Chapter 13 Socioeconomics

This chapter presents the socioeconomic environment within the area of analysis and discusses potential effects on regional economics from the proposed alternatives.

13.1 Affected Environment

This section describes the area of analysis and affected environment for socioeconomics.

13.1.1 Area of Analysis

The area of analysis for socioeconomics includes counties where Central Valley Project (CVP) water service contractors affected by the CVP Municipal and Industrial Water Shortage Policy (M&I WSP) are located. See Chapter 1, Introduction, for a list of applicable CVP contractors. These CVP water service contractors have service areas north of the Sacramento-San Joaquin River Delta (Delta) throughout the Sacramento Valley along both the Sacramento and American rivers, in areas of the San Joaquin Valley ranging from the Delta south to Kern County, and in the Bay Area region. The socioeconomic area of analysis is divided into the following regions, which are made up of counties grouped together based on whether the major water use is agricultural or M&I.

- Sacramento Valley Region – most CVP water use is agricultural
- American River Region – most CVP water use is M&I
- San Joaquin Valley Region – most CVP water use is agricultural
- Bay Area Region – most CVP water use is M&I

Figure 13-1 shows the socioeconomic area of analysis. In many of the counties, CVP service areas are a small fraction of the county area and CVP water supplies are a small fraction of all water supplies. In some counties, CVP service areas and water supplies are important shares of the totals. Chapter 4, Surface Water, provides data on water supplies for the CVP contractors.

Figure 13-1. Socioeconomic Area of Analysis

13.1.2 Regulatory Setting

Under the National Environmental Policy Act (NEPA), economic or social effects must be discussed if they are inter-related to the natural or physical environmental effects of a project. NEPA states the following with regard to analysis of economic effects (Title 40, Code of Federal Regulations, Section 1508.14):

> *"…economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment."*

Since economic effects of the project are related to physical environmental effects, a NEPA economic analysis is required.

Local governments have adopted policies and ordinances to protect local economies. County and city general plans in the area of analysis have policies for economic development, including the promoting the agricultural economy.

13.1.3 Existing Conditions

This section presents the regional economic conditions within the socioeconomics area of analysis. The section first presents the 2011 economy by region as defined by the area of analysis, and then summarizes the 2011 economy of each individual county in the region. Chapter 12, Agricultural Resources, presents data on agricultural production and irrigated acreage in each county.

Regional economic data is shown for output, employment, labor income, and value added. Output represents the dollar value of industry production. Employment is measured in number of jobs. Income is the dollar value of total payroll for each industry plus income received by self-employed individuals. Total value added is the difference between an industry's total output and cost of its intermediate inputs. It consists of compensation of employees, taxes on production and imports less subsidies and gross operating surplus. Chapter 14 presents demographic data for the counties in the area of analysis.

13.1.3.1 Sacramento Valley Region

The CVP water service contractors within the Sacramento Valley Region have service areas within Colusa, Glenn, Shasta, Tehama, and Yolo counties. Table 13-1 presents the regional economy for this entire region, followed by a discussion of the regional economy in each individual county.

With the exception of Yolo County, the counties in the Sacramento Valley Region have economies that are largely dependent on agricultural production for output, employment and labor income. Yolo County also has an important agricultural economy, but is supported by more urban-based industries as it is adjacent to the Sacramento metropolitan area and contains the University of California at Davis.

In 2011, the total population in the 5-county region was 493,106 (IMPLAN Group, LLC 2012).

CVP contractors in this region deliver both irrigation and M&I water supplies. Most CVP water provided in the region is used for irrigation for agricultural production.

In 2011, services provided the most jobs (102,981 jobs) in the region, followed by government (54,474 jobs), trade (32,544 jobs) and agriculture (19,873 jobs). Services also had the highest output ($12.4 billion) of all industries in the region, followed by manufacturing ($5.1 billion), government ($4.8 billion), and trade ($3.3 billion).

Table 13-1. Sacramento Valley Region 2011 Regional Economy Summary (Colusa, Glenn, Shasta, Tehama, and Yolo Counties)

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	19,873	$2,749.8	$821.8	$1,224.0
Mining	1,310	$303.9	$37.1	$125.8
Construction	12,487	$1,437.8	$673.2	$788.8
Manufacturing	11,920	$5,089.3	$708.8	$1,159.3
Transportation, Information, Public Utilities (TIPU)	14,603	$2,513.9	$757.2	$1,221.4
Trade	32,544	$3,286.1	$1,350.5	$2,391.8
Service	102,981	$12,372.4	$3,744.5	$7,637.8
Government	54,474	$4,768.8	$3,970.6	$4,507.6
Total	250,192	$32,521.8	$12,063.7	$19,056.3

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Colusa County Colusa County has a highly agricultural economy. Colusa and Williams are the only incorporated cities in the county (California State Association of Counties [CSAC] 2014).

In 2011, the total population in Colusa County was 21,549 (IMPLAN Group, LLC 2012). In 2011, agriculture provided the most jobs (3,810 jobs) in Colusa County, followed by services (2,722 jobs), and government (2,083 jobs). Specifically, the grain farming sector provided the most jobs, followed by state and local government, and tree nut farming. Manufacturing had the highest output ($854.9 million) in the county, followed by agriculture ($642.3 million), and services ($321.6 million). Specifically, flour milling and malt manufacturing had the highest output of all sectors in the county, followed by tree nut farming and fruit and vegetable canning (IMPLAN Group, LLC 2012). Table 13-2 summarizes the regional economy in Colusa County, in terms of employment, output, labor income, and total value added.

Table 13-2. Colusa County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	3,810	$642.3	$179.1	$296.0
Mining	5	$1.4	$0.2	$0.4
Construction	251	$31.9	$16.6	$18.9
Manufacturing	1,485	$854.9	$90.0	$152.4
TIPU	273	$76.5	$17.5	$30.6
Trade	1,495	$186.3	$73.4	$135.6
Service	2,722	$321.6	$86.5	$194.5
Government	2,083	$160.3	$120.4	$144.1
Total	12,124	$2,275.2	$583.7	$972.5

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Glenn County Glenn County has a highly agricultural economy. Orland and Willows are the only incorporated cities in the county (CSAC 2014).

In 2011, the total population in Glenn County was 28,128 (IMPLAN Group, LLC 2012). In 2011, agriculture provided the most jobs (3,924 jobs) in Glenn County, followed by services (3,730 jobs), and government (2,015 jobs). Agriculture had the highest output ($703.7 million) in the county, followed by services ($445.2 million), and manufacturing ($278.1 million). Specifically, tree nut farming and grain farming had the highest employment and output of all sectors in the county (IMPLAN Group, LLC 2012). Table 13-3 summarizes the regional economy in Glenn County, in terms of employment, output, labor income, and total value added.

Table 13-3. Glenn County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	3,924	$703.7	$148.0	$307.9
Mining	43	$13.2	$3.8	$7.1
Construction	695	$70.3	$27.8	$34.2
Manufacturing	616	$278.1	$34.7	$57.0
TIPU	837	$170.6	$38.4	$64.4
Trade	1,054	$109.3	$45.3	$79.4
Service	3,730	$445.2	$93.2	$279.7
Government	2,015	$185.1	$146.2	$170.5
Total	12,914	$1,975.5	$537.4	$1,000.2

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Shasta County Shasta County's economy is based on agriculture and travel. Incorporated cities are Anderson, Redding, and Shasta Lake (CSAC 2014).

In 2011, the total population in Shasta County was 177,774 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (44,448 jobs) in Shasta County, followed by trade (12,810 jobs), and government (12,225 jobs). Specifically, state and local government and food services and drinking places had the highest employment of all sectors in the county. Services had the highest output ($5.1 billion) in the county, followed by trade ($1.1 billion), and government ($1.0 billion). Specifically, rental income had the highest output of all sectors in the county (IMPLAN Group, LLC 2012). Table 13-4 summarizes the regional economy in Shasta County, in terms of employment, output, labor income, and total value added.

Table 13-4. Shasta County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	2,465	$218.3	$76.1	$86.1
Mining	753	$133.9	$16.0	$58.0
Construction	5,306	$597.2	$272.3	$321.4
Manufacturing	2,524	$733.0	$143.8	$202.8
TIPU	3,786	$925.0	$236.4	$405.7
Trade	12,810	$1,129.9	$458.9	$824.8
Service	44,448	$5,074.1	$1,598.3	$3,170.5
Government	12,225	$1,033.3	$827.4	$966.4
Total	84,317	$9,844.7	$3,629.2	$6,035.7

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Tehama County Tehama County's economy is based on agriculture, including ranching. Corning, Red Bluff, and Tehama are the only incorporated cities in the county (CSAC 2014).

In 2011, the total population in Tehama County was 63,601 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (8,946 jobs) in Tehama County, followed by government (3,853 jobs), and agriculture (3,290 jobs). Services had the highest output ($1,056.5 million) in the county, followed by manufacturing ($495.0 million), and agriculture ($367.1 million). Specifically, rental income had the highest output of all sectors in the county, followed by fruit and vegetable canning and wood work manufacturing (IMPLAN Group, LLC 2012). Table 13-5 summarizes the regional economy in Tehama County, in terms of employment, output, labor income, and total value added.

Table 13-5. Tehama County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	3,290	$367.1	$106.0	$164.7
Mining	169	$55.3	$3.2	$14.5
Construction	1,284	$128.2	$49.6	$61.5
Manufacturing	1,430	$495.0	$86.7	$117.7
TIPU	1,569	$280.3	$80.1	$126.0
Trade	2,573	$239.7	$92.0	$173.4
Service	8,946	$1,056.5	$272.6	$637.0
Government	3,853	$303.2	$228.1	$273.2
Total	23,114	$2,925.3	$918.3	$1,568.0

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Yolo County Yolo County has an increasingly growing urban economy, relative to its agricultural economy. Yolo County urban areas are tied to education facilities, the I-80 corridor, and the Sacramento urban economy. Incorporated cities in Yolo County include Davis, West Sacramento, Winters, and Woodland (CSAC 2014).

In 2011, the total population in Yolo County was 202,054 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (43,135 jobs) in Yolo County, followed by government (34,297 jobs), and trade (14,613 jobs). Services had the highest output ($5,475.0 million) in the county, followed by government ($3,087.0 million), and manufacturing ($2,728.3 million). Specifically, state and local government education had the highest employment and output of all sectors in the county (IMPLAN Group, LLC 2012). Table 13-6 summarizes the regional economy in Yolo County, in terms of employment, output, labor income, and total value added.

Table 13-6. Yolo County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	6,385	$818.2	$312.6	$369.3
Mining	340	$100.2	$14.0	$45.7
Construction	4,951	$610.1	$307.0	$352.8
Manufacturing	5,865	$2,728.3	$353.5	$629.4
TIPU	8,138	$1,061.4	$384.9	$594.6
Trade	14,613	$1,620.9	$680.8	$1,178.6
Service	43,135	$5,475.0	$1,693.9	$3,356.1
Government	34,297	$3,087.0	$2,648.5	$2,953.3
Total	117,724	$15,501.1	$6,395.2	$9,479.8

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

13.1.3.2 American River Region

The CVP water service contractors within the American River Region have service areas within El Dorado, Placer, and Sacramento counties. Table 13-7 presents the regional economy for this entire region, followed by a discussion of the regional economy in each individual county.

The counties in the American River Region are largely represented by the Sacramento metropolitan area, which has large government, services, and manufacturing sectors. In 2011, the total population in the 3-county region was 1,974,181 (IMPLAN Group, LLC 2012). Most CVP contractors in this region provide M&I water service with the exception of one M&I and agriculture water service contract.

In 2011, services provided the most jobs (556,308 jobs) in the region, followed by government (216,659 jobs), trade (128,508 jobs) and construction (55,875 jobs). Services also had the highest output ($76.9 billion) of all industries in the region, followed by government ($21.2 billion), manufacturing ($15.9 billion), and trade ($12.1 billion).

Table 13-7. American River Region 2011 Regional Economy Summary (El Dorado, Placer, and Sacramento Counties)

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	6,432	$1,112.3	$312.3	$485.2
Mining	815	$276.8	$18.4	$107.5
Construction	55,875	$7,127.4	$3,707.5	$4,224.3
Manufacturing	29,538	$15,897.7	$2,555.0	$4,941.5
TIPU	18,857	$4,720.9	$1,476.2	$2,327.3
Trade	128,508	$12,092.2	$5,286.1	$8,919.1
Service	556,308	$76,992.0	$26,572.6	$49,496.2
Government	216,659	$21,189.7	$17,910.4	$20,414.5
Total	1,012,992	$139,409.0	$57,838.5	$90,915.6

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

El Dorado County The only incorporated cities in El Dorado County are Placerville and South Lake Tahoe (CSAC 2014). A relatively large share of the population resides in the unincorporated communities of Cameron Park and El Dorado Hills, suburbs of Sacramento, in the western portion of the County.

In 2011, the total population in El Dorado County was 180,938 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (59,539 jobs) in El Dorado County, followed by government (10,707 jobs), and trade (9,564 jobs). Services had the highest output ($7.1 billion) in the county, followed by government ($952.9 million), and construction ($860.8 million). Specifically, real estate establishment and rental income generated the highest output in the county of all the sectors, followed by insurance carriers (IMPLAN Group, LLC 2012).

Table 13-8 summarizes the regional economy in El Dorado County, in terms of employment, output, labor income, and total value added.

Table 13-8. El Dorado County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	1,302	$113.9	$33.4	$48.3
Mining	194	$75.5	$3.4	$24.1
Construction	7,796	$860.8	$383.4	$455.6
Manufacturing	1,714	$515.3	$102.4	$164.6
TIPU	1,592	$268.5	$55.3	$137.7
Trade	9,564	$839.9	$328.6	$615.9
Service	59,539	$7,066.5	$1,903.5	$4,442.8
Government	10,707	$952.9	$753.9	$881.0
Total	92,408	$10,693.3	$3,563.9	$6,770.0

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Placer County The incorporated cities in this county are Auburn, Colfax, Lincoln, Loomis, Rocklin, and Roseville (CSAC 2014). Most of the population and economy is in the western portion of the county in the Sacramento Valley.

In 2011, the total population in Placer County was 357,138 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (104,943 jobs) in Placer County, followed by trade (32,379 jobs), government (17,230 jobs), and construction (12,972 jobs). Services had the highest output ($14.3 billion) in the county, followed by manufacturing ($3.7 billion), and trade ($3.0 billion). Specifically, real estate establishment and rental income generated the highest output in the county of all the sectors, followed by monetary authorities (IMPLAN Group, LLC 2012). Table 13-9 summarizes the regional economy in Placer County, in terms of employment, output, labor income, and total value added.

Table 13-9. Placer County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	1,661	$166.8	$30.7	$54.8
Mining	297	$62.7	$2.1	$16.1
Construction	12,972	$1,856.4	$1,063.3	$1,183.0
Manufacturing	7,533	$3,741.1	$683.7	$1,275.1
TIPU	3,117	$1,287.9	$343.9	$583.3
Trade	32,379	$3,047.9	$1,342.5	$2,273.3
Service	104,943	$14,303.9	$4,740.8	$9,137.6
Government	17,230	$1,496.6	$1,207.4	$1,400.8
Total	180,132	$25,963.3	$9,414.4	$15,924.0

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Sacramento County The incorporated cities in this county include Citrus Heights, Elk Grove, Folsom, Rancho Cordova, and Sacramento (CSAC 2014). Sacramento, as the State capital of California, provides much economic base.

In 2011, services provided the most jobs (391,826 jobs) in Sacramento County, followed by government (188,723 jobs), and trade (86,564 jobs). Services had the highest output ($55.6 billion) in the county, followed by government ($18.7 billion), and manufacturing ($11.6 billion). Specifically, state and local government had the highest employment and output in the county (IMPLAN Group, LLC 2012). Table 13-10 summarizes the regional economy in Sacramento County, in terms of employment, output, labor income, and total value added.

Table 13-10. Sacramento County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	3,468	$831.7	$248.3	$382.1
Mining	325	$138.7	$12.9	$67.3
Construction	35,107	$4,410.2	$2,260.8	$2,585.7
Manufacturing	20,291	$11,641.3	$1,768.8	$3,501.8
TIPU	14,149	$3,164.5	$1,077.0	$1,606.2
Trade	86,564	$8,204.4	$3,615.0	$6,029.8
Service	391,826	$55,621.6	$19,928.2	$35,915.8
Government	188,723	$18,740.2	$15,949.1	$18,132.7
Total	740,453	$102,752.6	$44,860.1	$68,221.4

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

13.1.3.3 San Joaquin Valley Region

The CVP water service contractors within the San Joaquin Valley have service areas within Fresno, Kern, Kings, Merced, San Joaquin, Stanislaus, and Tulare counties. Table 13-11 presents the regional economy for this entire region, followed by a discussion of the regional economy in each individual county.

In 2011, the total population in the 7-county region was 3,872,266 (IMPLAN Group, LLC 2012). The region is largely rural with some large population centers in the cities of Stockton, Merced, Fresno, and Bakersfield. Much of the region's land is in agricultural production. In 2011, the region accounted for seven counties of the top eight counties ranked for value of agricultural production in the state, generating over $28.6 billion in gross value of agricultural production (USDA 2012).

CVP contractors in this region deliver both irrigation and M&I water supplies with the majority of the CVP water used in the region for agriculture.

In 2011, services provided the most jobs (679,500 jobs) in the region, followed by government (244,456 jobs), trade (218,369 jobs), and agriculture (199,324 jobs). Services also had the highest output ($82.6 billion) of all industries in the region, followed by manufacturing ($58.8 billion), agriculture ($29.5 billion), and government ($24.4 billion).

Table 13-11. San Joaquin Valley 2011 Regional Economy Summary (Fresno, Kern, Kings, Merced, San Joaquin, Stanislaus, and Tulare Counties)

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	199,324	$29,462.1	$9,776.1	$13,953.8
Mining	15,863	$7,151.0	$1,732.6	$4,002.8
Construction	74,500	$8,809.9	$4,250.1	$4,938.9
Manufacturing	105,641	$58,828.5	$6,181.0	$12,615.9
TIPU	71,564	$13,600.0	$4,175.8	$7,111.9
Trade	218,369	$20,967.3	$8,589.7	$15,221.1
Service	679,500	$82,640.1	$25,092.7	$52,288.1
Government	244,456	$24,394.9	$19,961.8	$23,148.3
Total	1,609,217	$245,853.8	$79,759.8	$133,280.8

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Fresno County Fresno County has 14 incorporated cities, including Fresno, Clovis, Reedley, and Selma (CSAC 2014). The county's economy is highly agricultural except that Fresno provides a more diverse economic base.

In 2011, the total population in Fresno County was 942,904 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (196,250 jobs) in Fresno County, followed by government (61,505 jobs), and trade (58,944 jobs). Specifically, state and local government and support activities for agriculture had the highest employment of all sectors (IMPLAN Group, LLC 2012). Services had the highest output ($24.1 billion) in the county, followed by manufacturing ($11.2 billion), and agriculture ($7.3 billion). Table 13-12 summarizes the regional economy in Fresno County, in terms of employment, output, labor income, and total value added.

Table 13-12. Fresno County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	50,811	$7,262.1	$2,805.7	$3,778.5
Mining	339	$125.8	$23.8	$70.1
Construction	18,037	$2,154.7	$1,050.7	$1,217.4
Manufacturing	27,686	$11,158.3	$1,463.4	$2,439.0
TIPU	15,906	$3,567.0	$919.5	$1,991.9
Trade	58,944	$5,715.3	$2,303.9	$4,141.7
Service	196,250	$24,140.2	$7,359.8	$15,291.5
Government	61,505	$5,903.9	$4,873.0	$5,624.2
Total	429,478	$60,027.3	$20,799.8	$34,554.3

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Kern County Kern County has 11 incorporated cities, including Bakersfield, Delano, Ridgecrest, and Wasco (CSAC 2014). The county's economy is agricultural except that transportation, petroleum and some urban areas, primarily Bakersfield, provide other economic base.

In 2011, the total population in Kern County was 851,710 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (140,557 jobs) in Kern County, followed by government (58,154 jobs), and agriculture (49,515 jobs). Support activities for agriculture had the highest employment of all sectors, 29,557 jobs. Services had the highest output ($17,726.2 million) in the county, followed by manufacturing ($16,760.4 million), and government ($6,995.4 million). Specifically, petroleum refineries and extraction of oil and natural gas were the two largest sectors in terms of output (IMPLAN Group, LLC 2012). Table 13-13 summarizes the regional economy in Kern County, in terms of employment, output, labor income, and total value added.

Table 13-13. Kern County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	49,515	$5,088.0	$2,262.0	$2,622.1
Mining	15,136	$6,903.9	$1,688.6	$3,874.5
Construction	21,249	$2,534.2	$1,233.6	$1,430.2
Manufacturing	13,619	$16,760.4	$978.2	$3,807.7
TIPU	12,836	$3,176.0	$1,044.5	$1,695.7
Trade	42,907	$4,213.3	$1,801.9	$3,089.5
Service	140,557	$17,726.2	$5,641.1	$11,231.0
Government	58,154	$6,995.4	$5,906.9	$6,715.5
Total	353,973	$63,397.4	$20,556.8	$34,466.2

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Kings County Kings County has four incorporated cities, being Avenal, Concoran, Hanford, and Lemoore (CSAC 2014). The economy is very agricultural with a naval air station and manufacturing contributing.

