
North Bay Aqueduct at Barker Slough	188	323	0.042	6.0	24
SWP Clifton Court Intake	235	401	0.190	3.4	62
CVP Banks Pumping Plant	225	392	0.186	3.4	59
Contra Costa Intake at Rock Slough	255	553	0.240	3.8	77
San Joaquin River at Vernalis	324	531	0.210	3.1	68

Source: California DWR 2013
Sampling period varies, depending on location and constituent, but generally is between 2006-2012

Salinity Salinity is a measure of the mass fraction of salts (including chloride and bromide), measured in parts per thousand (ppt). Salinity is measured using a variety of methods. Total dissolved solids (TDS) is a measure of the concentration of salt, as measured in mg/L (DWR 2001). TDS is defined as those solids remaining after drying a sample to a constant weight at 180 degrees Celsius (°C). Electrical conductivity (EC) is a measure of the ability of a solution to carry a current and depends on the total concentration of ionized substances dissolved in the water. Because changes in EC of water are generally directly proportional to changes in dissolved salt concentrations, EC is a convenient surrogate measure for TDS.

Salinity is a concern in the Delta because it can adversely affect municipal, industrial, agricultural, and recreational uses. Table 5-11 illustrates that within the Delta, mean TDS concentrations are highest in the west Delta and the south Delta channels that are affected by the San Joaquin River (CALFED 2000). Salinity problems in the western Delta result primarily from the intrusion of saline water from the San Francisco Bay system (SWRCB 1997). The extent of seawater intrusion into the Delta is a function of daily tidal fluctuations, the freshwater inflow to the Delta from the Sacramento and San Joaquin rivers, the rate of export at the SWP and CVP intake pumps, and the operation of various control structures, such as the Delta Cross-Channel Gates and Suisun Marsh Salinity Control System (DWR 2001). In the southern Delta, salinity is largely associated with the high concentrations of salts carried by the San Joaquin River into the Delta (SWRCB 1997). The high mean concentration of TDS in the San Joaquin River at Vernalis reflects the accumulation of salts in agricultural soils and the effects of recirculation of salts via the Delta Mendota Canal (CALFED 2000). Locations in the north portion of the Delta at Barker Slough, which is not substantially affected by seawater intrusion, and in the Sacramento River at Greene's Landing have lower mean concentrations of TDS than other locations in the Delta. A similar pattern is seen using mean EC levels as a surrogate for TDS.

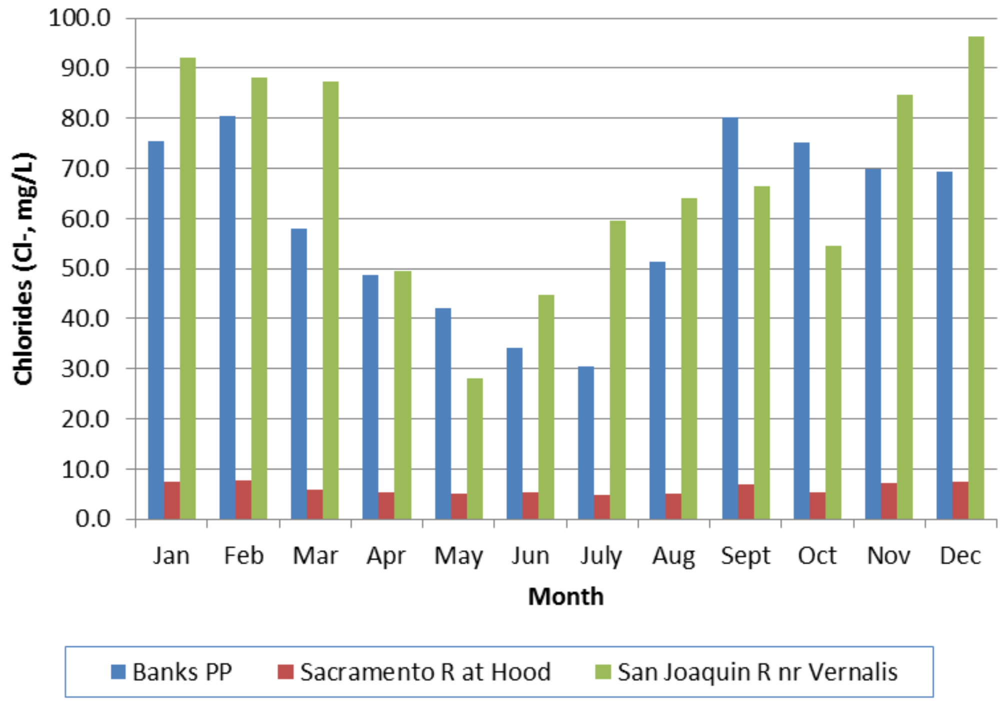
Table 5-11. Comparison of Total Dissolved Solids Concentrations at Selected Stations Within the Delta

TDS (mg/L)	Sacramento River at Hood	Banks Pumping Plant	San Joaquin River Near Vernalis
Mean	92	225	324
Median	91	233	330
Low	46	74	64
High	140	428	672

Source: California DWR 2013

Water quality data collected between 2006 and 2012 show that TDS levels at Banks Pumping Plant and in the Sacramento River at Hood never exceeded the secondary MCL for drinking water of 500 mg/L (Table 5-11) (DWR 2013). In the San Joaquin River near Vernalis, only 27 out of the 201 samples exceeded the secondary MCL for TDS. The secondary MCL for chloride is 250 mg/L, and the secondary MCL for electrical conductivity is 900 µS/cm. Because TDS is a measure of the total dissolved solids and does not measure the relative contribution of individual constituents such as chloride and bromide, it is possible to meet the secondary TDS MCL for (500 mg/L) but still exceed a standard for an individual salt constituent such as chloride (250 mg/L) (DWR 2001). For this reason, and because of their importance in formation of disinfection by-products (DBPs), chloride and bromide are addressed in detail in the following sections.

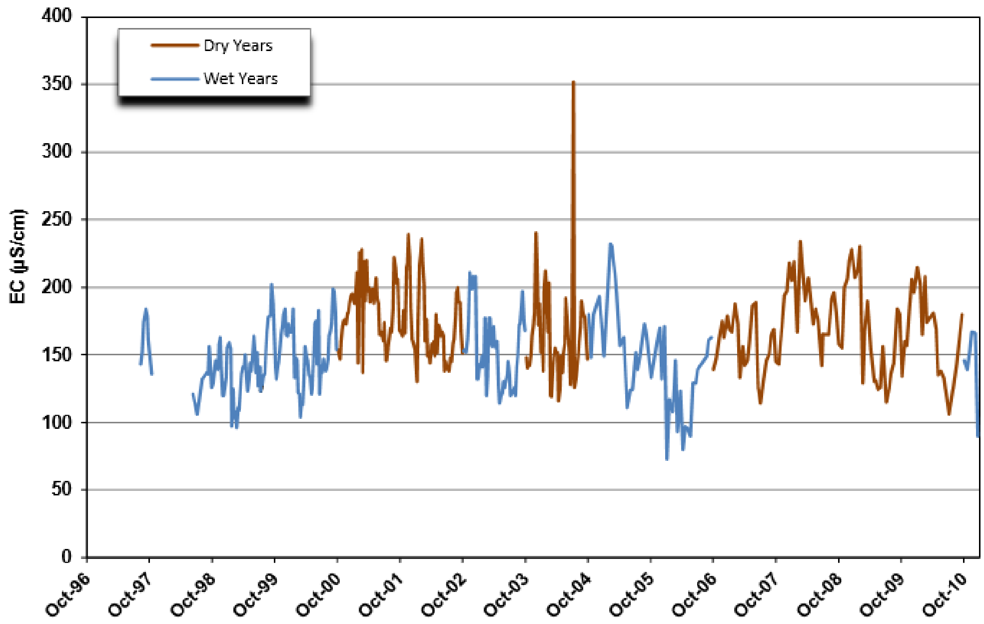
Figure 5-2 presents monthly median chloride concentrations at Banks Pumping Plant, Sacramento River at Hood, and the San Joaquin River near Vernalis. As Figure 5-2 shows, the lowest median concentrations of chloride typically occur in spring and early summer (April through July). The monthly median concentrations of chloride for the period of record (January 2006-December 2012) do not exceed the secondary MCL for chloride of 250 mg/L.



Source: California DWR 2013.
Note: Bars represent the average monthly value.