In 2011, the total population in Kings County was 153,765 (IMPLAN Group, LLC 2012). In 2011, government provided the most jobs (18,066 jobs) in Kings County, followed by services (16,824 jobs), and agriculture (7,265 jobs). Manufacturing had the highest output ($3.2 billion) in the county, followed by government ($2.2 billion), and services ($2.1 billion). Specifically, cheese manufacturing had the highest output of all sectors in the county, dairy cattle and milk production ranked third (IMPLAN Group, LLC 2012). Table 13-14 summarizes the regional economy in Kings County, in terms of employment, output, labor income, and total value added.

Table 13-14. Kings County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	7,265	$1,965.5	$401.3	$735.3
Mining	0	$0.0	$0.0	$0.0
Construction	1,560	$174.3	$78.7	$93.2
Manufacturing	5,274	$3,193.2	$286.5	$463.0
TIPU	1,549	$260.6	$67.7	$112.0
Trade	5,599	$466.0	$199.2	$338.0
Service	16,824	$2,114.6	$607.0	$1,325.5
Government	18,066	$2,212.4	$1,730.8	$2,134.1
Total	56,137	$10,386.6	$3,371.2	$5,201.1

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Merced County Merced County has six incorporated cities: Atwater, Dos Palos, Gustine, Livingston, Los Banos, and Merced (CSAC 2014). The county's economy is highly agricultural. Merced is the largest city.

In 2011, the total population in Merced County was 259,898 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (34,518 jobs) in Merced County, followed by agriculture (16,175 jobs), and government (15,817 jobs). Specifically, state and local government and support activities for agriculture had the highest employment of all sectors (IMPLAN Group, LLC 2012). Services had the highest output ($4.3 billion) in the county, followed by manufacturing ($3.3 billion), and agriculture ($3.1 million). Dairy cattle and milk production had the highest output of all sectors in the county ($1.1 billion). Table 13-15 summarizes the regional economy in Merced County, in terms of employment, output, labor income, and total value added.

Table 13-15. Merced County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	16,175	$3,121.9	$680.3	$1,260.2
Mining	119	$27.5	$7.4	$12.1
Construction	3,469	$407.1	$194.7	$226.8
Manufacturing	7,764	$3,348.4	$383.7	$606.0
TIPU	4,254	$731.0	$220.1	$386.7
Trade	12,206	$1,107.5	$425.7	$800.1
Service	34,518	$4,320.3	$1,101.8	$2,617.3
Government	15,817	$1,306.5	$1,050.8	$1,229.9
Total	94,322	$14,370.2	$4,064.5	$7,139.1

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

San Joaquin County The incorporated cities in this county include Lathrop, Lodi, Manteca, Stockton, and Tracy, among others (CSAC 2014). The economy is largely based on agriculture, transportation and manufacturing. Much of the manufacturing is based on agricultural products. Stockton is the largest city.

In 2011, the total population in San Joaquin County was 696,214 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (124,825 jobs) in San Joaquin County, followed by trade (42,569 jobs), and government (34,953 jobs). State and local government provided the most jobs of all sectors in the county (18,530 jobs). Services had the highest output ($15.2 billion) in the county, followed by manufacturing ($8.2 billion), and trade ($4.2 billion). Table 13-16 summarizes the regional economy in San Joaquin County, in terms of employment, output, labor income, and total value added.

Table 13-16. San Joaquin County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	18,209	$2,890.0	$981.1	$1,398.2
Mining	134	$52.7	$7.7	$27.8
Construction	12,562	$1,575.9	$807.3	$923.3
Manufacturing	18,259	$8,263.0	$1,080.0	$1,916.4
TIPU	18,402	$3,114.1	$1,058.0	$1,553.9
Trade	42,569	$4,205.9	$1,680.4	$3,042.6
Service	124,825	$15,216.3	$4,549.7	$9,704.1
Government	34,953	$3,413.5	$2,788.0	$3,199.8
Total	269,913	$38,731.4	$12,952.2	$21,766.1

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Stanislaus County Stanislaus County has nine incorporated cities, including Modesto, Newman, Oakdale, Patterson, and Turlock (CSAC 2014). The economy is largely based on transportation, agriculture, and manufacturing. Much of the manufacturing is based on agricultural products. Modesto and Turlock account for about half of the county population.

In 2011, the total population in Stanislaus County was 518,522 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (99,976 jobs) in Stanislaus County, followed by trade (33,193 jobs), and government (25,316 jobs). State and local government provided the most jobs of all sectors in the county (15,672 jobs). Services had the highest output ($11,909.9 million) in the county, followed by manufacturing ($10,324.2 million), and trade ($3,117.5 million). Specifically, fruit and vegetable was the largest manufacturing sector, and ranked second of all sectors in the county in value of output (IMPLAN Group, LLC 2012). Table 13-17 summarizes the regional economy in Stanislaus County, in terms of employment, output, labor income, and total value added.

Table 13-17. Stanislaus County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	17,533	$2,463.4	$676.1	$1,118.2
Mining	65	$19.8	$2.2	$7.1
Construction	10,309	$1,141.6	$510.4	$605.8
Manufacturing	21,029	$10,324.2	$1,394.0	$2,347.8
TIPU	10,280	$1,216.5	$436.5	$574.7
Trade	33,193	$3,117.5	$1,255.0	$2,245.3
Service	99,976	$11,909.9	$3,697.9	$7,622.6
Government	25,316	$2,098.1	$1,673.6	$1,958.4
Total	217,701	$32,291.0	$9,645.7	$16,479.9

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Tulare County The incorporated cities in this county include Tulare and Visalia, among other (CSAC 2014). The economy is largely agricultural.

In 2011, the total population in Tulare County was 449,253 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (66,550 jobs) in Tulare County, followed by agriculture (39,816 jobs), and government (30,646 jobs). Support for agricultural activities provided the most jobs of all sectors in the county (25,679 jobs). Services had the highest output ($7,212.5 million) in the county, followed by agriculture ($6,671.2 million), and manufacturing ($5,781.1 million). Specifically, fruit farming produced the highest output of all sectors in the county, followed by dairy and cattle production (IMPLAN Group, LLC 2012). Table 13-18 summarizes the regional economy in Tulare County, in terms of employment, output, labor income, and total value added.

Table 13-18. Tulare County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	39,816	$6,671.2	$1,969.6	$3,041.3
Mining	69	$21.3	$3.0	$11.3
Construction	7,313	$822.3	$374.7	$442.3
Manufacturing	12,010	$5,781.1	$595.1	$1,036.0
TIPU	8,337	$1,534.7	$429.4	$797.0
Trade	22,950	$2,141.9	$923.5	$1,563.9
Service	66,550	$7,212.5	$2,135.5	$4,496.1
Government	30,646	$2,465.0	$1,938.7	$2,286.3
Total	187,691	$26,650.0	$8,369.5	$13,674.2

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

13.1.3.4 Bay Area Region

The CVP water service contractors within the Bay Area have service areas within Alameda, Contra Costa, San Benito, and Santa Clara counties. Table 13-19 presents the regional economy for this entire region, followed by a discussion of the regional economy in each individual county. In 2011, the total population in the 5-county region was 4,883,319 (IMPLAN Group, LLC 2012). Alameda, Contra Costa, and Santa Clara counties have the largest urban areas in the region, supporting the most employment and industry. These counties include residential suburbs of San Francisco, but are also home to important business services and retail businesses. California's Silicon Valley, the center of the region high-tech businesses, is in Santa Clara County.

CVP contractors in this region deliver both irrigation and M&I water supplies with Alameda, Contra Costa, and Santa Clara counties more reliant on M&I deliveries and San Benito County more reliant on irrigation deliveries.

In 2011, services provided the most jobs (1,559,187 jobs) in the region, followed by trade (353,936 jobs), government (264,851 jobs) and manufacturing (254,838 jobs). Manufacturing had the highest output ($318.6 billion) of all industries in the region, followed by services ($247.0 billion), trade ($41.5 billion), and government ($29.8 billion).

Table 13-19. Bay Area Region 2011 Regional Economy Summary (Alameda, Contra Costa, San Benito, and Santa Clara Counties)

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	7,829	$1,060.4	$461.6	$559.9
Mining	3,091	$1,547.7	$338.9	$914.4
Construction	115,711	$16,101.6	$9,019.6	$10,088.4
Manufacturing	247,720	$315,977.5	$37,776.3	$100,118.8
TIPU	57,748	$13,726.0	$4,156.0	$6,826.0
Trade	329,122	$38,935.6	$19,274.7	$29,816.1
Service	1,466,241	$235,398.0	$103,398.0	$159,185.8
Government	230,123	$24,986.0	$21,152.5	$23,795.2
Total	2,457,585	$647,732.8	$195,577.6	$331,304.6

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Alameda County The incorporated cities in this county include Alameda, Albany, Berkeley, Emeryville, Fremont, Hayward, Livermore, Oakland, Pleasanton, San Leandro, and Union City, among others (CSAC 2014). Oakland is the largest city in a major metropolitan area, the East Bay, which is divided by the Oakland Hills.

In 2011, Alameda County had a population of 1,529,875 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (491,208 jobs) in Alameda County, followed by trade (123,535 jobs), and government (99,992 jobs). Services had the highest output ($69,727.7 million) in the county, followed by manufacturing ($37,549.1 million), and trade ($14,244.8 million). Specifically, top services in terms of output included rental income, real estate establishments, scientific research and development services, and management of companies and enterprises (IMPLAN Group, LLC 2012). Table 13-20 summarizes the regional economy in Alameda County, in terms of employment, output, labor income, and total value added.

Table 13-20. Alameda County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	1,175	$131.8	$63.0	$68.7
Mining	495	$198.6	$18.7	$105.0
Construction	44,360	$6,108.7	$3,394.6	$3,803.9
Manufacturing	66,793	$37,549.1	$6,319.7	$12,049.0
TIPU	28,780	$6,762.0	$2,037.0	$3,130.6
Trade	123,535	$14,244.8	$6,505.2	$10,685.1
Service	491,208	$69,727.7	$28,896.4	$45,941.4
Government	99,992	$11,102.1	$9,499.0	$10,647.3
Total	856,338	$145,824.8	$56,733.6	$86,431.0

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Contra Costa County The incorporated cities in this county include Antioch, Concord, Lafayette, Martinez, Pittsburg, Pleasant Hill, Richmond, and Walnut Creek, among others (CSAC 2014).

In 2011, Contra Costa County had a population of 1,066,096 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (297,383 jobs) in Contra Costa County, followed by trade (62,583 jobs), and government (45,553 jobs). Manufacturing had the highest output ($89.5 billion) in the county, followed by services ($44.8 billion), and trade ($6.0 billion). Most of the manufacturing in Contra Costa County was from petroleum refineries, which was the largest sector in the county in terms of output ($82.4 billion) (IMPLAN Group, LLC 2012). Table 13-21 summarizes the regional economy in Contra Costa County, in terms of employment, output, labor income, and total value added.

Table 13-21. Contra Costa County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	1,552	$175.5	$54.5	$77.9
Mining	2,145	$1,165.5	$303.8	$717.0
Construction	26,433	$3,700.9	$2,082.4	$2,327.0
Manufacturing	21,506	$89,528.0	$3,588.4	$20,286.2
TIPU	15,678	$4,071.4	$1,287.2	$2,045.7
Trade	62,583	$6,014.1	$2,782.4	$4,487.2
Service	297,383	$44,777.9	$16,103.6	$29,393.1
Government	45,553	$4,542.7	$3,741.4	$4,257.3
Total	472,833	$153,976.0	$29,943.7	$63,591.4

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

San Benito County The incorporated cities in this county are Hollister and San Juan Bautista (CSAC 2014). Important economic base includes agriculture and residential sectors.

In 2011, San Benito County had a population of 56,072 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (6,786 jobs) in San Benito County, followed by manufacturing (3,414 jobs), and trade (3,137 jobs). Manufacturing had the highest output ($1.2 billion) in the county, followed by services ($823.3 million), and agriculture ($369.8 million). Specifically, the fruit and vegetable canning sector, which is part of manufacturing, had the highest output in the county ($354.2 million) (IMPLAN Group, LLC 2012). Table 13-22 summarizes the regional economy in San Benito County, in terms of employment, output, labor income, and total value added.

Table 13-22. San Benito County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	1,750	$369.8	$132.7	$192.5
Mining	21	$5.1	$1.1	$1.9
Construction	1,450	$148.9	$60.1	$73.6
Manufacturing	3,414	$1,169.9	$160.9	$268.0
TIPU	875	$186.9	$30.2	$63.1
Trade	3,137	$293.8	$135.7	$222.0
Service	6,786	$823.3	$194.2	$511.4
Government	2,995	$280.7	$222.7	$257.4
Total	20,428	$3,278.4	$937.6	$1,589.9

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

Santa Clara County The incorporated cities in this county include Cupertino, Los Altos, Los Altos Hills, Palo Alto, San Jose, and Sunnyvale, among others (CSAC 2014). The county is world-renowned as the “Silicon Valley,” an important region for computer and information technology development in the United States.

In 2011, Santa Clara County had a population of 1,809,378 (IMPLAN Group, LLC 2012). In 2011, services provided the most jobs (670,863 jobs) in Santa Clara County, followed by manufacturing (156,006 jobs), and trade (139,867 jobs). Manufacturing had the highest output ($187.7 billion) in the county, followed by services ($120.1 billion), and trade ($18.4 billion). Specifically, the top two sectors in value of output in the county were electronic computer manufacturing ($104.6 billion) and semiconductor and related devices manufacturing ($41.3 billion) (IMPLAN Group, LLC 2012). Table 13-23 summarizes the regional economy in Santa Clara County, in terms of employment, output, labor income, and total value added.

Table 13-23. Santa Clara County 2011 Regional Economy Summary

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	3,351	$383.2	$211.5	$220.8
Mining	431	$178.5	$15.3	$90.4
Construction	43,467	$6,143.1	$3,482.5	$3,884.0
Manufacturing	156,006	$187,730.6	$27,707.3	$67,515.7
TIPU	12,415	$2,705.7	$801.5	$1,586.5
Trade	139,867	$18,382.9	$9,851.5	$14,421.8
Service	670,863	$120,069.2	$58,203.8	$83,339.9
Government	81,582	$9,060.6	$7,689.5	$8,633.2
Total	1,107,982	$344,653.8	$107,962.9	$179,692.3

Source: 2011 IMPLAN data; IMPLAN Group, LLC 2012

13.2 Environmental Consequences

This section presents the assessment methods and environmental consequences of each alternative. M&I economic effects are evaluated in all regions defined in the area of analysis. Agricultural economic effects are evaluated in the Sacramento Valley and San Joaquin Valley regions.

13.2.1 Assessment Methods

The M&I WSP alternatives could result in socioeconomic effects to M&I water users, agricultural water users, and their respective regional economies. Changes in water supply to CVP contractors and the associated assessment methods are described in other chapters and appendices of this Environmental Impact Statement. Effects to CVP water service contractor deliveries are evaluated in Chapter 4 and effects to groundwater are evaluated in Chapter 6. Appendix B, Water Operations Model Documentation, includes information on assumptions of future water supply conditions. This section applies various economic models, described below, to quantify potential effects of the action alternatives on regional economies relative to the No Action Alternative. Some socioeconomic effects are described qualitatively.

13.2.1.1 M&I Service Area Economic Effects Analysis

The M&I economic effects analysis uses the Least Cost Planning Simulation Model (LCPSIM) and the Other Project Water Economic Model (OPWEM) to estimate economic effects to M&I water service contractors as a result of the water supply changes caused by the M&I WSP alternatives. Direct effects are the increased costs incurred by water agencies for implementing alternate water supply options as a result of decreased CVP supplies. This cost is passed onto customers which reduces their discretionary income available to spend in the region.

LCPSIM LCPSIM is used to estimate the economic benefits and costs of water supply for M&I purposes in the urban areas of the CVP water service contractors in the Bay Area Region. LCPSIM was constructed to include the Bay Area and Southern California regions and does not include other areas of California. LCPSIM uses CalSim II results for annual M&I water supply under the 2030 condition over the 1922 to 2003 hydrologic period as input.

LCPSIM is an annual time-step urban water system model that finds the point which minimizes the sum of the total annual cost of the adopted long-term measures and the total expected annual shortage costs and losses remaining after their adoption. Long-term measures available for the Bay Area Region are indoor conservation, outdoor conservation, and water recycling. LCPSIM accounts for the ability of shortage management (contingency) measures, including temporary water transfers, to reduce regional costs and losses associated with shortage events, and for the ability of long-term regional demand reduction and supply augmentation measures, in conjunction with regional carryover storage opportunities, to reduce the frequency, magnitude, and duration of shortage events. To estimate costs of shortage, LCPSIM uses a shortage loss function derived from contingent valuation studies and water agency shortage allocation strategies. LCPSIM generates output for shortage size, costs and losses due to shortage, quantities and costs of water transfers, surface and groundwater carryover storage operations, and overall system operations costs.

The following is a summary of modeling limitations in LCPSIM, which are further described in Appendix G, M&I Economic Model Documentation.

- LCPSIM model assumes all Bay Area demands and supplies are aggregated as one region. Some Bay Area CVP water service contractors are currently in a better position to cope with changes in CVP water allocations than others. Marginal and total costs in some sub-regions of the Bay Area are likely to be less than, and some more than, LCPSIM implies. Given increasing marginal costs, the net effect is likely to be an understatement of total economic costs and impacts of CVP M&I supply reductions.

- LCPSIM was designed to operate more or less within the range of historical experience. CVP M&I water delivery reductions in some years under Alternative 2 would be much larger than have historically occurred. To cope with such supply reductions, Bay Area providers might develop new supply alternatives that are included in LCPSIM. There is no information to judge whether these alternative might be more or less expensive than the costs implied by LCPSIM results.

- LCPSIM does not include an explicit production or cost function for commercial and industrial (C&I) water shortage. Water suppliers generally protect C&I users from water shortage, and this is reflected in LCPSIM logic. C&I users would incur unusual costs in some years to cope with water shortage, and without economical supply alternatives, decisions regarding production, employment, and siting of facilities might be affected.

- LCPSIM alone does not include all potential economic effects of water shortage. LCPSIM estimates the economic costs of water shortage, but these costs might themselves have economic consequences that are not quantified. In particular, the end-user shortage cost, or reduced end-user shortage benefit, may affect the decisions of water users about where to live and do business, and these decisions might have regional effects. These regional effects cannot be directly modeled with LCPSIM or IMPLAN.

OPWEM OPWEM estimates representative economic benefits or costs of changes in CVP supplies for all urban areas outside of the Bay Area Region that receive these supplies. The model is similar to LCPSIM in terms of the types of management taken in response to changing water supplies.

OPWEM includes CVP M&I supplies in the Sacramento Valley, American River basin, and San Joaquin Valley. Twenty-four providers who have CVP M&I water service contracts, and 13 providers who have CVP agricultural water service contracts that provide some water for M&I purposes are included. OPWEM includes small amounts of agricultural use that could not be separated from urban use.

OPWEM uses CalSim II results for annual CVP M&I water supply under the 2030 condition over the 1922 to 2003 hydrologic period as input. For each year of the hydrologic period, demand and supply quantities are compared. If supply is insufficient to meet demand, the costs of additional water supplies are calculated. OPWEM uses two different types of unit costs of water supplies – one for years that are wetter than dry years, and another for dry and critical years. These unit costs are based on data from individual providers, where available, but most costs are groundwater costs or water transfer costs developed from secondary information. OPWEM also includes water shortage costs in dry and critical years. Shortage costs are based on individual retail water prices and quantities, and a short-run demand elasticity of -0.1.

OPWEM limitations are similar to those for LCPSIM except that OPWEM considers each CVP contract holder to be a separate entity so there is little potential error arising from aggregation.

IMPLAN LCPSIM and OPWEM results are input into the IMpact analysis for PLANning (IMPLAN) model to estimate regional economic effects. Average annual effects are reported. IMPLAN modeling is described below. Appendix G, M&I Economic Model Documentation, provides a detailed description of the models, methods, and results of the M&I economic effects analysis.

13.2.1.2 Agricultural Economic Effects Analysis

The Statewide Agricultural Production (SWAP) model was used to evaluate the effects on agricultural production for each alternative. The SWAP model is a regional agricultural production and economic optimization model that simulates the decisions of farmers across 93 percent of agricultural land in California. The model assumes that farmers maximize profit subject to resource, technical, and market constraints. Farmers sell and buy in competitive markets, and no one farmer can affect or control the price of any commodity. The model selects those crops, water supplies, and other inputs that maximize profit subject to constraints on water and land, and subject to economic conditions regarding prices, yields, and costs. The SWAP model incorporates project water supplies (State Water Project [SWP] and CVP), other local water supplies, and groundwater. As conditions change within a SWAP region (e.g., the quantity of available project water supply increases or the cost of groundwater pumping increases), the model optimizes production by adjusting the crop mix, water sources and quantities used, and other inputs. It also fallows land when that appears to be the most cost-effective response to resource conditions.

The SWAP model is used to compare the long-run response of agriculture to potential changes in SWP and CVP irrigation water delivery, other surface or groundwater conditions, or other economic values or restrictions. Results from the SWAP model are used to compare the long-run agricultural economic responses to changes in CVP irrigation water delivery under the M&I WSP alternatives. Results from the CalSim II model are used as inputs into SWAP through a standardized data linkage tool. For this agricultural analysis, the San Joaquin Valley Region is split into the San Joaquin River Region that includes most of Sacramento, San Joaquin, Stanislaus, Merced, and Madera counties, and the Tulare Lake Region that includes Fresno, Kings, Tulare, and Kern counties.

The SWAP model provides changes in value of production and groundwater pumping costs. The SWAP model estimates effects during all year types. Results for critical years are presented in this section. Changes in value of production are used as inputs to the regional economic effects analysis, described below. Effects of changes in groundwater pumping costs are also discussed in the economic effects analysis. Appendix D, Statewide Agricultural Production Model Documentation, provides a detailed description of the model and methods of the agricultural economic effects analysis.

13.2.1.3 Regional Economic Effects Analysis

Regional economic effects occur because of trade linkages in a regional economy. Industries purchase and sell inputs from and to one another. For example, many businesses trade with farmers. Farmers buy inputs from workers, farm stores, equipment supply stores, custom operators, and other farmers. Other regional businesses earn their income by transporting, storing, marketing, and processing agricultural products. Changes in crop production affect the volume of sales for these businesses and also household income that these businesses support. Regional economic effects analyses quantify these indirect and induced impacts.

Specifically, indirect effects are caused by expenditures in the region by affected regional industries, and include purchases of inputs to grow crops and make products. Induced effects are caused by expenditure of household income. The analysis estimates the regional economic effects of the alternatives using IMPLAN.

IMPLAN is a county-level database and modeling package that calculates the economic indirect and induced impacts of a change in value of production, labor income, household income, industry and institutional spending. IMPLAN estimates effects on various economic measures, including employment, labor income, and total value of output, and total value added. This analysis uses IMPLAN 2011 data set for all counties that could be affected by the M&I WSP, which is developed by the IMPLAN Group, LLC. The IMPLAN data sets include study area data, industry accounts, social accounts, and multipliers. The study area data is presented above in Chapter 13.1.3. This chapter presents IMPLAN model results in Chapters 13.2.2 through 13.2.6. For the analysis of M&I economic effects, LCPSIM and OPWEM estimate changes in discretionary income as a result of changes in water costs. A change in water costs is assumed to result in an equivalent change in retail water revenues through water rates, which changes household spending, which is input into IMPLAN to estimate regional economic effects. That is, changes in water costs must be passed onto customers, and the customers then have less money to spend for other things. The impact is a change in the household spending pattern.

For the analysis of agricultural economic effects, SWAP estimates changes in value of production of crops as a result of changes in water supply. This is a direct effect to the crop industry sectors, which is input into IMPLAN as an industry change to estimate regional economic effects.

13.2.2 Alternative 1: No Action

Under the No Action Alternative, CVP allocations to M&I water service contractors could result in economic effects to M&I water service contractors and the regional economy. Under the No Action Alternative, socioeconomic effects could occur to M&I water users due to water shortages in some years and unmet public health and safety (PHS) ~~water~~ needs. Chapter 4 defines PHS need~~s~~ and discusses water users that could experience unmet PHS ~~demands~~ needs under the No Action Alternative.

In the Sacramento Valley Region and American River Region, PHS ~~demands~~ need would be met, except for a slight shortage in the Shasta and Trinity River Division (~~less than 1 percent in~~in all but 10 percent of the 81 modeled years; in those years, the volume of PHS need not met would be less than 1 percent. S~~s~~ee Chapter 4.2.2.1). This would not result in socioeconomic effects because it is such a small amount of water and the shortage occurs infrequently. Contractors would likely find a way to meet the need through conservation, increased groundwater pumping, or transfers with adjacent agencies.

In the San Joaquin Valley Region, there would be unmet PHS ~~demands~~ needs in the West San Joaquin Division and Cross Valley Canal Unit under the No Action Alternative (see Chapter 4.2.2.2). The M&I contractors in ~~this unit~~ these divisions may not have sufficient alternate water supplies readily available to meet PHS needs~~demands~~. This could result in adverse short- and long-term economic impacts. In the short-term, contractors may need to implement more expensive options to provide water supply, such as trucking water in. Businesses and residents may also need to spend additional money on purchasing water. In the long-term, the area may not be attractive to future economic development, which would hinder growth of the regional economy.

In the Bay Area Region, PHS needs ~~demands~~ would be met under the No Action Alternative (see Chapter 4.2.2.2). This would not result in socioeconomic effects.

Implementation of water conservation measures reduces water use by customers, which then reduces payments to water districts and water district revenues. When the volume of water sold is decreased on average, either by planned conservation or drought shortage, water revenues may be insufficient to cover fixed costs. Then, either costs must be reduced, or water rates must be increased to raise revenue to cover the fixed costs. Assuming water rates would be increased, this would reduce the disposable income of water customers and result in regional economic effects to output, employment, wages and salaries and value added.

Under the No Action Alternative, CVP allocations could result in economic effects to agricultural water users and the regional economy. Under the No Action Alternative, socioeconomic effects could occur to agricultural water users and the regional economy due to changes in water supply, crop demand, crop prices, and other market factors. Additionally, California producers will continue to be strongly affected by international market and trade conditions.

Under the No Action Alternative, agricultural water deliveries would decrease. Growers would implement actions, such as idling or increased groundwater pumping, to respond to water shortages under the No Action Alternative. Idling could last for one year or multiple years depending on the length of the shortage. Cropland idling would reduce farm incomes, purchases of agricultural inputs, and farm labor. These would be adverse effects to regional economics. Some farm laborers would move to other areas of the region to work on farms, as the opportunity is available, which would offset some of the regional economic impacts. Impacts associated with increased groundwater pumping are addressed below.

Changes in crop demand and prices would affect crop production and the regional economy in the future. Increases in population and income would increase crop demand, which would increase crop prices in the future. Increased crop prices would increase value of production for the agricultural economy. This would increase output, employment, and income in the regional economy, which would be a positive effect under the No Action Alternative. Increased prices may affect other sectors of the economy if residents are spending more money on food because of higher prices. This may adversely affect sales and output in other sectors of the regional economy, but total sales would increase under the No Action Alternative.

Under the No Action Alternative, M&I WSP allocations could change groundwater pumping costs for agricultural water users. Expenditures for groundwater pumping in the future would rise due to increasing electricity costs, whose rise is unrelated to the proposed project. Because of increasing electricity costs in the future, it is expected that growers would try to pump less groundwater for irrigation when surface water supplies are available. As a result, groundwater pumping costs could decrease during years when surface water is available. This would increase net revenues from crop production because input costs would decrease. During years when surface water shortages would occur, growers may need to rely on groundwater for irrigation. In this event, production costs could increase substantially due to the need for increased groundwater pumping, as well as the increased electricity costs associated with that pumping. Growers would need to make a business decision regarding whether or not to produce a crop during surface water shortages based on these economic factors. Growers could also implement other cost savings measures, such as switching to more energy efficient water tools/equipment. Any reduced value of production would be an adverse economic effect under the No Action Alternative.

13.2.3 Alternative 2: Equal Agricultural and M&I Allocation

13.2.3.1 Sacramento Valley Region

Providing equal allocations to agricultural and M&I water service contractors could result in economic effects to M&I water users and the regional economy. Alternative 2 would result in reduced CVP water supplies to M&I water service contractors in the Sacramento Valley Region when the M&I WSP is implemented. As a result, these water contractors would need to use alternate water supplies to provide water to customers, which would increases costs to the water contractors and their customers.

OPWEM estimates that implementation of Alternative 2 would increase water supply costs, including net operations costs, in the Sacramento Valley Region by an average of about $2.2 million annually, relative to the No Action Alternative. The water supply cost represents increased costs to the M&I water service contractors in the Sacramento Valley Region for alternate water supplies. These costs would be passed on to customers through increased water rates. The resulting socioeconomic effect would be a reduction in customers' discretionary income available to spend in the region. This would result in induced effects in the regional economy. Table 13-24 summarizes the regional economic effects of a reduction in household spending in the Sacramento Valley Region, as measured by IMPLAN. These adverse effects would be a small change relative to the baseline economy and would be offset by beneficial economic effects in the agriculture sector, as described below.

Table 13-24. Average Annual M&I Economic Effects in the Sacramento Valley Region of Alternative 2

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Economic Effect	-13	-$0.46	-$0.93	-$1.5

Providing equal allocations to agricultural and M&I water service contractors could result in economic effects to crop value of production and the regional economy. Implementation of Alternative 2 would increase water supplies to CVP agricultural water service contractors in the Sacramento Valley Region. As a result, growers would increase irrigated acreage and crop production, which would be a positive effect in the regional economy. Modeling predicts that irrigated acreage would increase by about 10,000 acres in critical years. In addition, there would be a total increase in annual value of production of about $35.7 million in critical years. Increased value of production would increase employment, value added, labor income, and output in the regional economy through indirect and induced impacts. Table 13-25 summarizes the total economic effect on the regional economy in the Sacramento Valley relative to the No Action Alternative. These would be a positive effect to the regional economy.

Table 13-25. Agricultural Economic Effects in Critical Water Years in the Sacramento Valley Region of Alternative 2

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Direct Effect	210	$11.72	$20.28	$35.72
Indirect Effect	117	$3.96	$5.27	$7.86
Induced Effect	75	$2.72	$5.55	$8.76
Total Effect	402	$18.40	$31.10	$52.34

Modeling estimates that value of production would be the same in wet and above normal years relative to the No Action Alternative. Positive economic effects in below normal and dry years would be less than in critical years because water supply and irrigated acreage would not increase as much. Average annual value of production would increase by $3.7 million in below normal years and $10.6 million in dry years. Positive effects to the regional economy in below normal and dry would be proportionate to those shown in Table 13-25 for critical years.

Providing equal allocations to agricultural and M&I water service contractors could change groundwater pumping costs for agricultural water users. Increased water supplies to agricultural CVP contractors in the Sacramento Valley Region would decrease the need for groundwater pumping as additional surface water supply would be available for irrigation needs. Modeling estimates that annual groundwater pumping costs would decrease by about $0.2 million in critical years relative to the No Action Alternative. Decreased pumping expenditures would reduce production costs for growers, which would increase net revenues. This would be a positive effect to growers' incomes. They would likely spend a portion of the increased income in the regional economy, which would be a minor positive effect to output, sales and income in the region. Positive effects would be greater in wetter hydrologic conditions because more surface water would be available, and less groundwater pumping would be necessary for irrigation.

13.2.3.2 American River Region

Providing equal allocations to agricultural and M&I water service contractors could result in economic effects to M&I water users and the regional economy. Similar to the Sacramento Valley Region, OPWEM estimates economic costs to M&I water service contractors in the American River Region. Implementation of Alternative 2 would increase water supply costs, including net operations costs, in the American River Region by an average of about $8.0 million annually, relative to the No Action Alternative.

The increased water supply cost represents increased costs to the M&I water service contractors in the American River Region for alternate water supplies. These costs would be passed on to customers through increased water rates. The resulting socioeconomic effect would be a reduction in customers' discretionary income available to spend in the region. Table 13-26 summarizes the regional economic effects of a reduction in household spending in the American River Region. These adverse effects would be a small change relative to the baseline economy.

Table 13-26. Average Annual M&I Economic Effects in the American River Region of Alternative 2

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Economic Effect	-52	-$2.3	-$4.3	-$6.7

13.2.3.3 San Joaquin Valley Region

Providing equal allocations to agricultural and M&I water service contractors could result in economic effects to M&I water users and the regional economy. Similar to the Sacramento Valley Region, OPWEM estimates economic costs to M&I water service contractors in the San Joaquin Valley Region. Implementation of Alternative 2 would increase water supply costs, including net operations costs, in the San Joaquin Valley Region by an average of about $7.0 million annually, relative to the No Action Alternative.

This cost represents increased costs to the water contractors in the San Joaquin Valley Region for alternate water supplies. These costs would be passed on to customers through increased water rates. The resulting socioeconomic effect would be a reduction in customers' discretionary income available to spend in the region. Table 13-27 summarizes the regional economic effects of a reduction in household spending in the San Joaquin Valley Region. These adverse effects would be a small change relative to the baseline economy.

Table 13-27. Average Annual M&I Economic Effects in the San Joaquin Valley Region of Alternative 2

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Economic Effect	-43	-$1.6	-$3.3	-$5.5

Providing equal allocations to agricultural and M&I water service contractors could result in economic effects to crop value of production and the regional economy. For this agricultural analysis, the San Joaquin Valley Region is split into the San Joaquin River Region that includes most of Sacramento, San Joaquin, Stanislaus, Merced, and Madera counties, and the Tulare Lake Region that includes Fresno, Kings, Tulare, and Kern counties.

Modeling predicts that irrigated acreage in the San Joaquin River Region would be the same as the No Action Alternative in critical years. Average annual value of production would decrease about $4.8 million in critical years relative to the No Action Alternative. The Sacramento Valley Region, as the impact discussion above describes, and Tulare Lake Region, described below, receive more water under Alternative 2, which increases production and drives the price of crops down. The SWAP model simulates statewide demand and capture price effects across regions. Because effects in the Sacramento Valley and Tulare Lake regions reduce crop prices, they would also be lower in the San Joaquin River Region. Lower crop prices would decrease the value of production, which would decrease employment, income, and output in the regional economy. This would be an adverse effect to this region. Table 13-28 summarizes the total economic effect on the regional economy in the San Joaquin Region in critical water years.

Table 13-28. Agricultural Economic Effects in Critical Water Years in the San Joaquin River Region of Alternative 2

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Direct Effect	-27	-$1.67	-$2.75	-$4.84
Indirect Effect	-17	-$0.54	-$0.71	-$1.12
Induced Effect	-12	-$0.49	-$0.96	-$1.53
Total Effect	-55	-$2.71	-$4.42	-$7.48

Alternative 2 would not result in economic effects to value of production or the San Joaquin River Region economy in wet and above normal years. Effects in below normal and dry years would be less than those in critical years. Average annual value of production would decrease by $0.6 million in below normal years and $0.9 million in dry years. Impacts to the regional economy in below normal and dry would be proportionate to those shown in Table 13-28 for critical years.

Increased water supplies for agricultural uses in the Tulare Lake Region would increase irrigated acreage and value of production. Irrigated acreage in the Tulare Lake Region would increase by about 34,000 acres in critical years. Annual value of production would increase by about $43.2 million in critical years. Increased value of production would increase employment, value added, labor income, and output in the crop sectors and the overall regional economy through indirect and induced impacts. This would be a positive effect to the regional economy.

Table 13-29 summarizes the total economic effect on the regional economy in the Tulare Lake Region.

Table 13-29. Agricultural Economic Effects in Critical Water Years in the Tulare Lake Region of Alternative 2

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Direct Effect	95	$6.80	$12.24	$43.24
Indirect Effect	172	$5.88	$10.65	$20.25
Induced Effect	64	$2.39	$4.89	$7.95
Total Effect	332	$15.08	$27.78	$71.44

Alternative 2 would not result in economic effects to value of production or the Tulare Lake Region economy in wet and above normal years. Effects in below normal and dry years would be less than those in critical years. Average annual value of production would increase by $0.4 million in below normal years and $39.8 million in dry years. Positive effects to the regional economy in below normal and dry would be proportionate to those shown in Table 13-29 for critical years.

Providing equal allocations to agricultural and M&I water service contractors could change groundwater pumping costs for agricultural water users. Increased water supplies to agricultural CVP contractors would decrease the need for groundwater pumping as additional surface water supply would be available for irrigation needs. Modeling estimates that annual groundwater pumping costs would decrease by about $2.4 million in critical years in the San Joaquin River Region and $1.5 million in critical years in the Tulare Lake Region relative to the No Action Alternative. Decreased pumping costs would reduce production costs for growers, which would increase net revenues. This would be a positive effect to growers' incomes. They would likely spend a portion of the increased income in the regional economy, which would be a minor positive effect to output, sales and income in the region. Positive effects would be greater in wetter hydrologic conditions because more surface water would be available, and less groundwater pumping would be necessary for irrigation.

13.2.3.4 Bay Area Region

Providing equal allocations to agricultural and M&I water service contractors could result in economic effects to M&I water users and the regional economy. Alternative 2 would result in reduced water supplies to M&I water service contractors with implementation of the M&I WSP. Effects to M&I water service contractor CVP deliveries are evaluated in Chapter 4 and effects to groundwater are evaluated in Chapter 6. Appendix B, Water Operations Model Documentation, and Appendix D, Statewide Agricultural Production Model Documentation, include information on assumptions of future water supply conditions. As a result of reduced supplies, water contractors would need to obtain alternate water supplies to provide water to customers. LCPSIM estimates that implementation of Alternative 2 would increase water supply costs in the Bay Area Region by an average of about $6.6 million annually, relative to the No Action Alternative. LCPSIM includes two types of demand reduction - permanent conservation and drought contingency shortage. With permanent conservation, demand is reduced every year, and the cost of permanent conservation is paid every year. The model selects a level or permanent conservation that minimizes cost over the hydrologic period. Drought contingency conservation is used in dry years to balance demand and supply.

The increased water supply cost represents increased costs to the water contractors in the Bay Area Region for alternate water supplies. These costs would be passed on to customers through increased water rates. The resulting economic effect is a reduction in customers' discretionary income available to spend in the region. Table 13-30 summarizes the adverse regional economic effects of a reduction in household spending in the Bay Area Region. These effects would be a small change relative to the baseline regional economy.

Table 13-30. Average Annual M&I Economic Effects in the Bay Area Region of Alternative 2

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Economic Effect	-37	-$2.0	-$3.5	-$5.4

In the Bay Area Region, some CVP contractors are in a better position to respond to reductions in CVP water allocations than others. As stated above and in Appendix G, one of the limitations of LCPSIM is that the model aggregates all supplies and demands of water supply contractors in the Bay Area as one aggregate region. This can result in underestimating total costs to individual contractors because sSome contractors do not have accessible alternate water supplies to replace large reductions in CVP water deliveries. As discussed in Chapter 4, Surface Water, this could result in unmet PHS need impacts. PHS needs ~~demands~~ are not fully met in ~~17~~ 19 percent of the 81 modeled water years (see Figure 4-22 in Chapter 4). Further conservation than the levels included in

LCPSIM could also be necessary, which would increase costs above those estimated by LCPSIM.

If alternate water supplies were not available, there may be additional economic effects than those described above. Effects of not having alternate water supplies available could also include businesses decisions to reduce production or employment, or site facilities outside of the region to avoid potential water supply impacts. Businesses consider many factors regarding production and employment levels and locations; therefore, it is difficult to assess the magnitude of these impacts. ~~These~~ However, these would be adverse impacts to the regional economy of the Bay Area and would reduce employment, wages and salaries, output and value added much greater than the impacts shown in Table 13-30.

13.2.3.5 Indirect Effects

Implementation of cropland idling water transfers under ~~of~~ Alternative 2 could result in indirect economic effects. M&I water contractors would seek alternate water supplies if CVP supplies are reduced under this alternative. Chapter 3 discusses potential actions that may be taken by these contractors. M&I contractors could purchase water transfers through cropland idling in the Sacramento Valley. Cropland idling transfers would occur with willing sellers that are agricultural water contractors in the Sacramento Valley. For cropland idling transfers, growers within the selling districts would idle crop fields and sell surface water supplies to agencies interested in purchasing water for transfer. Indirect economic effects could result in the counties in the Sacramento Valley as a result of cropland idling transfers to M&I water contractors. For a cropland idling transfer, growers would receive revenues from the transfers, but would not purchase inputs from agricultural support businesses or employ farm laborers. Value of agricultural production would also decrease. These would be adverse economic effects in the regional economies where cropland idling would occur.

Implementation of conservation measures under Alternative 2 could reduce CVP contractor revenues. Implementation of water conservation measures reduces water use by customers, which then reduces payments to water districts and water district revenues. When the volume of water sold is decreased on average, either by planned conservation or drought shortage, water revenues may be insufficient to cover fixed costs. Then, either costs must be reduced, or water rates must be increased to raise revenue to cover the fixed costs. Assuming water rates would be further increased, the effects in the Bay Area Region would be larger than the initial estimate of about $6.6 million annually on average, relative to the No Action Alternative. The regional economic effects would also be larger than those estimated in Table 13-30. This would be an adverse effect to the regional economy.

13.2.4 Alternative 3: Full M&I Allocation Preference

13.2.4.1 Sacramento Valley Region

Implementation of the Full M&I Allocation Preference Alternative could result in economic effects to M&I water users and the regional economy. Alternative 3 would increase average CVP water supply deliveries to M&I water service contractors in the Sacramento Valley Region when the M&I WSP is implemented. As a result, shortage and water costs would decrease relative to the No Action Alternative. OPWEM estimates that implementation of Alternative 3 would decrease water costs in the Sacramento Valley Region by an average of about $1.1 million annually, relative to the No Action Alternative. The entire amount of reduced water supply cost would be a reduced cost to the CVP water contractor, which would be passed on to the customers through reductions in water rates. This would be a positive regional economic effect. Customers would have increased discretionary income available to spend in the region, which would result in increased induced spending. IMPLAN estimates the effects of increased household spending in the regional economy.

Table 13-31 summarizes the regional economic effects in the Sacramento Valley Region. These would be minor positive effects relative to the baseline economy.

Table 13-31. Average Annual M&I Economic Effects in the Sacramento Valley Region of Alternative 3

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Economic Effect	7	$0.24	$0.48	$0.75

Implementation of the Full M&I Allocation Preference Alternative could result in economic effects to crop value of production and the regional economy. Implementation of Alternative 3 would decrease water supplies to agricultural water users in the Sacramento Valley Region. As a result, growers would decrease irrigated acreage and crop production, which would adversely affect the regional economy. Modeling predicts that irrigated acreage would decrease by about 4,000 acres in critical years. In addition, there would be a total decrease in annual value of production of about $16.1 million in critical years. Decreased value of production would decrease employment, value added, labor income, and output in the regional economy through indirect and induced impacts. Some employment and regional effects may be offset if workers go to other farms within the region. Table 13-32 summarizes the total economic effect on the regional economy in the Sacramento Valley. These would be adverse effects to the regional economy.