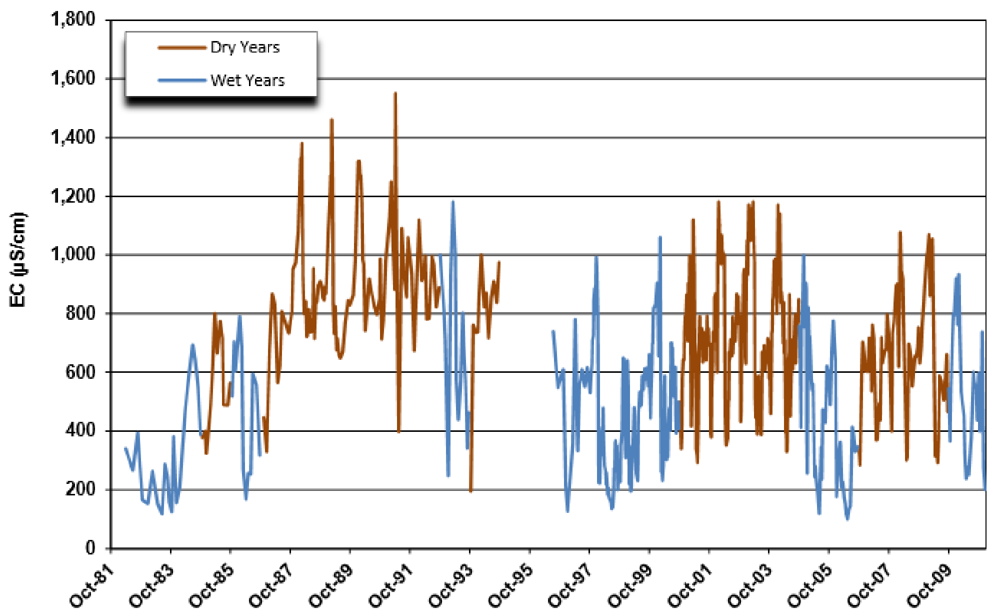
Figure 5-2. Monthly Average Chloride Concentrations at Banks Pumping Plant, Sacramento River at Hood, and San Joaquin River near Vernalis

Salinity patterns in the Delta also vary with water year type (Reclamation 2013). As shown in Figures 5-3 through 5-5, salinity, as measured by EC, is higher in dry water years (WYs) than in wet WYs (DWR 2013). In addition, a DWR project report (DWR 2013) found that EC levels generally rise during the late summer and fall months when river flows are low.



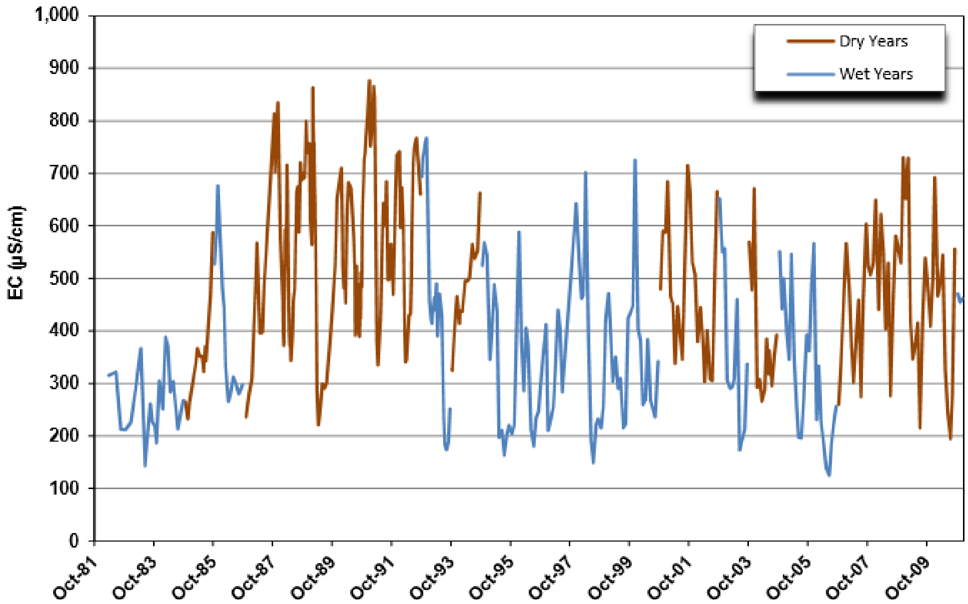
Source: DWR 2013.

Figure 5-3. Average Electrical Conductivity (µS/cm) by Year Type at the Sacramento River at Hood in the Sacramento-San Joaquin Delta



Source: DWR 2013.

Figure 5-4. Average Electrical Conductivity (µS/cm) by Year Type at the San Joaquin River at Vernalis in the Sacramento-San Joaquin Delta



Source: DWR 2013.

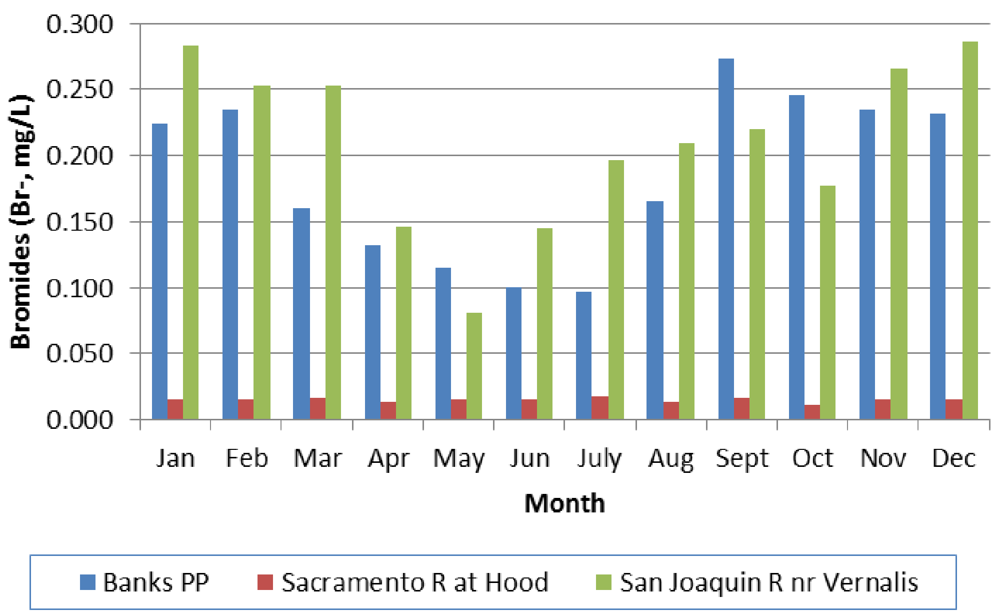
Figure 5-5. Average Electrical Conductivity (µS/cm) by Year Type at Banks Pumping Plant in the Sacramento-San Joaquin Delta

Bromide Bromide is important from a drinking water perspective because during chlorination of drinking water for disinfection, bromide reacts with natural organic compounds in the water to form trihalomethanes (THMs). Four species of THMs are regulated in drinking water including chloroform, bromodichloromethane, dibromochloromethane, and bromoform.

Stage 1 Disinfectants and Disinfection Byproducts Rule requires lower levels of bromate, a disinfection by-product of bromide, in drinking water (0.010 mg/L) than previously required. The Long Term 1 Enhanced Surface Water treatment Rule requires additional disinfection, primarily for pathogens such as *Cryptosporidium* and *Giardia*, and the requirement for increased disinfection has the potential to increase the quantity of disinfection by-products formed. In order to meet stringent USEPA drinking water standards, CALFED has proposed that the concentration of bromide levels at export pumps not exceed 0.05 mg/L (DWR 2001). However, this recommendation is a non-enforceable target level, and it has been found that this target level is often exceeded (CALFED 2008).

The primary source of bromide in Delta waters is sea-water intrusion (CALFED 2000). Other sources of bromide include drainage returns in the San Joaquin River and within the Delta, connate water beneath some Delta Islands, and possibly agricultural applications of the pesticide methyl bromide (CALFED 2000). The San Joaquin River and agricultural irrigation sources are primarily a "recirculation" of bromide that originated from historical sea-water intrusions (CALFED 2000). The bromide and chloride data shown in Table 5-11 indicates that seawater intrusion is highest in the western and southern portions of the Delta, where the direct effects of seawater intrusion and the effects of recirculated bromide from the San Joaquin River exist (DWR 2001).