Table 13-32. Agricultural Economic Effects in Critical Water Years in the Sacramento Valley Region of Alternative 3

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Direct Effect	-98	-$5.33	-$9.35	-$16.14
Indirect Effect	-53	-$1.81	-$2.35	-$3.49
Induced Effect	-34	-$1.23	-$2.51	-$3.97
Total Effect	-185	-$8.37	-$14.21	-$23.60

Modeling estimates that value of production would be the same in wet and above normal years relative to the No Action Alternative. Economic effects in below normal and dry years would be less than adverse effects in critical years because water supply and irrigated acreage would not decrease as much. Average annual value of production would decrease by $3.0 million in below normal years and $6.3 million in dry years. Adverse effects to the regional economy in below normal and dry would be proportionate to those shown in Table 13-25 for critical years.

Implementation of the Full M&I Allocation Preference Alternative could change groundwater pumping costs for agricultural water users. Decreased water supplies to agricultural CVP contractors would increase the need for groundwater pumping for irrigation. Modeling estimates that annual groundwater pumping costs would increase by about $0.1 million in critical years in the Sacramento Valley Region relative to the No Action Alternative. Increased pumping would increase production costs for growers, which would decrease net revenues. This would be an adverse effect to growers' incomes. They would likely spend less money in the regional economy, which would be a minor adverse effect to output, sales and income in the region.

13.2.4.2 American River Region

Implementation of the Full M&I Allocation Preference Alternative could result in economic effects to M&I water users and the regional economy. Similar to the Sacramento Valley Region, OPWEM estimates that implementation of Alternative 3 would decrease shortage and water costs in the American River Region by an average of approximately $4.6 million, which would be passed on to the customers through reductions in water rates. This would be a positive regional economic effect. Customers would have increased discretionary income available to spend in the region.

Table 13-33 summarizes the regional economic effects of an increase in household spending in the American River Region. These would be a minor positive effect relative to the baseline economy.

Table 13-33. Average Annual M&I Economic Effects in the American River Region of Alternative 3

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Economic Effect	30	$1.3	$2.5	$3.8

13.2.4.3 San Joaquin Valley Region

Implementation of the Full M&I Allocation Preference Alternative could result in economic effects to M&I water users and the regional economy. OPWEM estimates that implementation of Alternative 3 would decrease water supply costs to M&I contractors in the San Joaquin Valley Region by an average of approximately $3.8 million, which would be passed on to the customers through reductions in water rates. This would be a positive regional economic effect. Customers would have increased discretionary income available to spend in the region.

Table 13-34 summarizes the regional economic effects of an increase in household spending in the American River Region. These would be a minor positive effect relative to the baseline economy.

Table 13-34. Average Annual M&I Economic Effects in the San Joaquin Valley Region of Alternative 3

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Economic Effect	23	$0.89	$1.8	$3.0

Implementation of the Full M&I Allocation Preference Alternative could result in economic effects to crop value of production and the regional economy. For this agricultural analysis, the San Joaquin Valley Region is split into the San Joaquin River Region that includes most of Sacramento, San Joaquin, Stanislaus, Merced, and Madera counties, and the Tulare Lake Region that includes Fresno, Kings, Tulare, and Kern counties.

Modeling predicts that irrigated acreage in the San Joaquin River Region would be the same as the No Action Alternative. Average annual value of production would increase about $5.2 million in critical years relative to the No Action Alternative. The Sacramento Valley Region (described above) and Tulare Lake Region (described below) receive less water under Alternative 3, which decreases production and drives the price of crops up. The SWAP model simulates statewide demand and capture price effects across regions. The crop prices would be high in the San Joaquin River Region as a result of higher crop prices in the Sacramento Valley and Tulare Lake regions, which increases value of production. The increased value of production would increase employment, income, and output in the regional economy. This would be a positive economic effect to this region. Table 13-35 summarizes the effects on the regional economy in the San Joaquin Region in critical water years.

Table 13-35. Agricultural Economic Effects in Critical Water Years in the San Joaquin River Region of Alternative 3

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Direct Effect	22	$1.90	$3.00	$5.19
Indirect Effect	18	$0.57	$0.76	$1.19
Induced Effect	14	$0.55	$1.08	$1.72
Total Effect	54	$3.02	$4.85	$8.10

Table 13-35 shows economic effects in critical water years. Alternative 3 would not result in economic effects in the San Joaquin River Region to value of production or the regional economy in wet and above normal years. Effects in below normal and dry years would be less than those in critical years. Average annual value of production would increase by $0.4 million in below normal years and $0.3 million in dry years. Positive effects to the regional economy in below normal and dry would be proportionate to those shown in Table 13-35 for critical years.

Table 13-36 summarizes the effects on the regional economy in the Tulare Lake Region in critical water years. Decreased water supplies for agricultural uses in the Tulare Lake Region would decrease irrigated acreage and value of production. Irrigated acreage in the Tulare Lake Region would decrease by about 23,000 acres in critical years. Annual value of production would decrease by about $45.9 million in critical years. Decreased value of production would decrease employment, value added, labor income, and output in the crop sectors and the overall regional economy through indirect and induced impacts. This would be an adverse effect to the regional economy.

Table 13-36. Agricultural Economic Effects in Critical Water Years in the Tulare Lake Region of Alternative 3

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Direct Effect	-233	-$12.23	-$20.50	-$45.92
Indirect Effect	-177	-$5.45	-$9.19	-$15.67
Induced Effect	-91	-$3.38	-$6.91	-$11.22
Total Effect	-501	-$21.04	-$36.60	-$72.81

Alternative 3 would not result in economic effects in the Tulare Lake Region to value of production or the regional economy in wet and above normal years. Effects in below normal and dry years would be less than those in critical years. Average annual value of production would decrease by $0.8 million in below normal years and $26.3 million in dry years. Impacts to the regional economy in below normal and dry would be proportionate to those shown in Table 13-36 for critical years.

Implementation of the Full M&I Allocation Preference Alternative could change groundwater pumping costs for agricultural water users. Decreased water supplies to agricultural CVP contractors would increase the need for groundwater pumping for irrigation. Modeling estimates that annual groundwater pumping costs would increase by about $1.3 million in critical years in the San Joaquin River Region and $0.8 million in critical years in the Tulare Lake Region relative to the No Action Alternative. Increased pumping would increase production costs for growers, which would decrease net revenues. This would be an adverse effect to growers' incomes. They would likely spend less money in the regional economy, which would be a minor adverse effect to output, sales and income in the region.

13.2.4.4 Bay Area Region

Implementation of the Full M&I Allocation Preference Alternative could result in economic effects to M&I water users and the regional economy. Alternative 3 would result in increased CVP water supplies to M&I water service contractors under implementation of the M&I WSP. As a result, water contractors would have reduced costs relative to the No Action Alternative because of the availability of less expensive water supplies. LCPSIM estimates that implementation of Alternative 3 would decrease costs in the Bay Area Region by an average of about $7.9 million annually, relative to the No Action Alternative.

These costs would be passed on to customers through reduced water rates. The resulting economic effect is an increase in customers' discretionary income available to spend in the region. Table 13-37 summarizes the regional economic effects of an increase in household spending in the Bay Area Region. These effects would be a small positive effect relative to the baseline regional economy.

Table 13-37. Average Annual M&I Economic Effects in the Bay Area Region of Alternative 3

	Employment (jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)
Economic Effect	44	$2.4	$4.1	$6.5

13.2.4.5 Indirect Effects

Implementation of cropland idling water transfers under of Alternative 3 could result in indirect economic effects. M&I water contractors would buy less alternate water supplies if CVP supplies are increased under this alternative. However, agricultural CVP contractors may need to purchase additional water supplies because agricultural water supplies would be reduced. Chapter 3 discusses potential actions that may be taken by these contractors. Indirect economic effects could result from cropland idling that occurs in counties in the Sacramento Valley. Cropland idling transfers would occur with willing sellers that are agricultural water contractors in the Sacramento Valley. For a cropland idling transfer, growers in the selling districts would receive revenues from the transfers, but would not purchase inputs from agricultural support businesses or employ farm laborers. Value of agricultural production would also decrease. These would be adverse economic effects in the regional economies where cropland idling would occur.

13.2.5 Alternative 4: Updated M&I WSP

Implementation of the Updated M&I WSP would result in the same economic effects as the No Action Alternative. Allocations under Alternative 4 would be similar to those under the No Action Alternative, with the exception for how historical use is calculated. Allocation methodology for both agricultural and M&I water service contractors would be the same as under the No Action Alternative; therefore, economic effects generated by Alternative 4 would be identical to the economic effects of the No Action Alternative.

13.2.6 Alternative 5: CVP M&I Contractor Suggested WSP

Implementation of the CVP M&I Contractor Suggested WSP could result in similar economic impacts as the No Action Alternative. Allocations under Alternative 5 would be similar to those under the No Action Alternative; therefore, economic effects generated by Alternative 5 would be similar to ~~or less that~~ the economic effects of the No Action Alternative. Chapter 4 presents water supplies under Alternative 5 relative to the No Action Alternative. Approximately 1,000 AF of additional CVP water would be made available for delivery to SOD M&I water service contractors in all but wet water years and reductions in SOD agricultural deliveries less than 500 AF in all water years when compared to the No Action Alternative. The resulting economic effects from this change in water supply would be minimal relative to the No Action Alternative.

13.3 Mitigation Measures

No mitigation measures are identified for the adverse impacts anticipated in Alternatives 2 and 3.

13.4 Unavoidable Adverse Impacts

~~None of the action alternatives would result in unavoidable adverse impacts on regional economics.~~

Alternative 2 would have adverse impacts to regional economies due to decreased CVP deliveries to M&I contractors, including decreases in output, employment, labor income, and value added. In the Bay Area Region, adverse effects may be more than estimated due to model limitations and need for further conservation. Additional conservation over the No Action Alternative may be needed. M&I conservation measures would reduce volume of water sold and revenues to water supply contractors, which could cause customer rates to further increase.

Alternative 3 would have adverse impacts to regional economies in the Sacramento Valley and Tulare Lake regions due to decreased CVP deliveries to agricultural contractors, including decreases in output, employment, labor income, and value added.

13.5 Cumulative Effects

The timeline for the socioeconomics 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 13-1. The following section analyzes the cumulative effects using the project and projection method, which is further described in Chapter 20, Cumulative Effects Methodology.

13.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Providing equal allocations to agricultural and M&I water service contractors, in combination with other cumulative projects, could result in economic effects to M&I water users and the regional economy. The Bureau of Reclamation, California Department of Water Resources, and local water agencies are implementing water management activities that could result in cumulative effects to M&I water contractors in combination with the M&I WSP. Activities could affect water supplies and costs for M&I water contractors and their customers. State and Federal projects considered as part of this cumulative analysis include Long-Term Water Transfers, SWP transfers, Bay-Delta Conservation Plan (BDCP), Shasta Lake Water Resources Investigation, Upper San Joaquin Storage Investigation, San Luis Low Point Improvement Project, North of Delta Off-Stream Storage Investigation, and the San Joaquin River Restoration Program.

The cumulative projects listed above are being implemented to improve water management, supplies, and reliability, among other purposes, such as ecosystem restoration. Improved water supplies would benefit urban areas by providing more reliable water supplies for existing and new business and residential developments. Increase water supply reliability could attract businesses and residents to the region, which would increase output, employment, and income in the regional economies. Improved water supplies would also maintain indoor and outdoor water uses, which could attract new residents to the area.

Depending on the financing of the projects, customer water rates could increase as a result of these cumulative projects, which would reduce discretionary income in the region. This would reduce spending in the regional economy, which would be an adverse impact. The positive effects from increased business and residential development would likely offset these adverse effects in the regional economy.

Long-term water transfers and SWP transfers would be an additional water supply option for M&I water service contractors during dry and critical years. Transfers are typically annual transactions to supplement existing water supplies. Transfers would have similar effects as described above, but would be only occur during the year of the transfer. Transfers would not occur in all years.

Population growth would also contribute to cumulative economic impacts. Table 13-38 shows population projections in the Bay Area Region counties.

Table 13-38. Population Projections in the Bay Area and American River Regions

County	2015 Population	2030 Population	Total Growth Rate (%) 2015 to 2030
Alameda	1,577,938	1,657,567	5%
Contra Costa	1,093,171	1,254,205	15%
San Benito	57,512	69,215	20%
Santa Clara	1,874,604	1,986,545	6%
Sacramento	1,477,479	1,708,114	16%
Placer	371,536	442,505	19%
El Dorado	184,195	234,485	27%

Source: California Department of Finance 2013

Population growth would increase the demand for housing and services, resulting in new construction and urban development. Urban development would be associated with new businesses in the area, which would increase county revenues and provide employment opportunities. This would result in positive economic effects under the cumulative condition.

Alternative 2 would reduce water supplies to M&I contractors in dry and critical years because of the equal allocation with agricultural contractors. This would be an adverse cumulative impact to the M&I water users and the regional economy. The cumulative projects listed above would offset some of these effects by providing increased water supplies, particularly during dry and critical years. Increased population growth would also benefit the regional economy. The incremental cumulative impacts of Alternative 2 on M&I water users and the regional economy would be minor.

Providing equal allocations to agricultural and M&I water service contractors, in combination with other cumulative projects, could result in economic effects to crop value of production and the regional economy. Projects considered as part of this cumulative analysis include Long-Term Water Transfers, SWP transfers, the BDCP, Shasta Lake Water Resources Investigation, Upper San Joaquin Storage Investigation, San Luis Low Point Improvement Project, North of Delta Off-Stream Storage Investigation, and the San Joaquin River Restoration Program. These projects could increase water supplies for CVP agricultural water contractors. With increased and more reliable water supplies, growers could increase crop acreage planted or switch to higher value crops. Crop value of production would increase output, employment, and income in the regional economy. These projects would result in cumulative benefits to the regional economy in areas where agricultural water supplies are increased.

Population growth would also contribute to cumulative economic impacts. Table 13-39 shows projected population growth in counties with agricultural CVP contractors. Population growth would increase the demand for housing and services, resulting in new construction and urban development. Urban development would include new businesses in the area, which would increase county revenues and provide employment opportunities. The counties could use new revenues to provide services, including programs to train unskilled workers. Overall, population growth and urban development would boost the regional economies under the cumulative condition.

Table 13-39. Population Projections in Counties in the Sacramento Valley and San Joaquin Valley Regions

County	2015 Population	2030 Population	Total Growth Rate (%) 2015 to 2030
Shasta	181,792	220,019	21%
Tehama	64,733	77,437	20%
Glenn	28,871	33,552	16%
Colusa	22,417	29,023	29%
Yolo	209,198	250,414	20%
San Joaquin	725,884	1,004,147	38%
Stanislaus	540,853	674,859	25%
Madera	161,556	229,277	42%
Merced	273,156	366,352	34%
Fresno	988,970	1,241,773	26%
Kings	157,314	205,627	31%
Kern	911,750	1,341,278	47%
Tulare	473,785	630,303	33%

Source: California Department of Finance 2013

Urban development would increase agricultural land conversions and permanently remove land from agricultural production. Agricultural to urban land conversions would affect incomes and employment for farm workers and agricultural businesses in the area as crop production decreased. However, crop yield increases might outpace agricultural land conversions, conversions to higher-value crops would increase value of production, and some share of urban development will include agricultural service industries. Even with land conversion, agriculture is very likely to remain a dominant sector in the regional economy in the San Joaquin Valley and Sacramento Valley under the cumulative condition.

Long-term water transfers and SWP transfers would include some level of cropland idling transfers, which would temporarily idle cropland in the Sacramento Valley during dry and critical years when transfers are implemented.

Cropland idling transfers would reduce output, employment, and income in the regional economy due to less acreage being planted.

Alternative 2 in combination with other cumulative projects would increase water supplies during dry and critical years to CVP agricultural water contractors. Increased water supplies would benefit the regional economy by increasing value of production. This would be a cumulative benefit.

13.5.2 Alternative 3: Full M&I Allocation Preference

Providing equal allocations to agricultural and M&I water service contractors, in combination with other cumulative projects, could result in economic effects to M&I water users and the regional economy. The cumulative condition associated with other projects in the region would be the same as described for Alternative 2. Alternative 3 would increase water supplies to M&I water contractors during dry and critical years. Increased water supplies would contribute to the regional economic benefits of the other cumulative projects.

Similar to Alternative 2, water rates could increase as projects are implemented to improve future water supplies. Improved water supplies under the M&I WSP would reduce the need for CVP M&I contractors to purchase additional water supplies during dry conditions. This could reduce operational costs for M&I water contractors, a benefit which could be passed on to consumers. This would be a minor benefit to customers under the cumulative condition.

Providing equal allocations to agricultural and M&I water service contractors, in combination with other cumulative projects, could result in economic effects to crop value of production and the regional economy. The cumulative condition would be the same as described for Alternative 2. Alternative 3 in combination with other cumulative projects would decrease water supplies during dry and critical years to CVP agricultural water contractors. Decreased water supplies would adversely affect the regional economy by decreased value of production. Other cumulative projects would work to increase agricultural water supplies; however, there still may be water shortages for agricultural water service contractors in consecutive dry and critical years. This would be an adverse cumulative impact. Alternative 3 would contribute to this cumulative effect.

13.5.3 Alternative 4: CVP Updated M&I WSP

Changes in CVP water allocations under the CVP Updated M&I WSP alternative, in combination with other cumulative projects, could affect the regional economy.

The cumulative condition associated with other projects in the region would be the same as described for Alternative 2. Allocations under Alternative 4 would be similar to those under the No Action Alternative, with the exception for how historic use is calculated. Project-related impacts would be the same as those described for Alternative 2; therefore, this alternative would not contribute to cumulative impacts.

13.5.4 Alternative 5: CVP M&I Contractor Suggested WSP

Changes in CVP water allocations under the CVP M&I Contractor Suggested WSP alternative, in combination with other cumulative projects, could affect the regional economy.

The cumulative condition associated with other projects in the region would be the same as described for Alternative 2. Allocations under Alternative 5 are expected to change only slightly from the No Action Alternative. Project-related impacts would be the same as or less than those described for Alternative 2; therefore, this alternative would not contribute to cumulative impacts.

13.6 References

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Chapter 14
Environmental Justice

This chapter identifies minority and low-income populations within the area of analysis that are subject to consideration under federal and state environmental justice regulations and policies (hereafter referred to in this section as "environmental justice populations") and discusses potential environmental justice effects from the proposed alternatives. The concept of environmental justice embraces two principles: 1) fair treatment of all people regardless of race, color, nation of origin, or income; and 2) meaningful involvement of people in communities potentially affected by program actions.

The concept of environmental justice applied here is that minority and low-income people should not be adversely and disproportionately affected by economic and quality of life effects from implementation of the Central Valley Project (CVP) Municipal and Industrial Water Shortage Policy (M&I WSP). The proposed M&I WSP could change CVP deliveries to the M&I and agricultural water service contractors. Proposed water delivery changes could affect farm labor employment by reducing the amount of water received for agricultural purposes, thus reducing the amount of agricultural land in production and the number of farmworkers needed to work on agricultural fields. As a high percentage of farmworkers consist of minorities, and many farmworkers are low income, the potential for the alternatives to result in environmental justice impacts is evaluated in this chapter.

14.1 Affected Environment

This section describes the area of analysis and presents county-level demographic data in regards to environmental justice issues.

14.1.1 Area of Analysis

The area of analysis for environmental justice includes counties where CVP water service contractors are located. See Chapter 1 for a detailed list of the applicable CVP contractors. These CVP water service contractors are generally located throughout the Sacramento Valley, San Joaquin River Valley, Tulare Lake Region, and San Francisco Bay/Central Coast area. The Sacramento Valley Region falls within the North of Delta geographic area, and the San Joaquin River, Tulare Lake, and San Francisco Bay/Central Coast regions generally fall within the South of Delta geographic area. Figure 14-1 presents the environmental justice area of analysis.

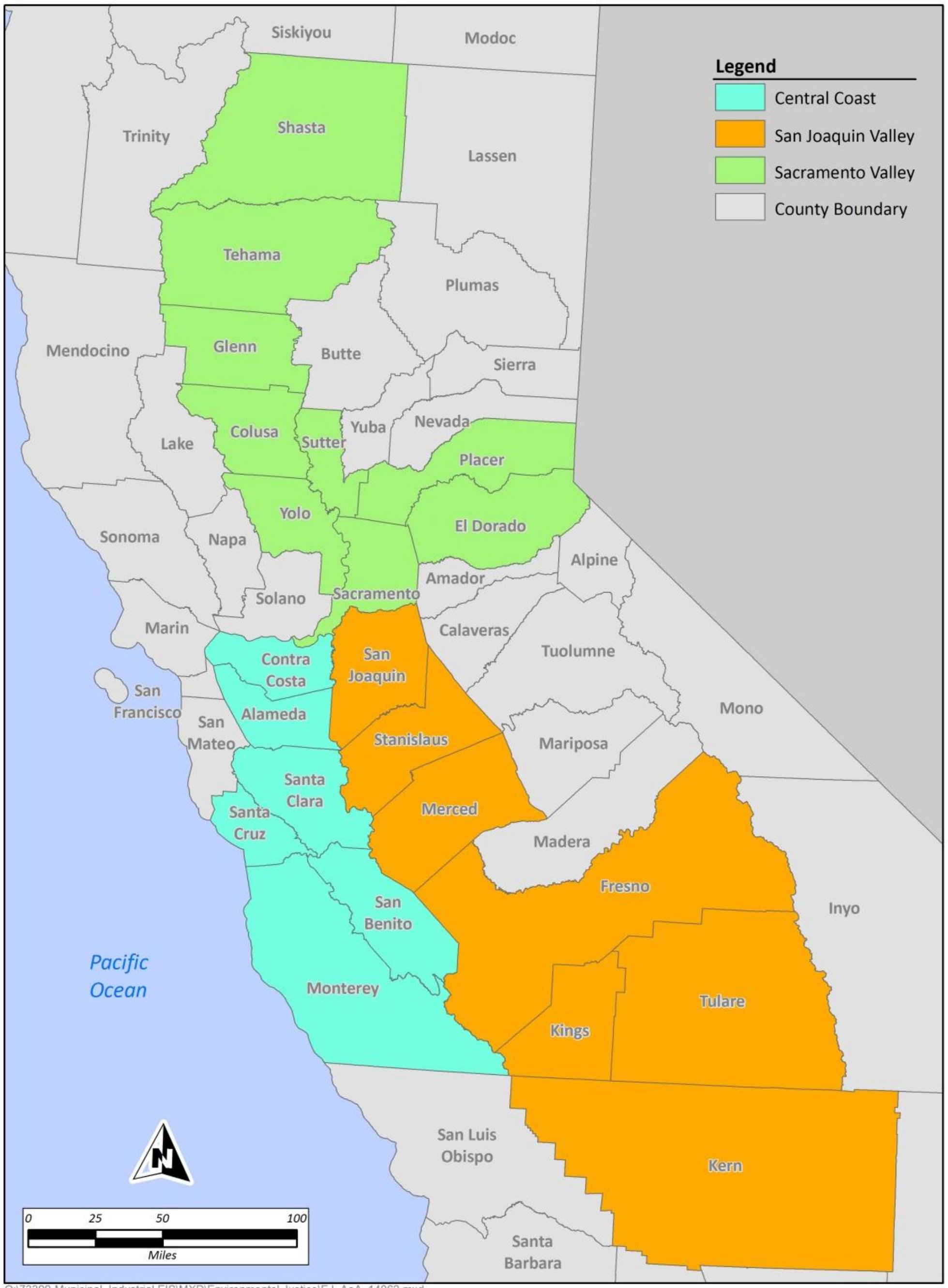

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Figure 14-1. Environmental Justice Area of Analysis

14.1.2 Regulatory Setting

The following section describes the applicable environmental justice laws, rules, regulations, and policies.

14.1.2.1 Federal

Executive Order 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued February 11, 1994, requires all federal agencies to conduct "programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under, such programs, policies, and activities, because of their race, color, or national origin." Section 1-101 of the Order requires federal agencies to identify and address "disproportionately high and adverse human health or environmental effects" of programs on minority and low-income populations.

The Council on Environmental Quality (CEQ) (1997) states that environmental justice concerns may arise from effects on the natural or physical environment, such as human health or ecological effects on minority or low-income populations, or from related social or economic effects.

14.1.2.2 State

California law defines environmental justice as the "fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies," in Government Code Section 65040.12(e). Section 65040.12(a) designates the Governor's Office of Planning and Research (OPR) as the coordinating agency in state government for environmental justice programs and directs the agency to coordinate with Federal agencies regarding environmental justice information. OPR incorporated environmental justice into the State of California *2003 General Plan Guidelines* (OPR 2003) and recommends that policies supportive of environmental justice be incorporated into all general plan elements.

14.1.2.3 Definitions

Minority The CEQ (1997) defines the term "minority" as persons from any of the following United States (U.S.) Census categories for race: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, and American Indian or Alaska Native. Additionally, for the purposes of this analysis, "minority" also includes all other nonwhite racial categories, such as "some other race" and "two or more races." The CEQ also mandates that persons identified through the U.S. Census as ethnically Hispanic, regardless of race, should be included in minority counts (CEQ 1997). Hispanic origin is considered to be an ethnic category separate from race, according to the U.S. Census. For this analysis, regional populations for CVP water service contractor counties were compared to the State of California as a whole. Regional minority populations exceeding 50 percent of the total regional population were considered environmental justice populations.

Low-Income The U.S. Census Bureau uses a set of money income thresholds that vary by family size and composition to establish who falls below the poverty level (low-income). If a family's total income is less than the poverty threshold, then that family and every individual in it is considered in poverty. The official poverty thresholds do not vary geographically, but are updated for inflation using the Consumer Price Index. The official poverty definition uses money income before taxes and does not include capital gains or noncash benefits (such as public housing, Medicaid, and food stamps). A "poverty area" or low-income population is where 20 percent or more of the population lives in poverty. An "extreme poverty area" or area of concentrated poverty is where 40 percent or more of the population lives in poverty (U.S. Census Bureau, 2010a).

14.1.3 Existing Conditions

The following section describes the existing environmental justice conditions within the study area.

14.1.3.1 Existing Regional Demographic and Economic Characteristics

This section presents the existing demographic and economic characteristic census data from the 2012 American Community Survey Estimates by the U.S. Census Bureau for the area of analysis. Information for the State of California as a whole is presented for comparison purposes. See Chapter 14.2.1 below for assessment methodology on the identified thresholds to determine a minority or low-income affected area. Tables 14-1 and 14-2 below present demographic and economic characteristic data for the area of analysis by demographic regions.

Sacramento Valley The CVP water service contractors within the Sacramento Valley have service areas within Colusa, El Dorado, Glenn, Placer, Sacramento, Shasta, Sutter, Tehama, and Yolo counties. As shown in Table 14-1, the populations of Colusa, Sacramento, Sutter, and Yolo counties exhibit a total minority proportion exceeding 50 percent. These counties are considered minority affected areas. Colusa County is the only county that has a Hispanic ethnic population that exceeds the State average of 38.2 percent, suggesting that the high total minority percentage in the region is closely related to the proportion of Hispanic residents.

As shown in Table 14-2, Sacramento, Shasta, Sutter and Tehama counties have higher poverty rates compared to the state average of 12.9 percent. However, none of the Sacramento Valley counties exceed the poverty threshold for a poverty area or area of concentrated poverty. Therefore, there are no areas defined as low-income affected areas in the Sacramento Valley region.

Table 14-1. 2012 County Demographic Characteristics by County for the Area of Analysis

Geographic Area	Total Population	Race[1]							Hispanic Origin[2]		Total Minority[5]
		White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	White Alone, Non-Hispanic[3]	All Race, Hispanic[4]	
Sacramento Valley											
Colusa	**21,421 (100%)**	**16,733 (78.1%)**	**111 (0.5%)**	**250 (1.2%)**	**238 (1.1%)**	**4 (0.0%)**	**3,054 (14.3%)**	**1,031 (4.8%)**	**8,376 (39.1%)**	**11,976 (55.9%)**	**13,045 (60.8%)**
El Dorado	180,866 (100%)	158,399 (87.4%)	1,349 (0.7%)	2,057 (1.1%)	6,597 (3.6%)	28 (0.0%)	6,203 (3.4%)	6,467 (3.6%)	144,294 (79.8%)	22,028 (12.2%)	36,573 (20.2%)
Glenn	28,090 (100%)	23,707 (84.4%)	244 (0.9%)	589 (2.1%)	734 (2.6%)	0 (0.0%)	1,854 (6.6%)	962 (3.4%)	17,381 (61.9%)	10,709 (38.1%)	13,709 (48.8%)
Placer	356,331 (100%)	299,130 (83.9%)	4,235 (1.2%)	2,614 (0.7%)	22,793 (6.4%)	664 (0.2%)	12,057 (3.4%)	14,838 (4.2%)	268,757 (74.5%)	46,604 (13.1%)	87,574 (24.5%)
Sacramento	**1,436,233 (100%)**	**859,876 (59.9%)**	**144,247 (10.0%)**	**13,352 (0.9%)**	**209,317 (14.6%)**	**14,640 (1.0%)**	**101,673 (7.1%)**	**93,128 (6.5%)**	**687,161 (47.8%)**	**313,586 (31.8%)**	**749,072 (52.1%)**
Shasta	177,980 (100%)	155,956 (87.6%)	1,789 (1.0%)	4,667 (2.6%)	4,323 (2.4%)	308 (0.2%)	3,230 (1.8%)	7,707 (4.3%)	145,805 (81.9%)	15,389 (8.6%)	32,175 (18.0%)
Sutter	**95,022 (100%)**	**66,209 (69.7%)**	**1,412 (1.5%)**	**1,600 (1.7%)**	**13,962 (14.7%)**	**51 (0.1%)**	**6,248 (6.6%)**	**5,540 (5.8%)**	**46,358 (48.8%)**	**27,878 (29.3%)**	**48,644 (51.2%)**
Tehama	63,488 (100%)	55,925 (88.1%)	393 (0.6%)	1,279 (2.0%)	568 (0.9%)	311 (0.5%)	2,250 (3.5%)	2,762 (4.4%)	45,313 (71.4%)	14,237 (22.4%)	18,175 (28.6%)
Yolo	**204,118 (100%)**	**136,360 (66.8%)**	**5,129 (2.5%)**	**1,806 (0.9%)**	**28,186 (13.8%)**	**640 (0.3%)**	**20,778 (10.2%)**	**11,219 (5.5%)**	**99,667 (48.8%)**	**63,340 (31.0%)**	**104,451 (51.1%)**
San Joaquin Valley											
Fresno	**940,493 (100%)**	**533,459 (56.7%)**	**47,433 (5.0%)**	**9,534 (1.0%)**	**90,960 (9.7%)**	**1,373 (0.1%)**	**218,696 (23.3%)**	**39,038 (4.2%)**	**302,405 (32.2%)**	**477,827 (50.8%)**	**638,088 (67.8%)**
Kern	**849,101 (100%)**	**618,684 (72.9%)**	**48,013 (5.7%)**	**11,030 (1.3%)**	**36,597 (4.3%)**	**1,087 (0.1%)**	**103,573 (12.2%)**	**30,117 (3.5%)**	**321,827 (37.9%)**	**423,057 (48.9%)**	**527,274 (62.0%)**
Kings	**151,869 (100%)**	**112,399 (74.0%)**	**10,049 (6.6%)**	**1,704 (1.1%)**	**6,109 (4.0%)**	**301 (0.2%)**	**15,103 (9.9%)**	**6,204 (4.1%)**	**53,055 (34.9%)**	**78,299 (51.6%)**	**98,824 (65.0%)**
Merced	**259,716 (100%)**	**176,054 (67.8%)**	**9,636 (3.7%)**	**2,444 (0.9%)**	**19,935 (7.7%)**	**611 (0.2%)**	**42,780 (16.5%)**	**8,256 (3.2%)**	**80,910 (31.2%)**	**144,339 (55.6%)**	**178,806 (68.8%)**
San Joaquin	**695,251 (100%)**	**414,182 (59.6%)**	**50,312 (7.2%)**	**7,281 (1.0%)**	**99,900 (14.4%)**	**3,815 (0.5%)**	**73,772 (10.6%)**	**45,989 (6.6%)**	**273,524 (35.3%)**	**245,521 (39.3%)**	**421,727 (60.6%)**

Geographic Area	Total Population	Race[1]							Hispanic Origin[2]		Total Minority[5]
		White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	White Alone, Non-Hispanic[3]	All Race, Hispanic[4]	
Stanislaus	**521,726 (100%)**	**395,749 (75.9%)**	**14,118 (2.7%)**	**3,515 (0.7%)**	**27,678 (5.3%)**	**3,884 (0.7%)**	**54,101 (10.4%)**	**22,681 (4.3%)**	**237,445 (45.5%)**	**224,498 (43.0%)**	**284,281 (54.4%)**
Tulare	**447,704 (100%)**	**358,270 (80.0%)**	**7,646 (1.7%)**	**5,533 (1.2%)**	**14,899 (3.3%)**	**484 (0.1%)**	**44,205 (9.9%)**	**16,667 (3.7%)**	**142,811 (31.9%)**	**274,299 (61.3%)**	**304,893 (68.1%)**
San Francisco Bay/Central Coast											
Alameda	**1,533,311 (100%)**	**703,935 (45.9%)**	**186,671 (12.2%)**	**8,686 (0.6%)**	**408,229 (26.6%)**	**13,251 (0.9%)**	**123,505 (8.1%)**	**89,034 (5.8%)**	**515,525 (33.6%)**	**346,799 (22.6%)**	**1,017,786 (66.3%)**
Contra Costa	**1,066,333 (100%)**	**678,055 (63.6%)**	**97,637 (9.2%)**	**5,322 (0.5%)**	**155,161 (14.6%)**	**5,076 (0.5%)**	**66,888 (6.3%)**	**58,194 (5.5%)**	**502,969 (47.2%)**	**262,306 (24.6%)**	**563,364 (52.8%)**
Monterey	**421,570 (100%)**	**315,076 (74.7%)**	**12,134 (2.9%)**	**4,272 (1.0%)**	**26,869 (6.4%)**	**2,259 (0.5%)**	**46,160 (10.9%)**	**14,800 (3.5%)**	**136,555 (32.4%)**	**235,968 (56.0%)**	**285,015 (67.6%)**
San Benito	**56,210 (100%)**	**47,911 (85.2%)**	**616 (1.1%)**	**472 (0.8%)**	**1,095 (1.9%)**	**0 (0.0%)**	**4,020 (7.2%)**	**2,096 (3.7%)**	**21,206 (37.7%)**	**32,002 (56.9%)**	**35,004 (62.2%)**
Santa Clara	**1,811,955 (100%)**	**913,156 (50.4%)**	**47,906 (2.6%)**	**10,189 (0.6%)**	**590,243 (32.6%)**	**7,021 (0.4%)**	**164,157 (9.1%)**	**79,283 (4.4%)**	**626,825 (34.6%)**	**487,897 (22.6%)**	**1,185,130 (65.4%)**
Santa Cruz	266,776 (100%)	221,730 (83.1%)	3,020 (1.1%)	1,952 (0.7%)	10,991 (4.1%)	521 (0.2%)	16,308 (6.1%)	12,254 (4.6%)	156,629 (58.7%)	87,299 (32.7%)	110,147 (41.2%)
California	**38,041,430 (100%)**	**23,628,545 (62.1%)**	**2,263,723 (6.0%)**	**285,342 (0.8%)**	**5,120,354 (13.5%)**	**146,712 (0.4%)**	**4,912,894 (12.9%)**	**1,683,860 (4.4%)**	**14,904,055 (39.2%)**	**14,537,661 (38.2%)**	**23,137,375 (60.8%)**

Source: U.S. Census Bureau 2012.

Notes:

[1] A minority is defined as a member of the following population groups: American Indian/Alaskan Native, Asian or Pacific Islander, Black (non-Hispanic), or Hispanic.

[2] The term "Hispanic" is an ethnic category and can apply to members of any race, including respondents who self-identified as "White." The total numbers of Hispanic residents for each geographic region are tabulated separately from the racial distribution by the U.S. Census Bureau.

[3] "White Alone-Non Hispanic" includes people who reported "White" and no other race group and did not report being "Hispanic."

[4] "All Race, Hispanic" includes all people regardless of race that reported being "Hispanic."

[5] "Total Minority" is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race with the total for "Not Hispanic or Latino: While Alone" subtracted from the total population.

Key:

Boldface denotes areas with meaningfully greater total minority proportion (more than 50 percent).

% = percent

Table 14-2. 2012 Economic Characteristics by County for the Area of Analysis

Geographic Area/County	Percent Population Below Poverty Threshold[3]	Geographic Area/County	Percent Population Below Poverty Threshold[3]
Sacramento Valley		**San Joaquin Valley**	
Colusa	12.1%	**Fresno**	**22%**
El Dorado	6.4%	Kern	19.1%
Glenn	12.0%	Kings	17.8%
Placer	6.4%	**Merced**	**21.0%**
Sacramento	13.8%	San Joaquin	14.7%
Shasta	12.7%	Stanislaus	17.4%
Sutter	16.8%	**Tulare**	**22.0%**
Tehama	14.9%		
Yolo	8.5%		
San Francisco Bay/Central Coast			
Alameda	9.3%		
Contra Costa	12.1%		
Monterey	13.0%		
San Benito	9.1%		
Santa Clara	7.1%		
Santa Cruz	7.8%		
California	12.9%		

Source: U.S. Census Bureau 2012.

Key:

Boldface denotes areas that exceed the poverty rate thresholds for either a poverty area (20 percent or more) or an area of extreme poverty (40 percent or more).

% = percent

San Joaquin Valley The CVP water service contractors within the San Joaquin Valley have service areas within Fresno, Kern, Kings, Merced, San Joaquin, Stanislaus, and Tulare counties. As shown in Table 14-1, all of the San Joaquin Valley counties exhibit a total minority proportion exceeding 50 percent. All of these counties are considered minority affected areas. Fresno, Kings, Merced and Tulare counties all have large Hispanic or Latino ethnic populations, above 50 percent and higher than the state average, suggesting that the high total minority percentage in the region is closely related to the proportion of Hispanic residents.

All of the San Joaquin Valley counties have higher poverty rates compared to the state average. As shown in Table 14-2, Fresno, Merced, and Tulare counties have poverty rates that exceed the 20 percent poverty threshold for a low-income area. These three counties are considered poverty areas. None of the counties within the San Joaquin Valley are considered extreme poverty areas.

San Francisco Bay/Central Coast The CVP water service contractors within the San Francisco Bay/Central Coast have service areas within Alameda, Contra Costa, Monterey, San Benito, Santa Clara, and Santa Cruz counties. As shown in Table 14-1, all of the San Francisco Bay/Central Coast counties except Santa Cruz exhibit a total minority population exceeding 50 percent. These counties are considered minority affected areas. Monterey and San Benito counties both have Hispanic ethnic populations above 50 percent and higher than the state average, suggesting that the high total minority percentage in these counties is closely related to the proportion of Hispanic residents.

Most of the San Francisco Bay/Central Coast counties have poverty rates that are lower than the state average, with the exception of Monterey County, which has a slightly higher poverty rate compared to the state average. As shown in Table 14-2, none of the San Francisco Bay/Central Coast counties exceed the poverty rate threshold for a poverty area or area of concentrated poverty. There are no low-income affected areas in the San Francisco Bay/Central Coast.

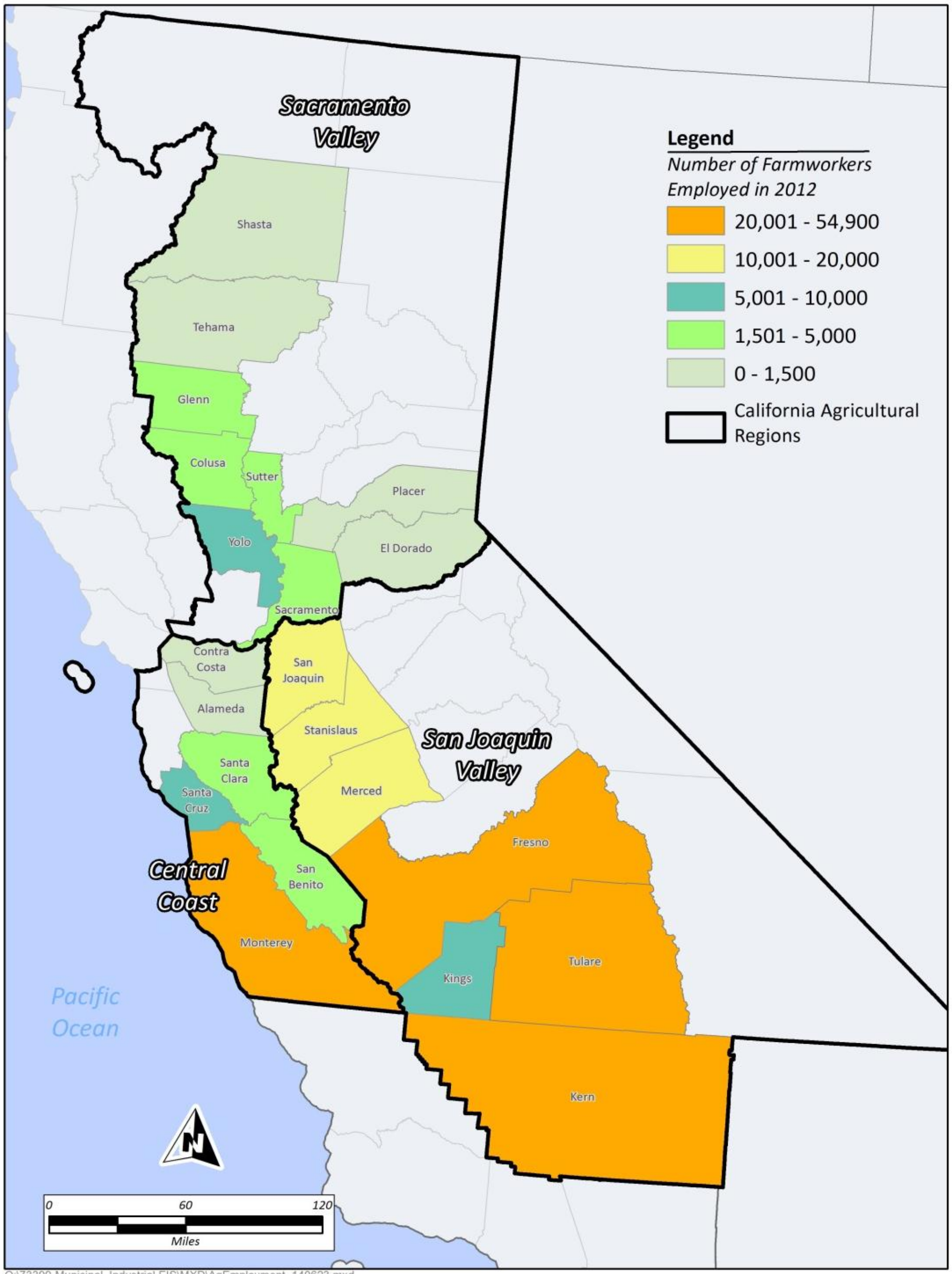
14.1.3.2 Farmworker Employment

According to EDD's 2008 Agricultural Report, Hispanics comprised 67.9 percent, or two-thirds, of the State's agricultural employment in 2008. Fourteen percent of farmworkers reported unemployment and half reported an annual family income of less than $35,000. The majority of employed farmworkers earned $10 or less per hour. Based on these statistics, it is assumed that the majority of California farmworkers are minority and low-income, and could be affected by changes in CVP water supply deliveries.