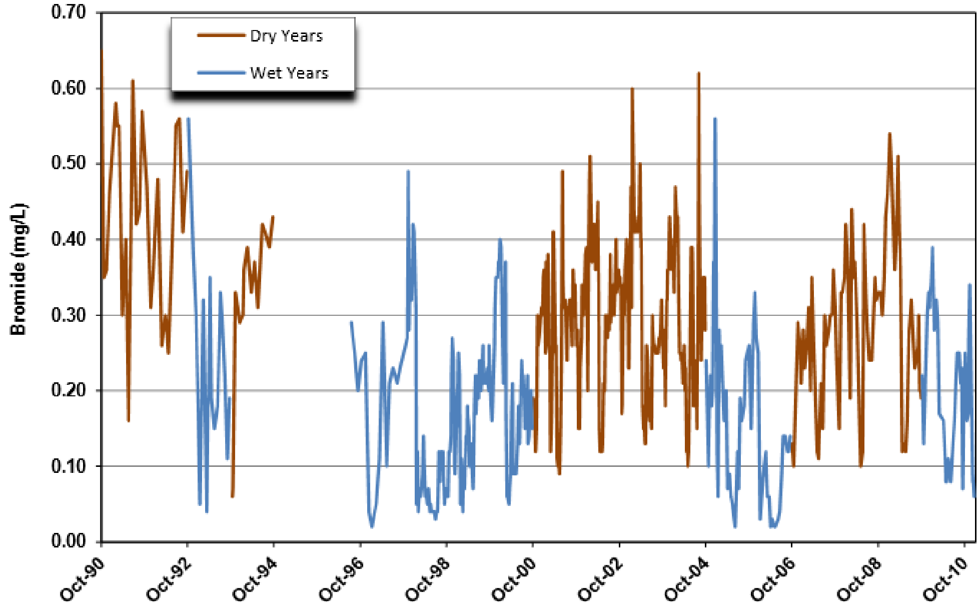
In addition to varying geographically within the Delta, bromide varies seasonally, in a pattern similar to that exhibited by salinity. Figure 5-6 presents median monthly bromide concentrations at Banks Pumping Plant, Sacramento River at Hood, and the Jan Joaquin River near Vernalis for each month of the year over the period of record (January 2006 - December 2012). The lowest median monthly concentrations of bromide typically occur in spring and early summer (April through July) when the high river flows and high Delta outflows reduce seawater intrusion.



Source: California DWR 2013.
Note: Bars represent the Average.

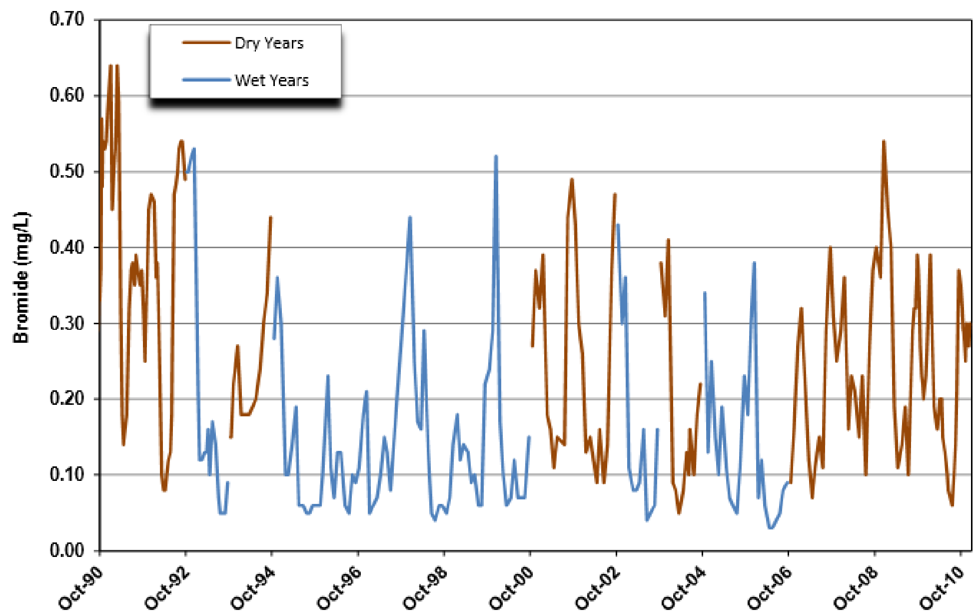
Figure 5-6. Monthly Average Bromide Concentrations at Banks Pumping Plant, Sacramento River at Hood, and San Joaquin River near Vernalis

In the Delta, the type of water year (e.g., wet, dry, normal) has a strong influence on bromide concentration (DWR 2012). Figures 5-7 through 5-8 illustrate that average bromide concentrations at three locations were higher in dry WYs than in wet WYs (DWR 2012).



Source: DWR 2012.

Figure 5-7. Average Bromide Concentrations (mg/L) by Year Type at the San Joaquin River at Vernalis in the Sacramento-San Joaquin Delta



Source: DWR 2012.

Figure 5-8. Average Bromide Concentrations (mg/L) by Year Type at Banks Pumping Plant in the Sacramento-San Joaquin Delta

5.1.3.5 West San Joaquin Division

The West San Joaquin Division consists of the Westlands Water District as well as the Delta Division in Alameda, Contra Costa, and San Joaquin counties. The Division includes the San Joaquin River, connected to the Delta Mendota Canal and the San Luis Reservoir, connected to the San Luis Canal and California Aqueduct. Flows in the San Joaquin River play a major role in the water quality of the region. Flows in the river are controlled mostly by dams on east-side tributaries and on the upstream portions of the main stem (Reclamation n.d.).

The West San Joaquin Division includes the San Luis Unit, which is operated by both the CVP and SWP. This unit includes the San Luis Reservoir and Canal, O'Neill Dam and Forebay, B.F. Sisk Reservoir, and Los Banos and Little Panoche Detention Reservoirs. San Luis Reservoir serves as the major storage reservoir and O'Neill Forebay acts as an equalizing basin for the upper stage dual-purpose pumping-generating plant. Los Banos and Little Panoche Reservoirs control cross drainage along the San Luis Canal (Reclamation 2012e). San Luis Reservoir allocations are conveyed through the Pacheco Tunnel to San Felipe Division users in Santa Clara and San Benito counties.

Certain water bodies in the West San Joaquin Division are listed as water quality limited (impaired) for one or more of the constituents of concern. Table 5-12 presents the 303(d) listed water bodies within the area of analysis and information about the constituents of concern contributing to their impairment. Some water quality constituents are also of concern with respect to drinking water.

Table 5-12. 303(d) Listed Water Bodies within the West San Joaquin Division and Associated Constituents of Concern

Name	Constituent	Potential Sources	Estimated Area Affected	Proposed TMDL Completion Year
O'Neill Forebay	Mercury	Source Unknown	2,254 Acres	2012
San Joaquin River[1]	Alpha.-Benzenehexachloride	Source Unknown	29 miles	2022
	Arsenic	Source Unknown	14 Miles	2021
	Boron	Agriculture	134 miles	2019
	Chlorpyrifos	Agriculture	145 miles	2007
	Dichlorodiphenyldichloroethylene (DDE)	Agriculture	32 miles	2011
	DDT	Agriculture	145 miles	2011
	Diazinon	Agriculture	99 miles	2007
	Diuron	Agriculture	3 miles	2021
	EC	Agriculture	57 miles	2019
	E coli	Source Unknown	20 miles	2021
	Group A Pesticides	Agriculture	145 miles	2011

Name	Constituent	Potential Sources	Estimated Area Affected	Proposed TMDL Completion Year
	Invasive Species	Source Unknown	70 miles	2019
	Mercury	Resource Extraction	57 miles	2012
	Selenium	Agriculture	3 miles	2002
	Temperature	Source Unknown	40 miles	2021
	Toxaphene	Source Unknown	3 miles	2019
	Unknown Toxicity	Agriculture and Source Unknown	145 miles	2019
San Luis Reservoir	Mercury	Source Unknown	13,007 Acres	2021

Source: SWRCB 2010.

Notes:

[1] San Joaquin River includes the following stretches: Mendota Pool to Bear Creek, Bear Creek to Mud Slough, Mud Slough to Merced River, Merced River to Tuolumne River, Tuolumne River to Stanislaus River, Friant Dam to Mendota Pool, and Stanislaus River to Delta Boundary

5.1.3.6 Beneficial Uses

Application of water quality objectives (i.e., standards) to protect designated beneficial uses is critical to water quality management in California. State law defines beneficial uses to include (but not be limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning. Significant points concerning the concept of beneficial uses are:

1. All water quality problems can generally be stated in terms of whether there is water of sufficient quantity or quality to protect or enhance beneficial uses (Central Valley RWQCB 1998).

2. Beneficial uses do not include all of the reasonable uses of water. For example, disposal of wastewaters is not included as a beneficial use. This is not to say that disposal of wastewaters is a prohibited use; it is merely a use that cannot be satisfied to the detriment of beneficial uses. Similarly, the use of water for the dilution of salts is not a beneficial use although it may, in some cases, be a reasonable and desirable use of water (Central Valley RWQCB 1998).

3. The protection and enhancement of beneficial uses require that certain quality and quantity objectives be met for surface and ground waters (Central Valley RWQCB 1998).

4. Fish, plants, and other wildlife, as well as humans, use water beneficially.

The beneficial uses designated for waters within the area of analysis are presented in Table 5-13. In some cases, a beneficial use may not be applicable to the entire body of water. In these cases, RWQCB judgment is applied. Water bodies within the basins that do not have beneficial uses designated are assigned municipal and domestic supply designations in accordance with the provisions of SWRCB Resolution No. 88-63. These municipal and domestic supply designations in no way affect the presence or absence of other beneficial uses in these water bodies.