Figure 14-2 presents the distribution of 2012 farmworker employment in the Sacramento and San Joaquin Valley and Central Coast Agricultural Employment Regions.

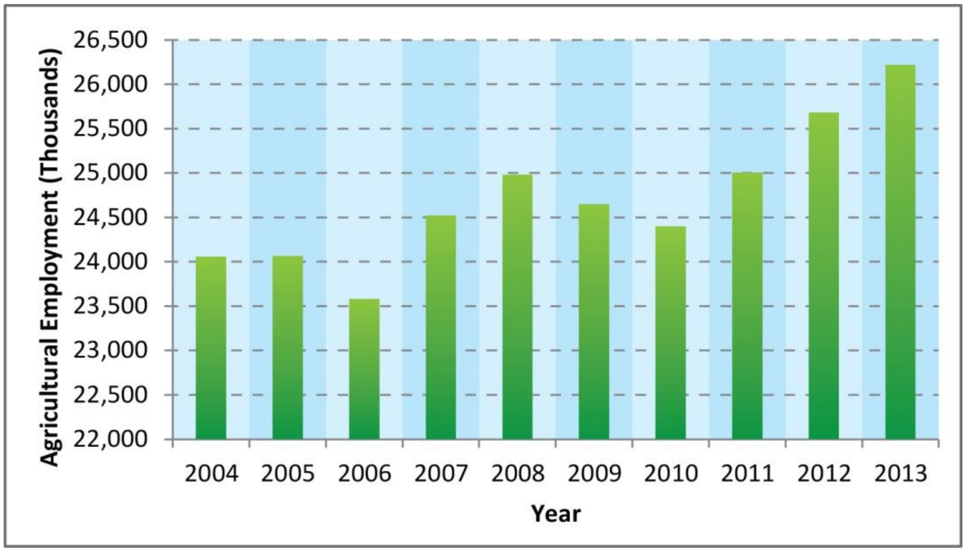
Sacramento Valley Counties within the Sacramento Valley are considered a part of the Sacramento Valley Agricultural Employment Region. Figure 14-2 shows that, in 2012, El Dorado, Placer, Shasta, and Tehama counties all employed between zero and 1,500 farmworkers; Colusa, Glenn, Sacramento, and Sutter counties all employed between 1,501 and 5,000 farmworkers; and Yolo County employed the most farmworkers in the region, between 5,001 and 10,000 (California Economic Development Department [EDD] 2012b).

Figure 14-3 shows historical farmworker employment for the Sacramento Valley region. In 2013, the Sacramento Valley region employed over 26,000 farmworkers. In 2006, farmworker employment was the lowest for the region, employing approximately 23,500 farmworkers. The Sacramento Valley region comprised approximately 6.5 percent of the State's agricultural employment in 2012 (EDD 2012b and EDD 2013).



Source: EDD 2012a.

Figure 14-2. California Farmworker Employment, 2012

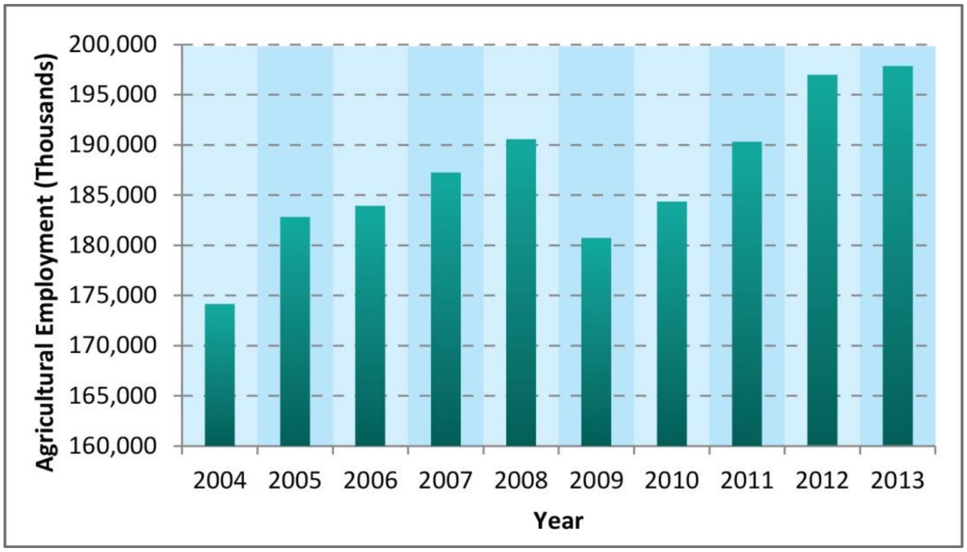


Source: EDD 2013.

Figure 14-3. Sacramento Valley Region Historical Farmworker Employment

San Joaquin Valley Counties within the San Joaquin Valley are considered a part of the San Joaquin Valley Agricultural Employment Region. Figure 14-2 shows that, in 2012, Kings County employed between 5,001 and 10,000 farmworkers; Merced, San Joaquin, and Stanislaus counties all employed between 10,001 and 20,000 farmworkers; and Fresno, Kern, and Tulare counties all employed the most farmworkers in the region, between 20,001 and 54,900 (EDD 2012b).

Figure 14-4 shows historical farmworker employment for the San Joaquin Valley region. For the past ten years, the San Joaquin Valley region has consistently employed over 170,000 farmworkers. The region experienced a decline in farmworker employment in 2009, but increased to exceed 2008 levels by 2011. The San Joaquin Valley region comprised approximately 49.5 percent of the State's agricultural employment in 2012 (EDD 2012b, EDD 2013).

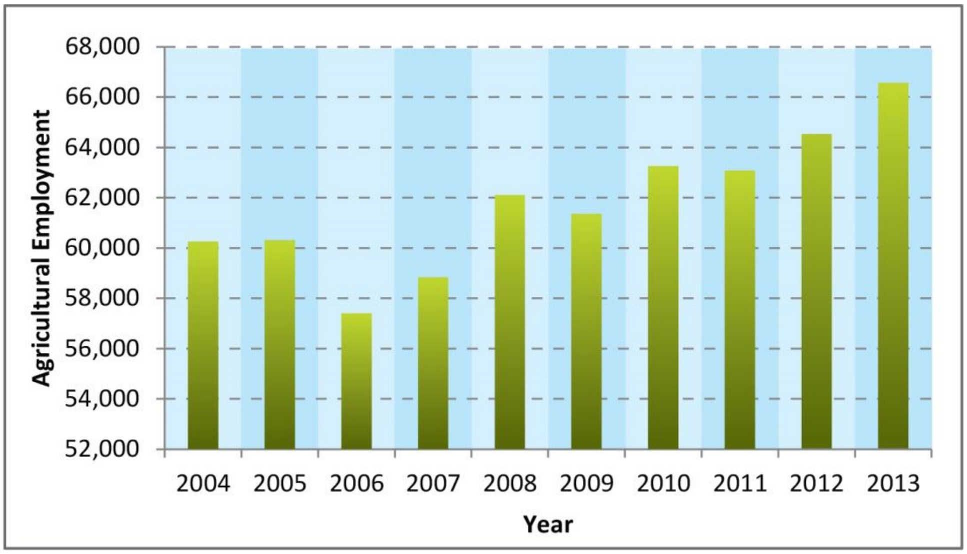


Source: EDD 2013.

Figure 14-4. San Joaquin Valley Region Historical Farmworker Employment

San Francisco Bay/Central Coast Counties within the San Francisco Bay/Central Coast are considered a part of the Central Coast Agricultural Employment Region. Figure 14-2 shows that in 2012, Alameda and Contra Costa counties employed between zero and 1,500 farmworkers, San Benito and Santa Clara counties employed between 1,501 and 5,000 farmworkers, Santa Cruz County employed between 5,001 and 5,000 farmworkers, and Monterey County employed the most farmworkers, between 20,001 and 54,900 (EDD 2012b).

Figure 14-5 shows historical farmworker employment for the San Francisco Bay/Central Coast region. Farmworker employment in the San Francisco Bay/Central Coast region has fluctuated over the past ten years, employing anywhere between 57,000 and 66,000 farmworkers, with the highest employed years being the past two years, 2012 and 2013. As a whole, the San Francisco Bay/Central Coast region comprised approximately 16.2 percent of the State's agricultural employment in 2012 (EDD 2012b and EDD 2013).



Source: EDD 2013.

Figure 14-5. San Francisco Bay/Central Coast Region Historical Farmworker Employment

Tables 14-3 through 14-5 describe demographic and economic characteristic data from the U.S. Department of Agriculture 2012 Census of Agriculture, U.S. Census Bureau's 2010 Census, and EDD's 2008 Agricultural Report. Information for the State of California as a whole is presented for comparison purposes.

Table 14-3 presents the racial and ethnic composition of farm operators in CVP water service contractor counties. These data show that the vast majority of farm operators in all counties are White, with the lowest percentage exhibited by Sutter County (71.4 percent), which has a large percentage of Asian operators (20.8 percent). In Glenn, Yolo, Fresno, Kings, Merced, Tulare, Monterey, San Benito and Santa Cruz counties, Hispanic farm operators are higher than the state average (11.9 percent).

Table 14-4 presents the racial and ethnic composition of laborers and helpers in the CVP water service contractor counties. Information for the State of California as a whole is presented for comparison purposes. The category "laborers and helpers" excludes construction personnel, as they are captured under a different category by the U.S. Census Bureau; however, the category is not necessarily exclusive to farm laborers and the data may include other manual labor sectors as part of the total. Regardless, the race and ethnic composition of this sector suggests that laborers and helpers, as an employment sector, are generally of minority status within the area of analysis, with Hispanics comprising the largest proportion of laborers and helpers, in most cases exceeding the percentage of Hispanics in sector statewide (58.5 percent). These data suggest that impacts to the agricultural industry could be considered to disproportionately accrue to environmental justice populations. According to the CEQ guidance (1997), agencies may consider environmental justice communities either as a group of individuals living in geographic proximity to one other, or "a geographically dispersed/transient set of individuals (such as migrant workers or Native American[s]), where either type of group experiences common conditions of environmental exposure or effect."

Table 14-5 presents median annual wage information for farming occupations in the CVP water service contractor counties. While these data do not demonstrate as clearly as the U.S. Census data the proportion of residents living below the poverty threshold, the information presented in this table does suggest that median incomes in the farming industry are lower than the median income for all industries, with less skilled workers (graders and sorters, equipment operators, and farmworkers) earning less than 50 percent of the median wage in the state. These data also suggest that impacts to the agricultural industry could be considered to disproportionately accrue to environmental justice populations.

Table 14-3. 2012 Farm Operators Demographic Characteristics by County

Geographic Area/County	Total Farm Operators	White	Black/African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Two or More Races	Spanish, Hispanic or Latino Origin
Sacramento Valley								
Colusa	1,372 (100%)	1,246 (90.8%)	2 (0.1%)	10 (0.7%)	44 (3.2%)	8 (0.5%)	7 (0.5%)	151 (11.0%)
El Dorado	2,289 (100%)	2,061 (90.0%)	14 (0.6%)	43 (1.8%)	86 (3.7%)	17 (0.7%)	37 (1.6%)	114 (4.9%)
Glenn	2,122 (100%)	1,935 (91.1%)	11 (0.5%)	19 (0.8%)	64 (3.0%)	1 (0.0%)	19 (0.8%)	272 (12.8%)
Placer	2,294 (100%)	2,080 (90.6%)	1 (0.0%)	34 (1.4%)	127 (5.5%)	NA	12 (0.5%)	110 (4.7%)
Sacramento	2,301 (100%)	1,855 (80.6%)	9 (0.3%)	23 (0.9%)	282 (12.2%)	1 (0.0%)	23 (0.9%)	159 (6.9%)
Shasta	2,488 (100%)	2,283 (91.7%)	1 (0.0%)	78 (3.1%)	10 (0.4%)	14 (0.5%)	61 (2.4%)	169 (6.7%)
Sutter	2,297 (100%)	1,641 (71.4%)	3 (0.1%)	41 (1.7%)	479 (20.8%)	13 (0.5%)	29 (1.2%)	179 (7.7%)
Tehama	2,841 (100%)	2,638 (92.8%)	23 (0.8%)	74 (2.6%)	31 (1.0%)	23 (0.8%)	17 (0.5%)	285 (10.0%)
Yolo	1,759 (100%)	1,486 (84.4%)	15 (0.8%)	20 (1.1%)	113 (6.4%)	7 (0.3%)	12 (0.6%)	222 (12.6%)
San Joaquin Valley								
Fresno	9,000 (100%)	6,964 (77.3%)	52 (0.5%)	140 (1.5%)	1,499 (16.6%)	36 (0.4%)	71 (0.7%)	1,616 (17.9%)
Kern	3,356 (100%)	2,908 (86.6%)	17 (0.5%)	62 (1.8%)	192 (5.7%)	1 (0.0%)	36 (1.0%)	364 (10.8%)
Kings	1,941 (100%)	1,621 (83.5%)	13 (0.6%)	29 (1.4%)	74 (3.8%)	7 (0.3%)	8 (0.4%)	235 (12.1%)
Merced	4,170 (100%)	3,585 (85.9%)	13 (0.3%)	41 (0.9%)	323 (7.7%)	35 (0.8%)	14 (0.3%)	572 (13.7%)
San Joaquin	5,685 (100%)	5,051 (88.8%)	21 (0.3%)	61 (1.0%)	341 (5.9%)	15 (0.2%)	40 (0.7%)	580 (10.2%)

Geographic Area/County	Total Farm Operators	White	Black/African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Two or More Races	Spanish, Hispanic or Latino Origin
Stanislaus	6,567 (100%)	6,089 (92.7%)	18 (0.2%)	106 (1.6%)	153 (2.3%)	31 (0.4%)	56 (0.8%)	762 (11.6%)
Tulare	7,550 (100%)	6,710 (88.8%)	23 (0.3%)	161 (2.1%)	1 (0.0%)	22 (0.2%)	27 (0.3%)	1,664 (22.0%)
San Francisco Bay/Central Coast								
Alameda	792 (100%)	697 (88.0%)	NA	10 (1.2%)	43 (5.4%)	1 (0.0%)	NA	89 (11.2%)
Contra Costa	901 (100%)	834 (92.5%)	1 (0.0%)	14 (1.5%)	44 (4.8%)	2 (0.2%)	3 (0.3%)	83 (9.2%)
Monterey	2,092 (100%)	1,725 (82.4%)	10 (0.4%)	26 (1.2%)	128 (6.1%)	15 (0.7%)	10 (0.4%)	349 (16.6%)
San Benito	1,015 (100%)	939 (92.5%)	3 (0.2%)	18 (1.7%)	24 (2.3%)	NA	3 (0.2%)	179 (17.6%)
Santa Clara	1,499 (100%)	1,154 (76.9%)	7 (0.4%)	8 (0.5%)	277 (18.4%)	26 (1.7%)	9 (0.6%)	147 (9.8%)
Santa Cruz	1,098 (100%)	937 (85.3%)	2 (0.1%)	12 (1.0%)	82 (7.4%)	4 (0.3%)	12 (1.0%)	158 (14.3%)
California	126,099 (100%)	111,141 (88.1%)	526 (0.4%)	1,761 (1.3%)	7,474 (5.9%)	455 (0.3%)	1,030 (0.8%)	15,123 (11.9%)

Source: U.S. Department of Agriculture (USDA) 2012.

Notes:

"Total Minority" cannot be computed from the data provided by the USDA Agriculture Census, as a tabulation of "White Alone, Non-Hispanic" farm operators is not provided.

Key:

% = percent

NA = applicable data not available for this jurisdiction

Table 14-4. 2012 Laborers and Helpers Demographic Characteristics by County

Geographic Area/County	Total Laborers and Helpers	Hispanic Origin[2] White Alone, Non-Hispanic[3]	All Race, Hispanic[4]	Total Minority[5]
Sacramento Valley				
Colusa	**1,715 (100%)**	**575 (33.5%)**	**875 (51.0%)**	**1,140 (66.4%)**
El Dorado	**2,670 (100%)**	**440 (16.5%)**	**405 (15.2%)**	**2,230 (83.5%)**
Glenn	**1,755 (100%)**	**605 (34.5%)**	**475 (27.1%)**	**1,150 (65.5%)**
Placer	**4,850 (100%)**	**1,095 (22.6%)**	**645 (13.3%)**	**3,755 (77.4%)**
Sacramento	**24,210 (100%)**	**6,165 (25.5%)**	**4,940 (20.4%)**	**18,045 (74.5%)**
Shasta	**3,510 (100%)**	**365 (10.4%)**	**305 (8.7%)**	**3,145 (89.6%)**
Sutter	**4,360 (100%)**	**1,545 (35.4%)**	**1,135 (26.0%)**	**2,815 (64.5%)**
Tehama	**2,745 (100%)**	**695 (25.3%)**	**880 (32.1%)**	**2,050 (74.6%)**
Yolo	**5,210 (100%)**	**1,935 (37.1%)**	**1,325 (25.4%)**	**3,275 (62.8%)**
San Joaquin Valley				
Fresno	46,120 (100%)	24,800 (53.8%)	14,910 (32.3%)	21,320 (46.2%)
Kern	42,700 (100%)	22,205 (52.0%)	13,585 (31.8%)	20,495 (47.9%)
Kings	9,520 (100%)	6,415 (67.4%)	1,615 (17.0%)	3,105 (32.6%)
Merced	**13,835 (100%)**	**6,175 (44.6%)**	**4,625 (33.4%)**	**7,660 (55.3%)**
San Joaquin	**22,330 (100%)**	**8,845 (39.6%)**	**6,855 (30.7%)**	**13,485 (60.3%)**
Stanislaus	16,835 (100%)	8,530 (50.7%)	3,245 (19.3%)	8,350 (49.3%)
Tulare	33,275 (100%)	22,920 (68.9%)	6,690 (20.1%)	10,355 (31.1%)

Geographic Area/County	Total Laborers and Helpers	Hispanic Origin[2]		Total Minority[5]
		White Alone, Non-Hispanic[3]	All Race, Hispanic[4]	
San Francisco Bay/Central Coast				
Alameda	**23,450 (100%)**	**5,835 (24.9%)**	**5,715 (24.4%)**	**17,615 (75.1%)**
Contra Costa	**17,885 (100%)**	**5,670 (31.7%)**	**4,265 (23.8%)**	**12,215 (68.2%)**
Monterey	30,715 (100%)	20,320 (66.2%)	7,735 (25.2%)	10,395 (33.8%)
San Benito	**3,350 (100%)**	**1,135 (33.9%)**	**1,840 (54.9%)**	**2,215 (66.1%)**
Santa Clara	**23,410 (100%)**	**7,725 (33.0%)**	**7,245 (30.9%)**	**15,685 (67.0%)**
Santa Cruz	**2,950 (100%)**	**880 (21.5%)**	**480 (11.7%)**	**2,070 (70.1%)**
California	**870,025 (100%)**	**360,550 (41.4%)**	**259,710 (29.9%)**	**509,475 (58.5%)**

Source: U.S. Census Bureau 2010b.

Notes:

[1] A minority is defined as a member of the following population groups: American Indian/Alaskan Native, Asian or Pacific Islander, Black (non-Hispanic), or Hispanic.

[2] The term "Hispanic" is an ethnic category and can apply to members of any race, including respondents who self identified as "White." The total numbers of Hispanic residents for each geographic region are tabulated separately from the racial distribution by the U.S. Census Bureau.

[3] White Alone-Non Hispanic" includes people who reported "White" and no other race group and did not report being "Hispanic."

[4] "All Race, Hispanic" includes all people regardless of race that reported being "Hispanic."

[5] "Total Minority" is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race with the total for "Not Hispanic or Latino: While Alone" subtracted from the total population.

Key:

Boldface denotes areas with meaningfully greater total minority proportion (more than 50 percent).

% = percent

Table 14-5. 2012 Agricultural Workers Median Annual Wages by County

Geographic Area/County	Farming, Fishing, and Forestry Occupations – Overall	First-Line Supervisors	Agricultural Inspectors	Graders and Sorters	Equipment Operators	Farmworkers (Crop, Nursery, and Greenhouse)	Farmworkers (Farm and Ranch Animals)	Agricultural Workers, All Other	Median Wage All Industries
Sacramento Valley									
Colusa, Glenn and Tehama	$22,045	$42,837	NA	$26,405	NA	$19,648	$21,108	NA	$40,334
El Dorado, Placer, Sacramento and Yolo	$24,718	$71,783	NA	$19,292	$26,950	$19,658	$25,809	$58,120	$52,261
Shasta	$35,735	$64,549	NA	NA	NA	NA	NA	NA	$42,571
Sutter	$20,622	$38,876	NA	$21,827	NA	$19,431	NA	NA	$42,633
San Joaquin Valley									
Fresno	$19,504	$31,512	$41,275	$19,847	$19,836	$18,821	$21,368	$38,584	$41,852
Kern	$19,318	$32,083	$28,506	$18,569	$24,160	$18,968	$22,481	$30,076	$45,009
Kings	$19,786	$40,077	NA	$18,262	$23,403	NA	NA	$23,225	$45,004
Merced	$20,369	$37,484	NA	$19,643	$20,787	$18,467	NA	$28,184	$39,885
San Joaquin	$19,461	$47,214	$19,212	NA	$23,178	$18,493	$19,907	$28,029	$44,057
Stanislaus	$20,047	$43,186	$42,099	$19,972	$25,883	$18,986	$28,265	NA	$42,883
Tulare	$20,218	$32,675	$50,335	$19,292	$23,632	$19,859	$40,315	$22,336	$38,706
San Francisco Bay/Central Coast									
Alameda	$27,889	$53,356	$51,827	NA	NA	$28,668	$39,652	NA	$58,687
Contra Costa	$26,854	$54,867	$47,895	NA	NA	$23,181	$26,997	NA	$58,687
Monterey	$20,669	$45,978	$59,804	$19,943	$31,609	$19,654	$29,728	NA	$43,954
San Benito and Santa Clara	$23,247	$52,471	$43,889	NA	$30,441	$19,813	$27,080	NA	$70,820
Santa Cruz	$34,002	$63,184	NA	NA	NA	$29,647	$22,374	NA	$48,352
California	$20,994	$43,958	$47,283	$19,594	$24,150	$19,551	$25,672	$28,725	$52,630

Source: EDD 2012b.