The Porter-Cologne Act defines water quality objectives as "… the limits or levels of water quality constituents or characteristics which are established for the reasonable protections of the beneficial uses of water or the preventions of nuisance within a specified area" [Water Code 13050(H)]. The Basin Plans present water quality objectives in numerical or narrative format for specified water bodies or for protection of specified beneficial uses throughout a specific basin or region.

Table 5-13. Beneficial Uses of Water Bodies in the Area of Analysis

Beneficial Use Designation	Shasta Lake	Sacramento River	Delta	Delta-Mendota Canal	San Luis Reservoir	O'Neill Reservoir	California Aqueduct	North Fork American River	Middle Fork American River	Folsom Lake	Lower American River	Whiskey Town Reservoir	Clear Creek	San Joaquin River	Cottonwood Creek	Black Butte Reservoir
Municipal and Domestic Supply	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Irrigation Watering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stock Watering		✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓
Industrial Process Supply			✓				✓							✓		
Industrial Service Supply		✓	✓		✓		✓				✓					
Hydropower Generation	✓	✓			✓		✓		✓	✓	✓	✓		✓		
Water Contact Recreation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Canoeing and Rafting[1]		✓						✓	✓		✓		✓	✓	✓	
Non-contact Water Recreation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Warm Freshwater Habitat[2]	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
Cold Freshwater Habitat[2]	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	
Warm[3] Water Migration Areas		✓	✓											✓		
Cold[4] Water Migration Areas		✓	✓										✓	✓	✓	
Warm Water Spawning Habitat[3]	✓	✓	✓							✓		✓	✓	✓	✓	✓
Cold Water Spawning Habitat[4]	✓	✓						✓	✓		✓		✓		✓	
Navigation		✓	✓													
Wildlife Habitat	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Central Valley RWQCB 1998

[1] Shown for streams and rivers only with the implication that certain flows are required for this beneficial use.

[2] Resident does not include anadromous. Any segments with both COLD and WARM beneficial use designations will be considered COLD water bodies for the application of water quality objectives.

[3] Striped bass, sturgeon, and shad.

[4] Salmon and steelhead.

5.2 Environmental Consequences

These sections describe the environmental consequences associated with each alternative.

5.2.1 Assessment Methods

This section describes the assessment methods used to analyze potential water quality effects of the alternatives, including the No Action Alternative. The analysis for reservoirs and waterways uses both quantitative and qualitative methods to assess changes in water quality. The quantitative analysis relies on hydrologic modeling results that estimate changes in river flow rates and reservoir storage under each of the action alternatives. If the change in storage is equal to or less than 1,000 acre-feet (AF), or if the change in flow is less than 10 cubic feet per second (cfs), it is assumed that there would be no water quality impacts as this is within the error margins of the model. If the changes are small and within the normal range of fluctuations (similar to the No Action Alternative) for that time period, it is generally assumed that any water quality impacts would be negligible and are not further discussed within the chapter. Appendix B, Water Operations Model Documentation, describes the modeling efforts to quantify changes in reservoir surface water elevation and river flow rates.

Reservoir storage data is not available for all reservoirs included in the area of analysis. Where this data is not available, effects are evaluated based on transfer quantities, anticipated changes in water storage (increases or decreases), and the timing of the changes.

The analysis for the Delta uses both quantitative and qualitative methods to assess changes in water quality. The quantitative analysis relies on water quality modeling output that estimates changes in various water quality parameters under each of the action alternatives. Hydrodynamic and water quality modeling of the Delta was performed using the Delta Simulation Model-2 (DSM2). Appendix C, Delta Water Quality Model Documentation, presents details on the model set up and results to quantify changes in water quality in the Delta. Where modeling is not available, effects are evaluated based on changes in CVP deliveries, anticipated changes in flow through the Delta (increases or decreases), and the timing of the changes.

As mentioned in Chapter 5.1.3.1, changes in Shasta and Trinity lakes and Lake Oroville reservoir storage are minimal, and are likely to be the result of modeling small changes to allocations. These minimal changes may or may not occur and amount to a less than one percent change in reservoir storage levels. This is further discussed in Appendix B; therefore, storage changes in these reservoirs will not be further analyzed within Chapter 5.2. Additionally, changes in Sacramento River flows are minimal and are further discussed in detail in Appendix B.

All other water quality effects are analyzed at a qualitative level using the best available information and taking into consideration the magnitude and timing of the change, as well as any location specific water quality issues.

5.2.2 Alternative 1: No Action

The No Action Alternative includes the most likely future conditions in the absence of the action alternatives.

Under the No Action Alternative, CVP allocations and changes in reservoir storage could affect water quality. Under the No Action Alternative, reductions in storage could occur. Any reductions in storage would be a result of future population growth and increases in water demand on these water supply sources. However, it is expected that any reductions in storage would continue on the same pattern as currently observed. Therefore, the potential for reductions in monthly median storage in these reservoirs would be the same as existing conditions and would not affect water quality.

Reservoir constituents of concern within the area of analysis are primarily listed with resource extraction as a potential source of contamination. Contamination resulting from resource extraction is generally the result of legacy pollution from historic mining activities in the region and would not be affected by CVP water allocation methodology; therefore, water quality under the No Action Alternative would most likely exhibit the same range of constituent levels. Reservoirs would be subject to the same environmental influences and variations including wind patterns and climatic variations. Implementation of TMDLs may improve water quality in some cases, but these measures would be implemented regardless of CVP water allocation methodology. There would be no substantial changes in water quality associated with the No Action Alternative.

Under the No Action Alternative, CVP allocations and changes to long-term average flow rates in rivers and streams could affect water quality. Under the No Action Alternative, future long-term average flow rates in the rivers could generally be lower throughout most of the year because of general population growth and a corresponding increase in demand on water supply resources. However, there are many flow requirements in place for fish and wildlife that would help to maintain minimum flow rates. Additionally, these changes would not be attributed to the project; they would occur without the project. Any changes in flow rates would not be expected to substantially change water quality.

Many of the constituents of concern in water bodies within the area of analysis have agriculture, resource extraction, or urban runoff listed as a potential source. Under the No Action Alternative, water allocation priority is given to M&I customers in years where CVP water supplies are not adequate to provide water to all water service contractors. This could lead to a reduction in agriculture, and a subsequent reduction in agricultural return flows which could introduce constituents of concern to area water bodies. However, water allocation under this alternative would continue on the same pattern as currently enforced;

therefore constituent levels are not likely to change as a result of water allocation methodology. Implementation of TMDLs may improve water quality in some cases, but these measures would be implemented regardless of CVP water allocation methodology. Water quality in these rivers under the No Action Alternative would exhibit the same range of constituent levels and be subject to the same environmental and riverine influences and variations, including wind patterns, climatic variation, water supply variations, and inland flow regime, that are already present. Therefore, the No Action Alternative would result in no water quality change on these rivers.

5.2.3 Alternative 2: Equal Agricultural and M&I Allocation

5.2.3.1 Shasta and Trinity River Divisions

Providing equal allocations to agricultural and M&I water service contractors in Dry and Critical WYs could cause changes in river flows resulting in water quality impacts in the Shasta and Trinity River divisions. As noted in the assessment methods above, reservoir storage amounts would not be affected by changes in CVP water allocations. Similarly, river flows in the Sacramento River downstream of these reservoirs would not be affected. Changes in flows are provided in Table 5-14. These changes in flow would account for a change in flow of a maximum of three percent. Changes are likely attributable to changes in CVP allocations throughout the year and not to changes in allocations from Alternative 2.

Table 5-14. Changes in Sacramento River flows below Keswick between Alternative 2 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	60	-102	-70	-72	13	1	2	1	6	-14	1	-44
AN	-106	-50	19	10	34	10	2	62	3	6	-6	15
BN	-15	22	35	-22	44	40	49	88	1	-113	-8	-16
D	-11	-45	30	26	31	1	83	117	48	-54	332	-91
C	-5	-52	-9	49	-39	3	162	50	-154	-49	-97	-105

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

The large flow increase in August of dry years is a reasonable response of a complex system to different CVP allocation procedures. There are only two simulated years in the hydrologic modeling that are driving this average (August of 1949 and 1989). In these months, the model is responding to several small changes and moving more CVP water through the Delta. It is unlikely that the higher Sacramento River flows in August of dry years are an effect of CVP allocations under Alternative 2. For additional information on changes in Sacramento River flows, please see Appendix B.

5.2.3.2 Sacramento River Region

Providing equal allocations to agricultural and M&I water service contractors in Dry and Critical WYs could cause changes in river flows in the Sacramento River Region resulting in water quality impacts. Flows in the Sacramento River Region change only minimally under Alternative 2. Tables 5-15 and 5-16 provide changes in Sacramento River flows between the No Action Alternative and Alternative 2 at Wilkins Slough and Hood, respectively.

Table 5-15. Changes in Sacramento River flows at Wilkins Slough between Alternative 2 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	55	-45	-6	-4	-4	-7	-6	-5	-2	-21	-4	-49
AN	-112	-50	-15	-3	-3	-3	-4	53	-11	-3	-15	10
BN	-7	20	22	-19	2	21	35	78	-13	-101	-11	-8
D	-13	-50	25	-20	25	-7	77	98	13	-80	318	-73
C	10	-52	-8	46	-46	-6	142	13	-180	-84	-114	-71

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 5-16. Changes in Sacramento River flows at Hood between Alternative 2 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	93	-92	-31	14	5	-5	-12	-2	4	-16	-11	-17
AN	-26	-30	43	97	40	-41	-1	61	0	-3	-18	6
BN	11	-6	17	-5	104	35	198	154	-23	-26	-49	-10
D	-14	-20	32	2	81	56	106	105	-26	45	735	197
C	34	-22	159	88	-59	-6	146	61	-187	391	62	84

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

The greatest change in flows occurs in August of dry WYs when there is a six percent increase in flows between the No Action Alternative and Alternative 2 at both Wilkins Slough and Hood. This is not likely to be an effect of changes in CVP allocations to M&I and agricultural water service contractors under Alternative 2, but rather reasonable response of a complex system to different CVP allocation procedures.

Although there are small changes in river flows in the Sacramento River region, these changes are likely attributable to additional CVP allocations and minimum flow requirements; therefore, water quality is not affected in the Sacramento Region under Alternative 2.

5.2.3.3 American River Region

Providing equal allocations to agricultural and M&I water service contractors in Dry and Critical WYs could cause changes in reservoir storage in the American

River Region resulting in water quality impacts. Under Alternative 2, M&I water service contractors would receive the same level of shortage allocations as agricultural water service contractors. This equal distribution would result in lower M&I deliveries during dry WYs directly out of Folsom Lake compared to the No Action Alternative. As a result, total storage in Folsom Lake increases by approximately three percent during the summer months of critical WYs. Changes in total storage are shown in Table 5-17.

Table 5-17. Changes in Folsom Lake Storage between Alternative 2 and the No Action Alternative (in thousand AF [TAF])

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	2	2	1	0	0	0	0	1	1	1	2	1
AN	7	6	5	0	0	0	0	0	0	0	1	1
BN	9	10	10	11	9	9	1	1	2	4	10	6
D	7	7	7	8	6	3	5	8	10	9	0	5
C	12	12	10	10	12	15	20	25	33	31	24	25

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Although there are changes in storage especially during dry and critical WYs as a result of changes in M&I and agricultural deliveries, these changes account for three percent or less of the total storage of the reservoir. The only current constituent of concern in Folsom Lake is mercury, with a potential source of resource extraction. Slight changes in reservoir levels as a result of Alternative 2 would not be enough to change the concentration of constituents within the reservoir, especially due to mercury's properties which cause it to settle within the sediment rather than throughout the water column. Additionally, resource extraction would not be affected by water allocations; therefore, the inflow of mercury into the reservoir would not be affected. Minimal changes in reservoir storage in Folsom Lake are not likely to affect water quality.

Providing equal allocations to agricultural and M&I water service contractors in Dry and Critical WYs could cause changes in river flows in the American River Region resulting in water quality impacts to M&I contractors. Under Alternative 2, M&I water service contractors would receive the same level of shortage allocations as agricultural water service contractors. This equal distribution would result in lower M&I deliveries during dry WYs directly out of the American River Region compared to the No Action Alternative, but higher deliveries from Folsom Lake to agricultural water service contractors south of the Delta. As a result, flows in the American River are expected to increase by up to approximately 18 percent during August of critical WYs. Agricultural water deliveries would likely be highest during the month of August, reducing the amount of water available for M&I deliveries under Alternative 2 compared to the No Action Alternative. Changes in flows on the American River below Nimbus and at H Street can be viewed in Table 5-18 and 5-19, respectively.

Tables 5-18 and 5-19 show a small number of months over all year types with minor decreases in flow under Alternative 2. Similar to flows on the Sacramento River, the hydrologic model is responding to several small changes within the complex system. It is unlikely that the few lower monthly American River flows are an effect of CVP allocations under Alternative 2.

Table 5-18. Changes in American River flows below Nimbus between Alternative 2 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	17	20	30	31	16	3	2	8	9	4	-1	32
AN	86	11	47	94	25	3	9	13	18	16	2	15
BN	32	2	15	19	53	14	181	55	64	34	-28	108
D	-7	21	18	10	65	70	49	22	51	118	225	-16
C	15	34	60	41	1	2	3	5	-25	149	203	51

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 5-19. Changes in American River flows at H Street between Alternative 2 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	16	20	30	31	16	3	2	8	9	4	-1	32
AN	86	10	40	94	23	3	9	13	17	16	2	15
BN	32	2	15	18	53	13	181	53	62	34	-28	108
D	-7	21	17	10	65	70	48	22	50	97	207	-18
C	15	34	60	40	0	-1	1	5	-25	149	201	49

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

As discussed in Chapter 5.1.3.3, water in the American River is generally of good quality. The river is, however, 303(d) listed for mercury impairment. Mercury impairment is not likely to be affected by changes in CVP water allocations because contamination is generally the result of legacy pollution from historic mining activities and will not change in the area of analysis under Alternative 2. Releases from Folsom Lake may affect levels of mercury in the American River. However, changes in releases from Folsom Lake under Alternative 2 are minor, and increased American River flows would not be substantial enough to negatively impact water quality in the region.

5.2.3.4 Delta Division

Providing equal allocations to agricultural and M&I water service contractors in Dry and Critical WYs could change Delta salinity and bromide concentrations, resulting in water quality impacts. X2 calculations were completed to determine the movement of salinity throughout the Delta. The "X2" water quality parameter represents the distance from the Golden Gate to the location of 2 ppt salinity concentration in the Delta. Larger values indicate higher salinity concentrations in the Delta, and smaller values indicate lower salinity concentrations.

Under Alternative 2, X2 generally moves westward, likely due to the subtle increase in Sacramento River inflow in comparison with the No Action Alternative. These changes are minimal, however, as shown in Table 5-20. X2 is regulated from February through June; therefore, fluctuations in X2 resulting from changes in allocations are more likely to be present during the summer, fall, and early winter months. Although export patterns change under Alternative 2, Reclamation will continue to operate in a way to meet these strict standards, and therefore water quality within the Delta is expected to exhibit only minor changes in movement of salinity concentrations.

Table 5-20. Percent changes in Delta X2 between Alternative 2 and the No Action Alternative

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.07	0.07	-0.01	0.00	0.00	0.00	0.00	-0.01	-0.02	0.00	0.01	0.02
AN	-0.01	-0.05	-0.08	-0.03	0.00	0.04	0.01	-0.05	-0.05	-0.05	-0.02	0.00
BN	0.02	0.07	0.34	0.24	-0.01	-0.07	-0.14	-0.29	-0.20	-0.16	0.04	0.03
D	0.01	0.09	0.06	-0.05	-0.06	-0.07	-0.16	-0.26	-0.24	-0.09	-0.35	-0.23
C	-0.11	-0.01	0.00	-0.08	-0.06	-0.06	-0.28	-0.38	-0.11	-0.25	0.02	0.01

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

DSM2 modeling results and analysis for the Delta Division indicate that the largest percent change in CVP and SWP export EC under Alternative 2 would occur in April through June in Critical WYs. These increases in EC are expected to range from 2.3 to 4.8 percent for SWP exports and 1.5 to 2.5 percent for CVP exports. This increased EC is likely to be the result of an increase in river flows during dry and critical years, as well as a slight increase in agricultural return flows. Agricultural return flows are expected to be higher due to the greater acreage of irrigated crops under Alternative 2. Table 5-21 displays changes in EC at CVP export locations between the No Action Alternative and Alternative 2. Table 5-22 provides the same information at SWP export locations.

Table 5-21. Percent changes in EC between Alternative 2 and the No Action Alternative at CVP export locations

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	-0.3	0.1	0.1	-0.2	0.0	0.1	0.0	0.1	0.0	-0.1	-0.1
BN	-0.1	0.1	0.0	0.1	0.0	-0.2	0.2	0.0	0.2	-0.2	-0.7	0.7
D	0.3	0.3	0.3	-0.1	-0.4	0.0	0.1	0.4	0.5	-0.3	-0.8	0.1
C	0.5	0.0	0.4	0.8	0.3	0.6	1.6	1.5	2.5	1.5	-0.6	1.0

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 5-22. Percent changes in EC between Alternative 2 and the No Action Alternative at SWP export locations

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.2	-0.4	0.2	0.2	0.2	0.1	0.0	0.0	0.0	-0.1	-0.2	-0.1
BN	-0.2	0.2	0.2	1.0	-0.3	0.1	0.2	0.0	-0.1	-0.4	-0.6	0.9
D	0.3	0.4	0.6	-0.1	-0.3	-0.1	-0.1	0.3	0.8	-0.2	0.4	0.3
C	0.5	0.2	0.7	1.2	0.8	1.0	2.3	3.0	4.8	0.8	-0.5	0.7

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

DSM2 modeling results for bromide indicate an overall average increase in bromide concentrations for all year types of 1.2 percent for SWP and 1.3 percent for CVP. This increase is especially apparent in dry and critical years. Table 5-23 displays the bromide percent increase for SWP and CVP for all year types. Bromide concentrations are likely higher under Alternative 2 due to increased agricultural return flows, especially in the South of Delta region including the San Joaquin River.