Notes:

[1]The EDD Occupational Employment & Wage data combines certain counties into geographic areas; Colusa, Glenn, and Tehama counties are combined as part of the North Valley Region; El Dorado, Placer, Sacramento and Yolo counties are combined as the Sacramento-Arden Arcade-Roseville; and San Benito and Santa Clara counties are combined as the San Jose-Sunnyvale-Santa Clara.

Key:

NA = applicable data not available for this jurisdiction

14.2 Environmental Consequences

The section presents assessment methods used to analyze the environmental justice effects and presents the potential environmental justice effects of the proposed alternatives.

14.2.1 Assessment Methods

This section describes the assessment methods used to analyze potential environmental justice effects of the project alternatives, including the No Action Alternative.

The CEQ's *Environmental justice: guidance under the National Environmental Policy Act* (1997) recommends that the following three factors be considered in an environmental justice analysis to determine whether disproportionately high and adverse impacts may accrue to minority or low-income populations. Impacts on Indian tribes are discussed in detail in Chapter 15, Indian Trust Assets.

- Whether there is or would be an impact on the natural or physical environment that significantly and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural environment.

- Whether the environmental effects are significant and are, or may be, having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group.

- Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

The methodologies and thresholds used in this analysis are taken from the U.S. Environmental Protection Agency's (USEPA) final guidance on incorporating environmental justice concerns into a National Environmental Policy Act (NEPA) analysis (USEPA 1998), which help define minority and low-income populations. The guidance states that a minority and/or low-income population may be present in an area if the proportion of the populations in the area of interest are "meaningfully greater" than that of the general population, or where the proportion exceeds 50 percent of the total population.

14.2.1.1 Minority

The CEQ defines the term "minority" as persons from any of the following U.S. Census categories for race: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, and American Indian or Alaska Native. Additionally, for the purposes of this analysis, "minority" also includes all other nonwhite racial categories, such as "some other race" and "two or more races." The CEQ also mandates that persons identified through the U.S. Census as ethnically Hispanic, regardless of race, should be included in minority counts (CEQ 1997). Hispanic origin is considered to be an ethnic category separate from race, according to the U.S. Census. For this analysis, regional populations were compared to the State of California as a whole. Regional populations exceeding 50 percent were considered environmental justice populations.

Based on demographic characteristic data presented above in Table 14-1, Colusa, Sacramento, Sutter and Yolo counties in the Sacramento Valley Region; Fresno, Kern, Kings, Merced, San Joaquin, Stanislaus and Tulare counties in the San Joaquin Valley Region; and Alameda, Contra Costa, Monterey, San Benito and Santa Clara counties in the San Francisco Bay/Central Coast Region are considered minority affected areas.

14.2.1.2 Low-Income

The U.S. Census Bureau uses a set of money income thresholds that vary by family size and composition to establish who is within the poverty level (low-income). If a family's total income is less than the family's poverty threshold, then that family and every individual in it is considered in poverty. The official poverty thresholds do not vary geographically, but are updated for inflation using the Consumer Price Index. The official poverty definition uses money income before taxes and does not include capital gains or noncash benefits (such as public housing, Medicaid, and food stamps). A "poverty area" or low-income population is where 20 percent or more of the population lives in poverty. An "extreme poverty area" or area of concentrated poverty is where 40 percent or more of the population lives in poverty (U.S. Census Bureau, 2010a).

Based on economic characteristic data presented above in Table 14-2, Fresno, Merced and Tulare counties in the San Joaquin Valley are considered low-income affected areas. None of the counties within the area of analysis are considered to be extreme poverty areas.

14.2.1.3 Farmworker Employment

As mentioned above, farmworkers within the area of analysis are considered both minority and low-income populations. Changes in CVP deliveries could affect farmworker employment by influencing the amount of agricultural production. Reduced deliveries could potentially reduce the need for farm labor and the number of farmworker jobs available in the CVP water service contractor service areas. Increased CVP deliveries for agricultural use could support agricultural employment. A reduction in farmworker employment in a region could cause an adverse and disproportionate effect on these populations.

Agricultural economic effects were calculated using a combination of the Statewide Agricultural Production (SWAP) and IMPLAN models. These models were used to calculate the total irrigated acreages of different crop types under each of the M&I WSP alternatives.

The SWAP model is a regional agricultural production and economic optimization model that simulates the decisions of farmers across 93 percent of agricultural land in California. The SWAP model is used to compare the long-run response of agriculture to potential changes in State Water Project (SWP) and CVP irrigation water delivery, other surface or groundwater conditions, or other economic values or restrictions. Results from the SWAP model are used to compare the long-run agricultural economic responses to changes in CVP irrigation water delivery under the M&I WSP alternatives. The SWAP model provides changes in value of production and groundwater pumping costs. Changes in value of production are used as inputs to the regional economic effects analysis.

IMPLAN is a county-level database and modeling package that calculates the economic impacts of a change in value of production. IMPLAN estimates effects on various economic measures, including employment, labor income, and total value of output, and total value added. This analysis uses IMPLAN 2011 data set for all counties that could be affected by the M&I WSP.

For the analysis of agricultural economic effects, SWAP estimates changes in value of production of crops as a result of changes in water supply. This is a direct effect to the crop industry sectors, which is input into IMPLAN as an industry change to estimate regional economic effects. Using these results and additional information on estimated average number of farmworkers per crop type, the total change in farmworker employment was determined. Changes in farmworker employment conditions were calculated for all water year types in three SWAP model regions: Sacramento Valley; San Joaquin River; and Tulare Lake. The Sacramento Valley Region falls within the North of Delta geographic area, and the San Joaquin River and Tulare Lake regions fall within the South of Delta geographic area.

See Chapter 13, Socioeconomics, for further detail on the SWAP and IMPLAN models and additional regional and agricultural economic effects, and see Appendix D, Statewide Agricultural Production Model Documentation, which provides detailed description of the SWAP model and methods of the agricultural economic effects analysis.

14.2.2 Alternative 1: No Action

Continued implementation of the current 2001 Draft M&I WSP could adversely and disproportionately affect minority and/or low-income populations. Under the No Action Alternative, CVP deliveries to agricultural water service contractors would be lower than under existing conditions due to changes in population growth and land use not attributable to this project. However, these water supply reductions would affect all agricultural water service areas and would not be directed at minority or low-income populations. Therefore, there is no adverse or disproportionate effect to environmental justice populations.

Continued implementation of the current 2001 Draft M&I WSP could adversely and disproportionately affect farmworker employment. CVP deliveries to agricultural water service contractors would be reduced; however, there would be some minor increases in irrigated acreage as contractors are able to make use of other supplemental supplies. Chapter 14.2.2 discusses impacts to the regional economy under the No Action Alternative. There is not anticipated to be adverse or disproportionate effects to farmworker employment from the No Action Alternative.

14.2.3 Alternative 2: Equal Agricultural and M&I Allocation

Providing equal CVP allocations to agricultural and M&I water service contractors during ~~shortage conditions~~a Condition of Shortage could adversely and disproportionately affect minority and/or low-income populations. Under Alternative 2, M&I water service contractors would receive lower CVP allocations than under the No Action Alternative. However, these water supply reductions would affect all M&I water service areas and would not be directed at minority or low-income populations. Therefore, there is no adverse or disproportionate effect to environmental justice populations.

Providing equal allocations to agricultural and M&I water service contractors could adversely and disproportionately affect farmworker employment. Table 14-6 presents the change in farmworker employment by region for Alternative 2 compared to the No Action Alternative. As shown in Table 14-6, Alternative 2 would have no effect on farmworker employment in wet and above normal years across all regions. The Sacramento Valley and Tulare Lake regions would experience a small increase in farmworker employment in all other years, which would benefit farmworker employment in these regions. The San Joaquin River Region would experience negligible reductions in employment in below normal and dry years, and a reduction of 0.2 percent in farmworkers employment in critical years. The impact of Alternative 2 compared to the No Action Alternative is not considered to be adverse or disproportional based on comparison to the maximum annual change in farmworker employment that occurred between 2003 and 2013 in each region.

Table 14-6. Farmworkers Affected under Alternative 2 Compared to the No Action Alternative

Region	Sacramento Valley		San Joaquin River		Tulare Lake	
Maximum Annual Change in Farmworker Employment (2003 to 2013)	8% (occurred between 2008 and 2009)		4% (occurred between 2008 and 2009)		4% (occurred between 2006 and 2007)	
Year Type	Farmworkers	Percent Change	Farmworkers	Percent Change	Farmworkers	Percent Change
W	0	0.0%	0	0.0%	0	0.0%
AN	0	0.0%	0	0.0%	0	0.0%
BN	13	0.1%	-2	0.0%	3	0.0%
D	87	0.4%	-4	0.0%	134	0.4%
C	210	0.9%	-27	-0.2%	95	0.3%

Source: EDD 2013.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

14.2.4 Alternative 3: Full M&I Allocation Preference

Providing 100 percent allocations to M&I water service contractors could adversely and disproportionately affect minority and/or low-income populations. Under Alternative 3, CVP deliveries to agricultural water service contractors would be lower than under the No Action Alternative. However, these water supply reductions would affect all agricultural water service areas and would not be directed at minority or low-income populations. Therefore, there is no adverse or disproportionate effect to environmental justice populations.

Providing 100 percent allocations to M&I water service contractors could adversely and disproportionately affect farmworker employment. Table 14-7 presents the change in farmworker employment by region for Alternative 3 compared to the No Action Alternative. As shown in Table 14-7, Alternative 3 would have no effect on farmworker employment in wet and above normal years compared to the No Action Alternative. The San Joaquin River Region would experience a small increase in farmworker employment in all other years, which would benefit farmworker employment in these years. The Sacramento Valley and Tulare Lake regions would experience a reduction in farmworker employment; however, the reduction in jobs is less than a one percent change. The impact of Alternative 3 compared to the No Action Alternative is not considered to be adverse or disproportional based on comparison to the maximum annual change in farmworker employment that occurred between 2003 and 2013 in each region.

Table 14-7. Farmworkers Affected under Alternative 3 Compared to the No Action Alternative

Region	Sacramento Valley		San Joaquin River		Tulare Lake	
Maximum Annual Change in Farmworker Employment (2003 to 2013)	8% (occurred between 2008 and 2009)		3.8% (occurred between 2008 and 2009)		4% (occurred between 2006 and 2007)	
Year Type	Farmworkers	Percent Change	Farmworkers	Percent Change	Farmworkers	Percent Change
W	0	0.0%	0	0.0%	0	0.0%
AN	0	0.0%	0	0.0%	0	0.0%
BN	-16	-0.1%	2	0.0%	-1	0.0%
D	-54	-0.2%	1	0.0%	-74	-0.2%
C	-98	-0.4%	22	0.1%	-233	-0.8%

Source: EDD 2013.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

14.2.5 Alternative 4: Updated M&I WSP

Implementation of the Updated M&I WSP could adversely and disproportionately affect minority and/or low-income populations. Under Alternative 4, CVP deliveries would be similar to those under the No Action Alternative. There are no adverse or disproportionate effects on minority and low-income populations under Alternative 4.

Implementation of the Updated M&I WSP could adversely and disproportionately affect farmworker employment. Under Alternative 4, CVP deliveries would be similar to those under the No Action Alternative. Therefore, there would be no changes to farmworker employment as compared to the No Action Alternative and no impacts to environmental justice populations.

14.2.6 Alternative 5: M&I Contractor Suggested WSP

Implementation of the M&I Contractor Suggested WSP could adversely and disproportionately affect minority and/or low-income populations. Under Alternative 5, CVP deliveries would be similar to those under the No Action Alternative, for the exception that Alternative 5 attempts to provide a higher ~~level~~ quantity of M&I water service contractor deliveries during Dry and Critical years. There are no adverse or disproportionate effects on minority and low-income populations under Alternative 4.

Implementation of the M&I Contractor Suggested WSP could adversely and disproportionately affect farmworker employment. Under Alternative 5, CVP deliveries would be similar to those under the No Action Alternative. Therefore, there would be no changes to farmworker employment as compared to the No Action Alternative and no impacts to environmental justice populations.

14.3 Mitigation Measures

There are no impacts to environmental justice populations; therefore, no mitigation measures are required.

14.4 Unavoidable Adverse Impacts

There are no unavoidable adverse impacts on environmental justice populations from the alternatives.

14.5 Cumulative Effects

The timeframe for the environmental justice 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 14-1. The following section analyzes the cumulative effects using both the project and the projection methods, which are further described in Chapter 20, Cumulative Effects Methodology. Chapter 20 describes the projects included in the cumulative condition and growth and development trends in the area of analysis.

The cumulative analysis for environmental justice considers projects and conditions that could affect employment and income for minority and low-income populations in the area of analysis. The following sections describe potential environmental justice effects for each of the proposed alternatives.

14.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Providing equal CVP allocations to agricultural and M&I water service contractors in ~~shortage conditions~~a Condition of Shortage in combination with other projects could cumulatively adversely and disproportionately affect minority and low-income populations, including farmworkers. Under Alternative 2, M&I water service contractors would receive lower CVP allocations than under the No Action Alternative.

Cumulative projects identified in Chapter 20 that could affect employment and income for minority and low-income populations include SWP transfers where contractors plan to implement long-term water transfers that include crop idling and shifting measures. The transfers would be voluntary and on a year-to-year basis. The majority of SWP transfers would occur from sellers within the Feather River region, mostly in Butte and Sutter counties. Butte County is outside of the area of analysis for environmental justice, and Sutter County is considered a minority affected area.

However, cropland idling transfers could result in crops being taken out of production, further decreasing available employment for farmworkers in the area.

Cropland idling would be temporary, and because of the temporary nature of effects and the relatively low percentage of farmworker losses relative to total agricultural employment, crop idling, in combination with the M&I WSP, would not cause a cumulative adverse and disproportionately high effect on minority and low-income farmworkers. Repeated SWP crop idling transfers over a period of time within a small geographic area could result in adverse and disproportionately high cumulative effects to farmworkers.

Changes in agricultural land conversion and land protection programs could also affect farmworker employment in the cumulative condition. Chapter 12 Agricultural Resources describes several programs aimed at protecting agricultural and open space lands. The 2014 Farm Bill provides financial incentives and technical assistance to keep land in agricultural production (USDA 2014). These programs would help farmers keep their land in private ownership and continue agricultural production in the long-term under the cumulative condition, which would protect jobs for farmworkers.

Additionally, counties proposing crop idling transfers include agricultural elements in their local general plans that identify policies and guidelines to preserve and protect agricultural resources and limit urban development and agricultural land conversions. Examples of these policies and programs include tax and economic incentives, the continued existence of large, contiguous areas of agricultural zoning, Williamson Act and Farmland Security Zone Programs, Right-to-Farm ordinances, and buffer zone requirements. These programs would also protect farmworker employment under the cumulative condition.

Agricultural land is being converted in support of urban development in the area of analysis. Permanent land conversions could decrease farmworker employment in the cumulative condition. Population projections generally reflect future development conditions, which assume conversion of undeveloped lands in order to accommodate projected increases in population. Chapter 13 presents population projections for the counties in the area of analysis. Development that converts farm land to non-agricultural uses would affect minority farmworker employment; however, urban development would likely include low-income housing and develop new job opportunities for minority and low-income populations. Temporary crop idling transfers associated with Alternative 2 would not contribute to increased agricultural land conversions and would not contribute to a cumulative effect on minority and low-income employment.

14.5.2 Alternative 3: Full M&I Allocation Preference

Providing 100 percent allocations to M&I water service contractors in a Condition of Shortage~~shortage conditions~~ in combination with other projects could cumulatively adversely and disproportionately affect minority and low-income populations. Cumulative effects under Alternative 3 would have the same effects as those experienced under Alternative 2.

14.5.3 Alternative 4: Updated M&I WSP

Implementation of the Updated M&I WSP in combination with other projects could cumulatively adversely and disproportionately affect minority and low-income populations. Project-related impacts to farmworker employment would be the same as those described for the No Action Alternative; therefore, this alternative would not contribute to cumulative impacts as compared to cumulative conditions under the No Action Alternative.

14.5.4 Alternative 5: M&I Contractor Suggested WSP

Implementation of the M&I Contractor Suggested WSP in combination with other projects could cumulatively adversely and disproportionately affect minority and low-income populations. Project-related impacts to farmworker employment would be the same as those described for the No Action Alternative; therefore, this alternative would not contribute to cumulative impacts as compared to cumulative conditions under the No Action Alternative.

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Chapter 15
Indian Trust Assets

This section presents the Indian Trust Assets (ITAs) within the area of analysis and discusses potential effects on ITAs from the proposed alternatives.

ITAs are defined as legal interests in property held in trust by the United States (U.S.) government for Indian tribes or individuals, or property protected under U.S. law for Indian tribes or individuals. An Indian trust has three components: 1) the trustee; 2) the beneficiary; and 3) the trust asset. ITAs can include land, minerals, federally-reserved hunting and fishing rights, federally-reserved water rights, and in-stream flows associated with a reservation or Rancheria. Beneficiaries of the Indian trust relationship are federally-recognized Indian tribes with trust land; the U.S. is the trustee. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the U.S. The characterization and application of the U.S. trust relationship have been defined by case law that supports Congressional acts, executive orders, and historic treaty provisions.

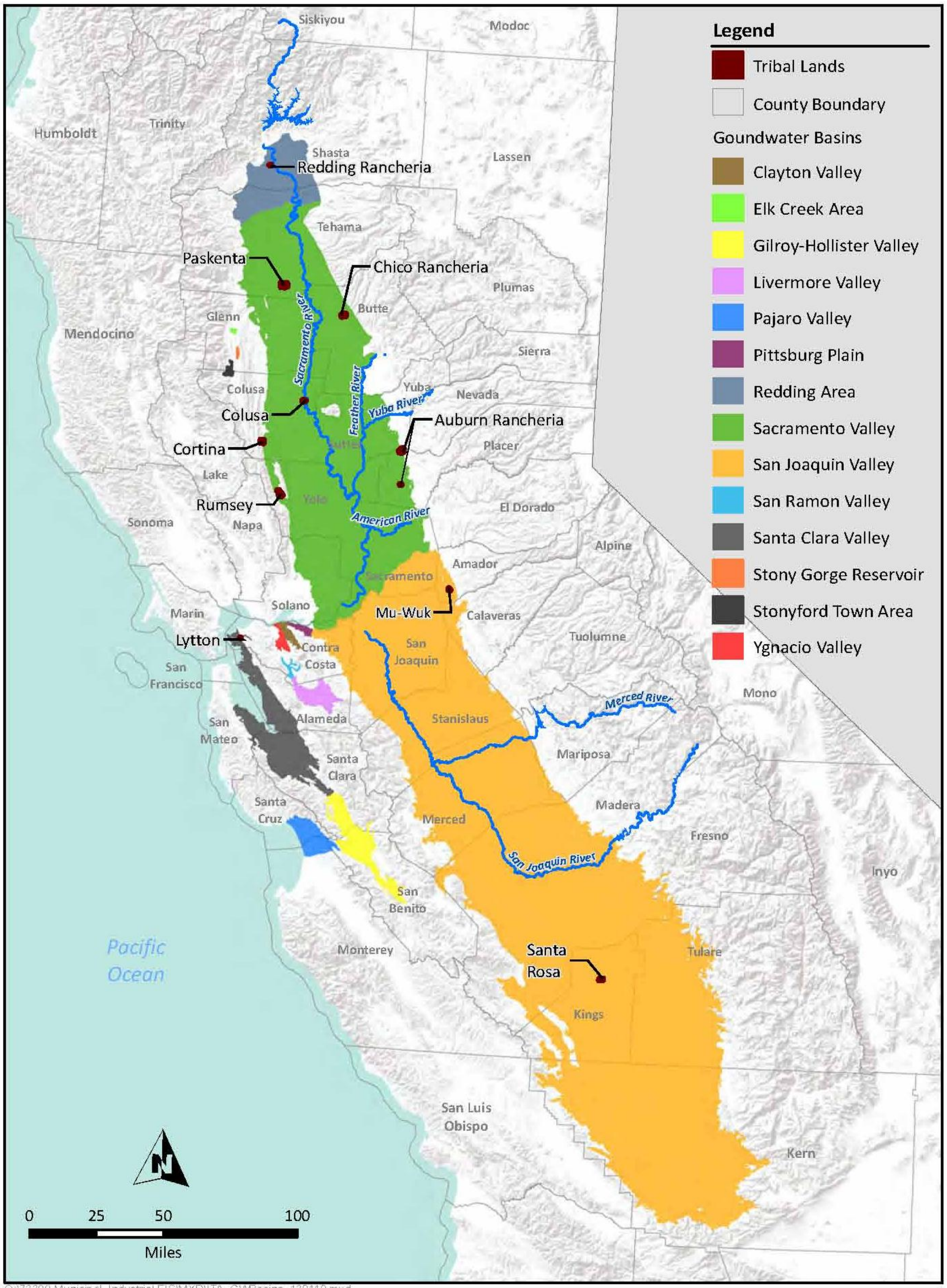
The Central Valley Project (CVP) Municipal and Industrial Water Shortage Policy (M&I WSP) proposes changes to water allocations to water service contractors during a Condition of Shortage~~shortage conditions~~. These proposed changes could reduce the amount of water received by certain M&I and agricultural water service contractors. A reduction in deliveries could influence additional groundwater pumping. Increased groundwater pumping could affect ITAs by increasing groundwater depth and increasing groundwater pumping costs near ITA sites. Lower groundwater elevations and increased pumping costs could interfere with the exercise of federally-reserved Indian rights.