Table 5-23. Annual percent change in bromide load for SWP and CVP between Alternative 2 and the No Action Alternative

Sac Yr Type	SWP % Diff	CVP % Diff
W	0.7	0.2
AN	-0.7	0.1
BN	1.9	0.6
D	1.4	2.2
C	3.3	4.2

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water quality in the Delta region would be reduced under the implementation of Alternative 2. These changes are most likely to negatively impact all SWP and CVP South of Delta users. Changes in salinity and bromide concentrations are small, and based on significant restrictions and monitoring of Delta water quality, any changes would be minor.

5.2.3.5 West San Joaquin Division

Providing equal CVP allocations to agricultural and M&I water service contractors in Dry and Critical WYs could change South of Delta reservoir storage resulting in water quality impacts. Under Alternative 2, CVP deliveries to agricultural water service contractors would increase compared to the No Action Alternative. This change in deliveries would have the greatest impact of South of Delta reservoirs and waterways. Table 5-24 provides total changes in CVP and SWP combined storage for San Luis Reservoir.

Table 5-24. Changes in total San Luis Reservoir storage between Alternative 2 and the No Action Alternative (in TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	18	21	22	18	15	0	-1	0	-1	-1	2	3
AN	3	5	9	3	2	-6	-5	-3	-4	-4	-4	1
BN	3	7	30	27	6	-7	-8	-5	-5	-5	3	8
D	11	21	25	21	20	4	-1	-7	-20	-26	1	15
C	39	46	59	53	46	39	35	28	11	14	27	31

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

For CVP storage, reservoir storage is lowest in Dry and Critical WYs during the months of May through September when agricultural deliveries are highest. These decreases in reservoir storage account for a maximum decrease of 13 percent during July of Dry WYs and 10 percent during July of Critical WYs compared to the No Action Alternative. SWP storage in San Luis Reservoir increases significantly under Alternative 2. As a result, CVP decreases in storage are counterbalanced. Overall, total San Luis Reservoir storage is expected to decrease by up to five percent during the summer months of dry years.

Any decreases in San Luis Reservoir storage are a concern due to high levels of algae in the reservoir. San Luis Reservoir is shallow and experiences high algal growth during warm summer months. This algal growth affects M&I users because intakes are not low enough to avoid intake of contaminated waters. Any decreases in storage in the reservoir would accelerate this process. During Dry WYs SWP storage does not increase enough to balance CVP decreases, and water quality deterioration may be a concern.

5.2.4 Alternative 3: Full M&I Allocation Preference

5.2.4.1 Shasta and Trinity River Divisions

Use of the full M&I allocation preference under Alternative 3 could cause changes in river flows resulting in water quality impacts in the Shasta and Trinity River Divisions. As noted above, reservoir storage amounts would not be affected by Alternative 3. Similarly, river flows in the Sacramento River downstream of these reservoirs would not be affected. Changes in flows are provided in Table 5-25. These changes in flow would account for a maximum change in flow of a maximum of three percent. Changes are likely attributable to changes in CVP allocations throughout the year and not to changes in allocations from Alternative 3.

Table 5-25. Changes in Sacramento River flows below Keswick between Alternative 3 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	10	-50	8	-42	-15	20	-20	-22	-23	-4	-20	30
AN	118	85	7	-14	39	-11	-1	-10	3	-1	16	89
BN	-31	25	3	4	3	-14	-39	-19	-9	88	-11	6
D	-55	113	-31	-7	-1	1	-25	-67	1	137	-65	-47
C	-120	-30	-55	38	-51	36	-10	18	21	-4	237	-77

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

5.2.4.2 Sacramento River Region

Use of the full M&I allocation preference under Alternative 3 could cause changes in river flows in the Sacramento River Region resulting in water quality impacts. Flows in the Sacramento River Region change only minimally under Alternative 3. Tables 5-26 and 5-27 provide changes in Sacramento River flows between the No Action Alternative and Alternative 3 at Wilkins Slough and Hood, respectively.

Although there are small changes in river flows in the Sacramento River region, these changes are likely attributable to additional CVP allocations and minimum flow requirements; therefore, water quality is not affected in the Sacramento Region under Alternative 3.

Table 5-26. Changes in Sacramento River flows at Wilkins Slough between Alternative 3 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	11	5	8	3	3	8	-17	-17	-18	0	-16	35
AN	123	93	11	0	6	3	5	-5	10	6	23	92
BN	-28	31	11	8	4	0	-37	-17	-7	78	-16	-9
D	-55	120	-25	-1	4	2	-28	-62	21	128	-68	-50
C	-115	-23	-55	41	-54	46	-2	28	38	10	258	-93

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 5-27. Changes in Sacramento River flows at Hood between Alternative 3 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	14	-45	21	-14	-14	11	-17	-14	-17	-9	1	12
AN	64	82	-34	-27	18	-60	11	5	1	3	16	108
BN	-77	19	-34	54	-62	-24	-94	-77	26	58	2	-32
D	31	143	-30	-3	-28	-46	-54	-83	24	188	-219	-329
C	-77	3	33	49	-82	-24	-50	-35	2	-48	24	-99

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

5.2.4.3 American River Region

Use of the full M&I allocation preference under Alternative 3 could cause changes in reservoir storage in the American River Region resulting in water quality impacts. Under Alternative 3, M&I water service contractors would receive 100 percent allocations during water shortage conditions. Since Folsom Lake is utilized primarily for M&I demands, Alternative 3 would result in decreases in total reservoir storage during dry years compared to the No Action Alternative. Changes in total storage can be viewed in Table 5-28.

Table 5-28. Changes in Folsom Lake storage between Alternative 3 and the No Action Alternative (in TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-1	-1	0	0	0	0	0	0	0	0	-1	0
AN	-2	-2	0	0	0	0	0	0	0	0	0	-2
BN	1	0	0	-4	-3	-3	-1	0	0	-2	-4	-1
D	1	0	0	-1	0	1	0	-1	0	-6	3	3
C	-7	-10	-11	-13	-12	-8	-8	-6	-6	-9	-7	-9

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

These changes in reservoir storage would account for a maximum decrease of one percent of total reservoir storage. This one percent decrease would occur only during critical WYs. The only constituent of concern in Folsom Lake is mercury. Contamination is the result of legacy pollutants from historic mining; therefore, changes in water allocations under Alternative 3 would not change the amount of mercury within the reservoir. Slight decreases in storage would not be enough to affect the water quality of the reservoir.

Use of the full M&I allocation preference under Alternative 3 could cause changes in river flows in the American River Region resulting in water quality impacts. Increased M&I deliveries during dry years would cause decreases in American River flows, especially during the month of August of dry and critical WYs when agricultural demands are highest and both M&I and agricultural demands must be met. Changes in flows on the American River below Nimbus and at H Street can be viewed in Table 5-29 and 5-30, respectively.

Table 5-29. Changes in American River flows below Nimbus between Alternative 3 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	3	-4	-18	-8	-7	-2	-5	-1	-2	-1	13	-28
AN	-54	3	-43	-13	-17	-12	-4	-2	-11	-1	-6	15
BN	-46	0	-5	43	-39	-19	-66	-54	-44	-10	-4	-74
D	-2	13	-3	0	-33	-56	-30	-32	-75	23	-199	-64
C	30	31	2	4	-31	-78	-59	-74	-51	3	-75	19

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 5-30. Changes in American River flows at H Street between Alternative 3 and the No Action Alternative (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	3	-4	-18	-8	-7	-2	-4	0	-2	-1	13	-28
AN	-53	4	-43	-12	-15	-8	2	3	-10	-1	-6	15
BN	-46	1	-5	43	-39	-19	-65	-53	-43	-10	-4	-74
D	-2	13	-3	0	-33	-56	-29	-31	-75	24	-199	-61
C	31	31	2	4	-29	-75	-55	-73	-49	4	-75	28

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Decreases in American River flows would be highest at H Street in dry WYs during August. This decrease in flow of approximately 199 cfs accounts for a 14 percent decrease in flow rate from the No Action Alternative. Decreases throughout the remainder of the year and in other WYs would be significantly less. Mercury is the only constituent of concern in the American River. The source of this contamination is listed as resource extraction, and it is likely affected by contaminated inputs from Folsom Lake. Contamination is the result of historic mining activities and would not be affected by Alternative 3. Changes in outflows from Folsom Lake into the American River are minor. Therefore, changes in water quality of the American River are not expected.

5.2.4.4 Delta Division

Use of the full M&I allocation preference under Alternative 3 could change Delta salinity and bromide concentrations resulting in water quality impacts. X2 calculations were completed to determine the movement of salinity throughout the Delta. Under this analysis, X2 generally moves eastward under Alternative 3, likely due to the subtle decrease in Sacramento River inflow in comparison with the No Action Alternative due to increased M&I allocations. These changes are minimal, however, as shown in Table 5-31.

Table 5-31. Percent changes in Delta X2 between Alternative 3 and the No Action Alternative

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.00	0.05	0.00	0.00	0.00	-0.01	0.02	0.03	0.04	0.01	0.00	0.00
AN	-0.03	-0.07	-0.05	0.00	0.00	0.04	0.01	0.00	0.02	0.02	-0.01	-0.03
BN	0.02	0.04	0.05	-0.03	0.00	0.01	0.07	0.14	-0.05	-0.03	-0.07	-0.04
D	-0.02	0.00	-0.19	-0.18	0.02	0.07	0.10	0.20	0.18	-0.15	0.05	0.21
C	0.00	-0.01	-0.02	-0.02	0.09	-0.01	0.08	0.20	0.21	0.02	0.06	0.05

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

DSM2 modeling results and analysis for the Delta Division indicate that the largest percent change in SWP and CVP export EC under Alternative 3 would occur in July through September in Critical WYs. These increases in EC are expected to range from 1.7 to 2.6 percent for SWP exports, and 0.5 to 1.1 percent for CVP exports. The slightly increased EC is likely to be the result of an increase in river flows during dry and critical years. Table 5-32 displays changes in EC at CVP export locations between the No Action Alternative and Alternative 3. Table 5-33 gives the same information at SWP export locations.

Table 5-32. Percent changes in EC between Alternative 3 and the No Action Alternative at CVP export locations

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.3	0.2	-0.1	-0.4	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	-0.1	-0.2	0.1	0.0	-0.4	-0.1	-0.1	-1.0	0.3	-0.1	0.2	-0.8
D	0.2	-0.2	0.6	-0.4	0.2	-0.1	-0.1	0.0	-0.1	0.1	0.6	-0.2
C	0.3	-0.1	-0.2	0.1	0.5	0.6	-0.2	-0.2	-0.6	0.5	0.4	1.1

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Table 5-33. Percent changes in EC between Alternative 3 and the No Action Alternative at SWP export locations

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.3	0.5	-0.1	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0
BN	-0.3	-0.1	0.1	0.0	-0.1	-0.3	-0.2	-0.7	-0.5	0.1	0.0	-1.0
D	0.3	-0.2	0.7	-0.7	-0.4	-0.2	0.0	0.1	-0.1	0.2	-0.7	-0.4
C	0.4	0.2	-0.3	0.3	0.3	0.7	1.1	0.4	0.0	2.3	2.6	1.7

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

DSM2 modeling results for bromide indicate an overall average decrease in bromide concentrations for all year types of 0.4 percent for SWP and 0.5 percent for CVP with the largest percentage decreases occurring in Dry and Critical WYs. Table 5-34 displays the bromide percent increase for SWP and CVP for all year types. Bromide concentrations are likely lower under Alternative 3 due to a decrease in agricultural return flows due to the decrease in agricultural allocations, especially in the South of Delta region including the San Joaquin River.

Table 5-34. Average annual change in bromide load for SWP and CVP between Alternative 3 and the No Action Alternative

Sac Yr Type	SWP % Diff	CVP % Diff
W	0.1	0.1
AN	0.9	0.1
BN	-1.0	0.5
D	-1.0	-2.2
C	-0.9	-0.5

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

5.2.4.5 West San Joaquin Division

Use of the full M&I allocation preference under Alternative 3 could change South of Delta reservoir storage resulting in water quality impacts. Under Alternative 3, CVP deliveries to agricultural water service contractors would be reduced as much as necessary to maintain 100 percent M&I water service contractor allocations as long as possible. Since M&I deliveries do not show the extreme peaks in seasonality that are apparent in agricultural deliveries, Alternative 3 would lead to a general decrease in CVP San Luis Reservoir storage throughout the year during Wet, Above Normal, and Below Normal WYs. During Dry and Critical WYs, agricultural deliveries would be significantly cut, while M&I deliveries would continue at 100 percent of their allocation. This cut in agricultural deliveries would cause a decline in irrigable lands, and thus an increase in available CVP storage especially during summer months. SWP storage would be minimally affected. Table 5-35 provides total changes in storage for San Luis Reservoir.

Table 5-35. Total Changes in San Luis Reservoir storage between Alternative 3 and the No Action Alternative (in TAF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-1	-1	-2	-1	1	0	0	0	0	-1	-1	-2
AN	-1	-3	-5	6	10	9	7	4	-2	-2	-2	2
BN	-20	-20	-24	-21	-9	-5	-7	-8	-13	-9	-14	-18
D	-4	4	-17	-16	-16	-12	-10	-7	2	15	8	-9
C	2	-1	-4	2	7	6	10	15	19	21	32	23

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

San Luis Reservoir storage is lowest in Below Normal WYs when M&I deliveries are highest. These decreases in storage would be year round and could result in up to a four percent decrease in total storage during some months. Since San Luis Reservoir is shallow and has significant issues with algal blooms during the hot summer months, the summer would be especially crucial in the degradation of water quality in the reservoir.

5.2.5 Alternative 4: Updated M&I WSP

Implementation of the Updated M&I WSP would not change water quality. CVP deliveries under Alternative 4 are similar to those under the No Action Alternative. Allocation methodology for both agricultural and M&I water service contractors would be the same as under the No Action Alternative; therefore, water quality effects generated by Alternative 4 would be identical to the water quality effects of the No Action Alternative.

5.2.6 Alternative 5: M&I Contractor Suggested WSP

Implementation of the M&I Contractor Suggested WSP under Alternative 5 would not change water quality. CVP deliveries under Alternative 5 are similar to those under the No Action Alternative, with the exception that M&I contractors would receive a higher level deliveries during water shortages. This alternative would result in less than 0.2 percent changes in reservoir storage and river flows; therefore, water quality effects generated by Alternative 5 would be very close to the water quality effects of the No Action Alternative.

5.3 Mitigation Measures

Mitigation Measures are not identified for water quality.

5.4 Unavoidable Adverse Impacts

Under Alternative 2, water quality in the Delta region would be slightly degraded. Salinity and Bromide concentrations would increase slightly, especially during dry and critical WYs. Additionally, storage in San Luis Reservoir during summer months of Dry WYs would decrease by up to five percent which could degrade water quality and impact water users due to increased algae contamination. Under Alternative 3, water quality in San Luis Reservoir may experience minor degradation year round during Below Normal WYs due to decreases in storage of up to four percent.

5.5 Cumulative Effects

The timeline for the water quality cumulative effects analysis extends from 2010 through 2030, a 20-year period. The relevant geographic study area for the cumulative effects analysis is the same area of analysis as shown in Figure 5-1. The following section analyzes the cumulative effects using both the project and the projection methods, which are further described in Chapter 20, Cumulative Effects. Chapter 20 describes the projects included in the cumulative condition and growth and development trends in the area of analysis.

The cumulative analysis for water quality considers projects and conditions that could affect water quality in surface water bodies within the area of analysis.

5.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Changes in CVP water allocations under the Equal Agricultural and M&I Allocation alternative, in combination with other cumulative projects, could degrade existing water quality.

Under Alternative 2, CVP deliveries to agricultural water service contractors would increase and CVP deliveries to M&I water service contractors would decrease. As a result, the most significant North of Delta impacts are increase in reservoir storage and river flows due to the reduction in M&I allocations. South of Delta, where agricultural demands are greatest, reservoir storage would decrease significantly. Alternative 2 also leads to a reduction in Delta outflows and degradation of Delta water quality in the form of increased salinity. Proposed modifications to CVP water allocations for agricultural and M&I water service contractors in combination with other cumulative projects could affect surface water quality through additional changes in reservoir storage and/or river flows.

Existing and foreseeable water acquisition programs with potential to affect reservoir storage and river flows, in addition to the impacts of Alternative 2, are described in Chapter 20. These projects include the Bay Delta Conservation Plan (BDCP), the Shasta Lake Water Resources Investigation, Upper San Joaquin Storage Investigation, South Delta Improvements Program, San Luis Reservoir Low Point Improvement Project (SLLPIP), In-Delta Storage Program, North-of-the-Delta Offstream Storage Investigation, Long Term Water Transfers, the San Joaquin River Restoration Program, and the Franks Tract Project have the potential to impact water quality based on reservoir storage and river flows.

The BDCP alternatives 1-5 would result in reductions in Delta outflows, but alternatives 6-9 could potentially result in increased Delta outflows. Decreased delta outflows may result in increased seawater intrusion into the west Delta leading to water quality degradation due to increased salinity and EC. The Los Vaqueros Reservoir Expansion Project and the Shasta Lake Water Resources Investigation both focus on increased reservoir water supply, and are not expected to negatively impact water quality in the region. The South Delta Improvements Program, In-Delta Storage Program, North of Delta Offstream Storage Program, and Frank Tract Project are all aimed at enhancing Delta water quality, with the Franks Tract Program specifically aimed at reducing seawater intrusion into the west Delta. The Upper San Joaquin Storage Investigation and San Joaquin River Restoration Program are aimed at enhancing water quality on the San Joaquin River, which in turn may lead to Delta water quality enhancements including decreased salinity. The SLLPIP is aimed at maintenance of water quality in San Luis Reservoir, which could reduce the water quality impacts associated with a decrease in reservoir storage associated with Alternatives 2 and 3. Long-Term Water Transfers could negatively affect water quality South of Delta due to increased late-summer exports from the Delta.

The cumulative projects described above, with the exception of BDCP Alternatives 1-5 and Long Term Water Transfers, are likely to enhance water quality within the area of analysis. Therefore, implementation of Alternative 2 in combination with these cumulative projects would not generate an adverse cumulative effect on water supply. Implementation of Alternative 2 in combination with the five BDCP Alternatives described above (1-5) and the Long-Term Water Transfers would generate an adverse cumulative effect on water quality for by potentially increasing Delta salinity concentrations and increasing the likelihood of seawater intrusion west of Delta.

5.5.2 Alternative 3: Full M&I Allocation Preference

Changes in CVP water allocations under the Full M&I Allocation Preference alternative, in combination with other cumulative projects, could degrade existing water quality.

Alternative 3 would generate a decrease in storage and flows in most reservoirs and water bodies within the area of analysis. This decrease in flows would lead to a decrease in Delta outflows and an increase of Delta salinity concentrations when compared to the No Action Alternative. Although changes in Delta water quality would not be as pronounced as those expected under Alternative 2, there would still be negative impacts associated with the implementation of Alternative 3.

Based on the similarities in impacts of Alternative 2 and Alternative 3, cumulative impacts would be similar to those listed above under Alternative 2.

5.5.3 Alternative 4: Updated M&I WSP

Changes in CVP water allocations under the Updated M&I WSP alternative, in combination with other cumulative projects, could degrade existing water quality.

CVP deliveries under Alternative 4 are similar to those under the No Action Alternative. There are no anticipated changes to water quality based on increases in reservoir storage or river flows; therefore, there would be no cumulative impacts under Alternative 4.

5.5.4 Alternative 5: M&I Contractor Suggested WSP

Changes in CVP water allocations under the M&I Contractor Suggested WSP alternative, in combination with other cumulative projects, could degrade existing water quality.

CVP deliveries under Alternative 5 are expected to change only slightly from the No Action Alternative. Changes in reservoir storage and river flows under Alternative 5 are minimal and are not anticipated to impact water quality within the area of analysis. Therefore, there are no cumulative impacts under Alternative 5.

5.6 References

CALFED. 2000. *Final Programmatic Environmental Impact Statement/Environmental Impact Report for CALFED Bay-Delta Program*. July 2000. Accessed on: 02/16/2005. Available: http://calwater.ca.gov/CALFEDDocuments/Final_EIS_EIR.shtml.

______. 2008. *CALFED Water Quality Program Stage 1 Final Assessment*. Accessed on: 01/24/2013. Available: http://www.calwater.ca.gov/content/Documents/FAR_Memo_1-4-08.pdf.

Central Valley RWQCB. 1998. *Fourth Edition of the Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins.* Amended 2010. Accessed on: 01/22/2013. Available: http://www.swrcb.ca.gov/centralvalley/water_issues/basin_plans/sacsjr.pdf.

DWR. 2001. *Sanitary Survey Update Report 2001*. Department of Water Resources, Division of Planning and Local Assistance, and Municipal Water Quality Investigations Program. Available: http://wq.water.ca.gov/mwq/second/publications/sanitary01.htm.

______. 2012. *California State Water Project: Watershed Sanitary Survey, 2011 Update*. Accessed on: 11/05/14. Available: http://www.water.ca.gov/waterquality/drinkingwater/docs/Printerscopycombin.pdf. June 2012.

______. 2013. *California Data Exchange Center (CDEC) Water Data Library*. Accessed on: 01/23/2013. Available: http://www.water.ca.gov/waterdatalibrary/.

______. 2014. *Water Quality Report*. Sacramento R BL Red Bluff Dam, 2006-2009. Accessed on: 11/03/2014. Available at: http://www.water.ca.gov/waterdatalibrary/waterquality/station_county/gst_report.cfm.

ENTRIX, Inc. 1996. *Interim South Delta Program (ISDP) Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS),* Volume I. July 1996.

Larry Walker Associates. 1999. *1998/99 Annual Monitoring Report and Comprehensive Evaluation, 1990-1999.*

LSA Associates Inc. 2003. *Environmental Conditions, Water Quality, Folsom Lake State Recreation Area.* April 2003. Accessed on: 09/07/2014. Available: http://www.parks.ca.gov/pages/500/files/Water_Quality.pdf.

Office of Environmental Health Hazard Assessment (OEHHA). 2014. *Safe Eating Guidelines for Fish from Trinity Lake and the East Fork Trinity River Based on Water Quality*. Updated 03/18/2009. Accessed on: 09/07/2014. Available: http://oehha.ca.gov/fish/so_cal/TrinRiverF2.html.

Reclamation. n.d. *San Luis Unit, West San Joaquin Division, Central Valley Project*. Accessed on: 01/21/2013. Available: http://www.usbr.gov/projects//ImageServer?imgName=Doc_1303396586494.pdf.

______. 2012a. *Shasta/Trinity River Division Project, General Description and Plan, Facility Descriptions*. Accessed on: 11/17/2012. Available: http://www.usbr.gov/projects/Project.jsp?proj_Name=Shasta/Trinity%20River%20Division%20Project.

______. 2012b. *Sacramento Canals Unit Project, General Description and Plan, Facility Descriptions*. Accessed on: 01/10/2013. Available: http://www.usbr.gov/projects/Project.jsp?proj_Name=Sacramento%20Canals%20Unit%20Project.

______. 2012c. *Central Valley Project*. Accessed on: 01/10/2013. Available: http://www.usbr.gov/projects/Project.jsp?proj_Name=Central+Valley+Project.

______. 2012d. *Auburn-Folsom South Unit Project*. Accessed on: 01/11/2013. Available: http://www.usbr.gov/projects/Project.jsp?proj_Name=Auburn-Folsom%20South%20Unit%20Project.

______. 2012e. *San Luis Unit Project*. Accessed on: 01/11/2013. Available: http://www.usbr.gov/projects/Project.jsp?proj_Name=San%20Luis%20Unit%20Project&pageType=ProjectDataPage.

______. 2013. *Water Quality Technical Report. Shasta Lake Water Resources Investigation, California*. June 2013. Accessed on: 10/21/2014. Available: http://www.usbr.gov/mp/nepa/documentShow.cfm?Doc_ID=14127.

SWRCB. 1995. *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary*. May 1995. Accessed on: 05/02/2005. Available: http://www.waterrights.ca.gov/baydelta/1995WQCPB.pdf.

______. 1997. *Draft Environmental Impact Report for Implementation of the 1995 Bay/Delta Water Quality Control Plan*. November 1997.

______. 1999. *SWRCB Bay Delta Program, Water Right Decision 1641 (Revised).* Accessed on: 05/02/2005. Available: http://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/decision_1641/index.shtml.

______. 2010. *2010 Integrated Report (Clean Water Act Section 303(d) List/305(b) Report).* Accessed on: 12/07/2012. Available: http://www.swrcb.ca.gov/water_issues/programs/tmdl/integrated2010.shtml.

USEPA. 2002a. *Major Environmental Laws, Clean Water Act*. Accessed on: 06/24/2003. Available: http://www.epa.gov/r5water/cwa.htm.

______. 2002b. *Overview of the TMDL Process.* Accessed on: 06/24/2003. Available: http://yosemite.epa.gov/R10/water.nsf/ac5dc0447a281f4e882569ed0073521f/2ac95839fe692ab6882569f100610e6a?OpenDocument.

USGS. 2002. *Water Quality Assessment of the Sacramento River Basin, California: Water – Quality, Sediment and Tissue Chemistry, and Biological Data, 1995-1998:* Accessed on: 02/16/2005. Available: http://ca.water.usgs.gov/sac_nawqa/waterindex.html.