15.1 Affected Environment

This section describes the area of analysis, regulatory requirements, and environmental setting relevant to ITAs.

15.1.1 Area of Analysis

The area of analysis for ITAs includes the federally-recognized reservations or Rancherias in the Clayton Valley, Elk Creek Area, Gilroy-Hollister Valley, Livermore Valley, Pajaro Valley, Pittsburg Plain, Redding Area, Sacramento Valley, San Joaquin Valley, San Ramon Valley, Santa Clara Valley, Stony Gorge Reservoir, Stonyford Town Area, and Ygnacio Valley groundwater basins where increased groundwater use could occur in lieu of CVP deliveries to M&I and agricultural water service contractors. Figure 15-1 provides an overview of the ITAs area of analysis.



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Source: U.S. Census Bureau 2010.

Figure 15-1. ITAs Area of Analysis

15.1.2 Regulatory Setting

This section describes the applicable laws and rules relating to ITAs. ITAs are regulated by the federal government; therefore, state and regional/local policies do not apply.

President William J. Clinton's 1994 memorandum, "Government-to-Government Relations with Native American Tribal Governments," directed the Bureau of Reclamation (Reclamation) to assess the effects of its programs on tribal trust resources and federally-recognized tribal governments. Reclamation is tasked with actively engaging federally-recognized tribal governments and consulting with such tribes on a government-to-government level (59 Federal Register 1994). Order number 3215, *Principles for the Discharge of the Secretary's Trust Responsibility*, assigns responsibility for ensuring protection of ITAs to the heads of bureaus and offices (Reclamation 2012). Reclamation is required to "protect and preserve Indian trust assets from loss, damage, unlawful alienation, waste, and depletion" (Reclamation 2012). Reclamation is responsible for assessing whether the updated M&I WSP would have the potential to affect ITAs.

It is the policy of the U.S. Department of Interior (DOI) to perform its activities and programs in such a way as to protect ITAs and avoid adverse effects whenever possible (Reclamation 2012). Reclamation complies with procedures contained in Departmental Manual Part 512 (DOI 1995), which are guidelines that protect tribal resources and require Secretary of the Interior approval before sale of land, natural resources, water, or other assets. Federally-reserved water rights held in trust for tribes by the U.S. are ITAs that are restricted from being separated from tribes and individual Indians without the approval of the Secretary of the Interior.

15.1.3 Existing Conditions

The following section describes the existing ITAs within the area of analysis. The area is analyzed by groundwater basin. There are no ITAs within the Clayton Valley, Elk Creek Area, Gilroy-Hollister Valley, Livermore Valley, Pajaro Valley, Pittsburg Plain, San Ramon Valley, Stony Gorge Reservoir, Stonyford Town Area, and Ygnacio Valley groundwater basins (U.S. Census Bureau 2010).

15.1.3.1 Redding Area Groundwater Basin

The Redding Area Groundwater Basin spans both Shasta and Tehama counties. The Redding Rancheria is located within the Redding Area Groundwater Bain in Shasta County, near the Shasta River. There are no ITAs present in the Tehama County portion of the Redding Area Groundwater Basin (U.S. Census Bureau 2010).

The northernmost indigenous people in the Sacramento Valley region were the Achowami, Atsugewi, Ajumawi, Wintun, Pit River, and the Yana (San Diego State University 2011). Descendants of these tribes live on the Big Bend, Burney Tract, Montgomery Creek, Redding, and Roaring Creek Rancherias in Shasta County (San Diego State University 2011, Redding Rancheria 2000). The

Redding Rancheria has a total area of 31 acres, adjacent to the City of Redding. The Rancheria's current population is 45 (San Diego State University 2011).

15.1.3.2 Sacramento Valley Groundwater Basin

The Sacramento Valley Groundwater Basin spans the counties of Tehama, Glenn, Butte, Colusa, Sutter, Placer, Yolo, Solano, and Sacramento. ITAs within the Sacramento Valley Groundwater Basin include the Paskenta (Tehama County), Chico Rancheria (Butte County), Colusa and Cortina (Colusa County), Auburn Rancheria (Placer County) and Rumsey (Yolo County). There are no ITAs present in the Glenn, Sutter, Solano, and Sacramento counties portions of the Sacramento Valley Groundwater Basin (U.S. Census Bureau 2010).

The Paskenta Band of Nomlaki Indians has an approximately 2,000-acre tract of trust land in western Tehama County (San Diego University 2011). The Paskenta are considered Central Wintun and have historically resided in Tehama and Glenn counties for centuries (Paskenta 2013).

The Mechoopda Maidu Indian Tribe holds trust land in Butte County on the Chico Rancheria. The Rancheria has a current population of 70 (San Diego State University 2011).

Wintun people historically inhabited the area of the Colusa Basin. Present-day descendants of the Wintun live on the Colusa and Cortina Rancherias in Colusa County and the Rumsey Rancheria in Yolo County (San Diego State University 2011).

The Cachil DeHe Band of Wintun Indians currently holds a 573-acre tract of land in Colusa County on the Colusa reservation and Rancheria, with 300 acres owned by the tribe and 273 acres held in trust by the U.S. government (San Diego University 2011). The Wintun Indians also hold land in trust on the Cortina Reservation, approximately 70 miles northwest of Sacramento. The Cortina Band of Wintun Indians holds 640 acres of land in trust with a population of 19 and a tribal enrollment of 117 (San Diego University 2011).

The Yocha Dehe Band of Wintun Indians resides at the Rumsey Rancheria in Yolo County, approximately 33 miles northwest of Sacramento. The tribe holds 185 acres of trust land with a current population of 36 people (San Diego State University 2011).

An integrated group of both Maidu and Miwok Indians historically inhabited parts of the Sierra Nevada Foothills near the American River. Descendants of the tribe, now recognized as the United Auburn Indian Community, hold trust land in Placer County known as the Auburn Rancheria (United Auburn Indian Community n.d.).

15.1.3.3 San Joaquin Valley Groundwater Basin

The San Joaquin Valley Groundwater Basin spans the counties of Sacramento, Contra Costa, San Joaquin, Amador, Stanislaus, Merced, Madera, Fresno, Kings, Tulare and Kern. ITAs within the San Joaquin Valley Groundwater Basin include the Mu-Wuk in Amador County and the Santa Rosa in Kings County. There are no ITAs present in the Sacramento, Contra Costa, San Joaquin, Stanislaus, Merced, Madera, Fresno, Tulare and Kern counties portions of the San Joaquin Valley Groundwater Basin (U.S. Census Bureau 2010).

Mu-Wuk Indians, also known as Miwok, descend from three different divisions; the Coast Miwok, the Lake Miwok and the Sierra Me-wuk, all from north-central California. The Sierra Me-Wuk historically inhabited the Sierra Nevada Foothills and today resides at various traditional reservations and Rancherias, including Jackson, Shingle Springs, Tuolumne, Chicken Ranch and the Mu-Wuk in Amador County (San Diego State University 2011).

The Tachi Yokut Indians have inhabited the San Joaquin Valley for centuries. The tribe currently resides and holds trust lands in the City of Lemoore, at the Santa Rosa Rancheria, in Kings County. The Rancheria is comprised of 170 acres and houses over 200 tribal members (Tachi-Yokut Tribe 2012).

15.1.3.4 Santa Clara Valley Groundwater Basin

The Santa Clara Valley Groundwater Basin spans the counties of Contra Costa, San Mateo, Alameda, and Santa Clara. The only ITA within the Santa Clara Valley Groundwater Basin is the Lytton in Contra Costa County. There are no ITAs present in the San Mateo, Alameda and Santa Clara counties portions of the Santa Clara Valley Groundwater Basin (U.S. Census Bureau 2010).

The Lytton Band of Pomo Indians holds trust land in the City of San Pablo, in Contra Costa County. The tribal population is approximately 100 members and they own and operate the San Pablo Lytton Casino (San Diego State University 2011 and San Pablo Lytton 2011).

15.2 Environmental Consequences

This section presents assessment methods performed to analyze ITA effects and presents the potential ITA effects for the proposed alternatives.

15.2.1 Assessment Methods

Reclamation guidance states that, "Actions that could impact the value, use or enjoyment of the ITA should be analyzed as part of the ITA assessment. Such actions could include interference with the exercise of a reserved water right, degradation of water quality where there is a water right, impacts to fish or wildlife where there is a hunting or fishing right, [and] noise near a reservation when it adversely impacts uses of reservation lands" (Reclamation 2012).

In light of potential changes to CVP water deliveries through the implementation of the M&I WSP alternatives, increased groundwater use could impact ITAs. To determine potentially affected reservations and Rancherias, the locations of reservations and Rancherias were overlaid on a map of the various groundwater basins used by the M&I and agricultural water service contractors. Reservations and Rancherias were identified using a reservation boundary database (U.S. Census Bureau 2010). All identified ITAs within a groundwater basin could be potentially affected by changes in groundwater use. ITAs found outside of the groundwater basins would not be affected by changes in groundwater use by CVP contractors and are not analyzed in this section.

Figure 15-1 shows the following Indian trust lands falling within or along the outlying boundaries of a groundwater basin. For additional information on the groundwater effects see Chapter 6, Groundwater Resources.

The following ITAs fall within the boundaries of a groundwater basin:

- Redding Rancheria
- Paskenta
- Chico Rancheria
- Colusa
- Cortina
- Auburn Rancheria
- Rumsey
- Mu-Wuk
- Lytton
- Santa Rosa

In addition, the Statewide Agricultural Production (SWAP) model was used to determine the change in groundwater pumping under different M&I WSP action alternatives compared to the No Action Alternative. The SWAP model analyzed groundwater pumping conditions in all water year types in three modeled regions which overlay the groundwater basins: Sacramento Valley, San Joaquin River, and Tulare Lake. The Sacramento Valley Region falls within the North of Delta geographic area, and the San Joaquin River and Tulare Lake regions fall within the South of Delta geographic area.

Based on the location of ITAs shown in Figure 15-1, no ITAs have been identified within the SWAP model's San Joaquin River Region; thus, model results for this area are not considered a part of the ITAs analysis. See Chapter 6 for additional information on groundwater effects and Appendix D, Statewide Agricultural Production Model Documentation, for the full SWAP modeling results.

15.2.2 Alternative 1: No Action

Groundwater levels could fluctuate and potentially affect ITAs. Under the No Action Alternative, the existing CVP allocations method would continue to be implemented. In dry and critical years, agricultural and M&I water service contractors could depend on alternative supplies when their CVP allocations are reduced, including using additional groundwater. Increased groundwater use in the area of analysis could adversely affect ITAs if existing wells were to be over pumped and dried out on tribal lands. This could interfere with the exercise of a federally-reserved water right, and/or reduce the health of tribal members by decreasing water supplies.

Under the No Action Alternative, the volume of groundwater pumping in the Sacramento Valley Region would be reduced between 50 thousand acre-feet (TAF) and 71 TAF over all year types when compared to existing conditions, or about four percent to five percent less than existing conditions. In the Tulare Lake Region, changes in groundwater pumping under the No Action Alternative would range from decrease of 30 TAF in above normal years to an increase 22 TAF in below normal years, or about a one percent reduction to a one percent increase. Change in groundwater pumping of this magnitude are very small compared to overall groundwater supplies throughout the basin and would not be substantial enough to create a noticeable change to water supply at existing wells near ITA sites. Therefore, the No Action Alternative would not interfere with the exercise of a federally-reserved water right, and/or reduce the health of tribal members by decreasing water supplies.

15.2.3 Alternative 2: Equal Agricultural and M&I Allocation

Groundwater levels could fluctuate and potentially affect ITAs. Under Alternative 2, CVP deliveries to M&I water service contractors would be lower than under the No Action Alternative in all year types. M&I water service contractors may turn to alternative methods to obtain additional water supply when their CVP allocations are reduced, including using additional groundwater. Under Alternative 2, CVP deliveries to agricultural water service contractors would be higher than under the No Action Alternative. Agricultural water service contractors would be less likely to increase the volume of groundwater use in the area of analysis and adversely affect ITAs from over pumping and drying out existing wells on tribal lands. Appendix B, Water Operations Model Documentation, contains the hydrologic modeling results with detail on the specific CVP deliveries for each alternative.

Under Alternative 2, the volume of groundwater pumping in the Sacramento Valley Region would be reduced between 1.3 TAF and 4.6 TAF, or less than one percent, over all year types when compared to the No Action Alternative. The volume of groundwater pumping in the Tulare Lake Region would be reduced between 12 TAF and 38 TAF, one percent or less, compared to the No Action Alternative. Reductions in groundwater pumping of these magnitudes are very small compared to overall groundwater supplies throughout the basin and would not be substantial enough to create a noticeable change to water supply at existing wells near ITA sites. Thus, Alternative 2 would not interfere with the exercise of a federally-reserved water right, and/or reduce the health of tribal members by decreasing water supplies.

15.2.4 Alternative 3: Full M&I Allocation Preference

Groundwater levels could fluctuate and potentially affect ITAs. Under Alternative 3, M&I water service contractors would receive greater CVP allocations than under the No Action Alternative in all year types. M&I water service contractors would be less likely to increase groundwater use in the area of analysis and would be less likely to adversely affect ITAs from over pumping and drying out existing wells. Under Alternative 3, agricultural water service contractors would receive lower CVP allocations than under the No Action Alternative in all year types. Agricultural water service contractors may turn to alternative methods to obtain additional water supply when their CVP allocations are reduced, including using additional groundwater. Appendix B contains the hydrologic modeling results with detail on the specific CVP deliveries for each alternative.

Under Alternative 3, the change in the volume of groundwater pumping in the Sacramento Valley Region would range from a decrease of 0.3 TAF in dry years to an increase of 2.0 TAF in above normal years, or less than one percent, compared to the No Action Alternative. The volume of groundwater pumping in the Tulare Lake Region would increase between 3.1 TAF and 14.5 TAF, or about one percent or less, compared to the No Action Alternative. Fluctuations in groundwater levels of these magnitudes are very small compared to overall groundwater supplies throughout the basin and would not be substantial enough to create a noticeable change to water supply at existing wells near ITA sites. Thus, Alternative 3 would not interfere with the exercise of a federally-reserved water right, and/or reduce the health of tribal members by decreasing water supplies.

15.2.5 Alternative 4: Updated M&I WSP

Groundwater levels could fluctuate and potentially affect ITAs. Under Alternative 4, CVP deliveries to both agricultural and M&I water service contractors under a Condition of Shortage ~~shortage conditions~~ would be the same as under the No Action Alternative; therefore, there would be no change from the No Action Alternative for ITAs in the area of analysis.

15.2.6 Alternative 5: M&I Contractor Suggested WSP

Groundwater levels could fluctuate and potentially affect ITAs. Under Alternative 5, CVP deliveries to M&I and agricultural water service contractors would be essentially the same as those of the No Action Alternative. There would be no change to groundwater use in the area of analysis and no effect to ITAs under Alternative 5 compared to the No Action Alternative.

15.3 Mitigation Measures

Reclamation's policy is to protect and avoid adverse impacts to ITAs whenever possible. The analysis has not identified any potential impacts to ITAs; therefore, no specific mitigation measures are included. However, if any unanticipated impacts (groundwater tables are depleted due to water service contractors turning to alternative water supply methods such as groundwater substitution), Reclamation shall initiate government-to-government consultation to determine interests, concerns, effects, and appropriate mitigation measures. Reclamation will take the lead on consultation with the tribes. Potentially affected tribes and the Bureau of Indian Affairs (BIA), Office of American Indian Trust, Regional Solicitor's Office, Reclamation's Native American Affairs Office, and or Regional Native American Affairs coordinator may be involved in identifying ITAs (Reclamation 2012). The agencies will discuss appropriate avoidance and/or minimization strategies on a government-to-government basis. Separate measures may be required for different types of trust assets.

Measures necessary to reduce effects will be developed in consultation with the affected federally recognized tribe(s) before implementation. Other measures will be used as determined appropriate through tribal consultation. Consultation and minimization measures would reduce any potential adverse effects on ITAs.

15.4 Unavoidable Adverse Impacts

None of the action alternatives would result in unavoidable adverse impacts to ITAs.

15.5 Cumulative Effects

The ITAs cumulative analysis focuses on those programs that would potentially affect groundwater in the area of analysis. The timeline for the surface water cumulative effects analysis extends from 2010 through 2030, a 20-year period. The following section analyzes the cumulative effects the project method, which is further described in Chapter 20, Cumulative Effects Methodology. Chapter 20 describes the projects included in the cumulative condition analysis.

15.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Groundwater fluctuation in combination with other cumulative projects could adversely affect ITAs. Under Alternative 2, agricultural and M&I water service contractors could depend on alternative methods to obtain additional water supply, such as groundwater, when their CVP allocations are reduced. Increased groundwater use in groundwater basins where ITAs exist could increase the likelihood of effects to ITAs. Changes in groundwater use associated with change to CVP deliveries, in combination with other existing and foreseeable future groundwater substitution programs and projects in the area of analysis, could adversely affect ITAs if existing wells were to be over pumped and dried out on tribal lands. This could interfere with the exercise of a federally-reserved water right, and/or reduce the health of tribal members by decreasing water supplies.

Existing and foreseeable water acquisition programs with potential groundwater substitution measures in the area of analysis, which would increase groundwater use, include CVP and State Water Project transfers which are described in Chapter 20, Cumulative Effects Methodology. The groundwater substitution elements of these programs, in conjunction with the potential increase in groundwater use by CVP contractors, could reduce groundwater levels in the area of analysis. If continuous groundwater substitution from multiple projects and programs were to cause over-pumping near ITAs located in the area of analysis, it could result in an adverse cumulative effect.

All groundwater substitution acquisitions require notification of Reclamation and the California Department of Water Resources before such acquisitions are finalized in order for the agencies to fully execute their Indian Trust responsibilities. If needed, Reclamation will deliberate with tribal and BIA subject matter experts to determine appropriate minimization measures to avoid impacts to ITAs. Because government-to-government consultations with potentially affected tribes and the development of appropriate minimization measures would be completed prior to the implementation of any groundwater substitution actions, Alternative 2 in combination with these cumulative projects would not generate an adverse cumulative effect on ITAs.

15.5.2 Alternative 3: Full M&I Allocation Preference

The cumulative impacts of Alternative 3 would be the same as those discussed under Alternative 2.

15.5.3 Alternative 4: Updated M&I WSP

The cumulative impacts of Alternative 4 would be the same as those discussed under Alternative 2.

15.5.4 Alternative 5: M&I Contractor Suggested WSP

The cumulative impacts of Alternative 5 would be the same as those discussed under Alternative 2.

15.6 References

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Chapter 16 Recreation

This chapter presents the existing recreational opportunities within the area of analysis and discusses potential effects on recreation from the proposed alternatives. Changes to Central Valley Project (CVP) water shortage allocations associated with the different alternatives would affect reservoir surface water elevations and river flows which, in turn, could affect user days at each recreation resource and overall recreation in the area of analysis.

16.1 Affected Environment

This section provides an overview of the regulatory setting associated with recreation and a description of the recreational facilities with the potential to be affected by the action alternatives.

16.1.1 Area of Analysis

The area of analysis includes recreation amenities within the service areas of CVP water service contractors affected by the Municipal and Industrial Water Shortage Policy (M&I WSP). Specifically, this includes rivers, reservoirs, waterfront parks, and other recreational amenities that would be affected by changes to the associated river flow and/or reservoir levels as a result of changes to CVP water deliveries.

As discussed in Chapter 3, Resources Introduction, there are only relatively small changes to Shasta and Trinity lakes, Lake Oroville, and San Luis Reservoir as a result of the different agricultural and municipal and industrial water service contractor allocations in the alternatives. The changes in storage and subsequent effects to surface water elevation 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. The differences between all alternatives for CalSim II modeled water storage in Shasta Lake, Trinity Lake, Lake Oroville, and San Luis Reservoir are very small and range from zero to one percent. This is further discussed in Appendix B, Water Operations Model Documentation. These changes are relatively small and are within the range of existing operational variability. Because of the small changes in water surface elevation and storage, potential differences between alternatives to Shasta Lake, Trinity Lake, Lake Oroville, and San Luis Reservoir will not be discussed further in this chapter.

Figure 16-1 shows the area of analysis, which includes reservoirs and river segments within the jurisdiction of the following CVP operational divisions as well as non-CVP facilities that may be affected.

- American River Division – middle fork of the American River, Folsom Lake State Recreation Area (SRA), Lake Natoma, and the American River Parkway
- Delta Division – Sacramento-San Joaquin River Delta (Delta)

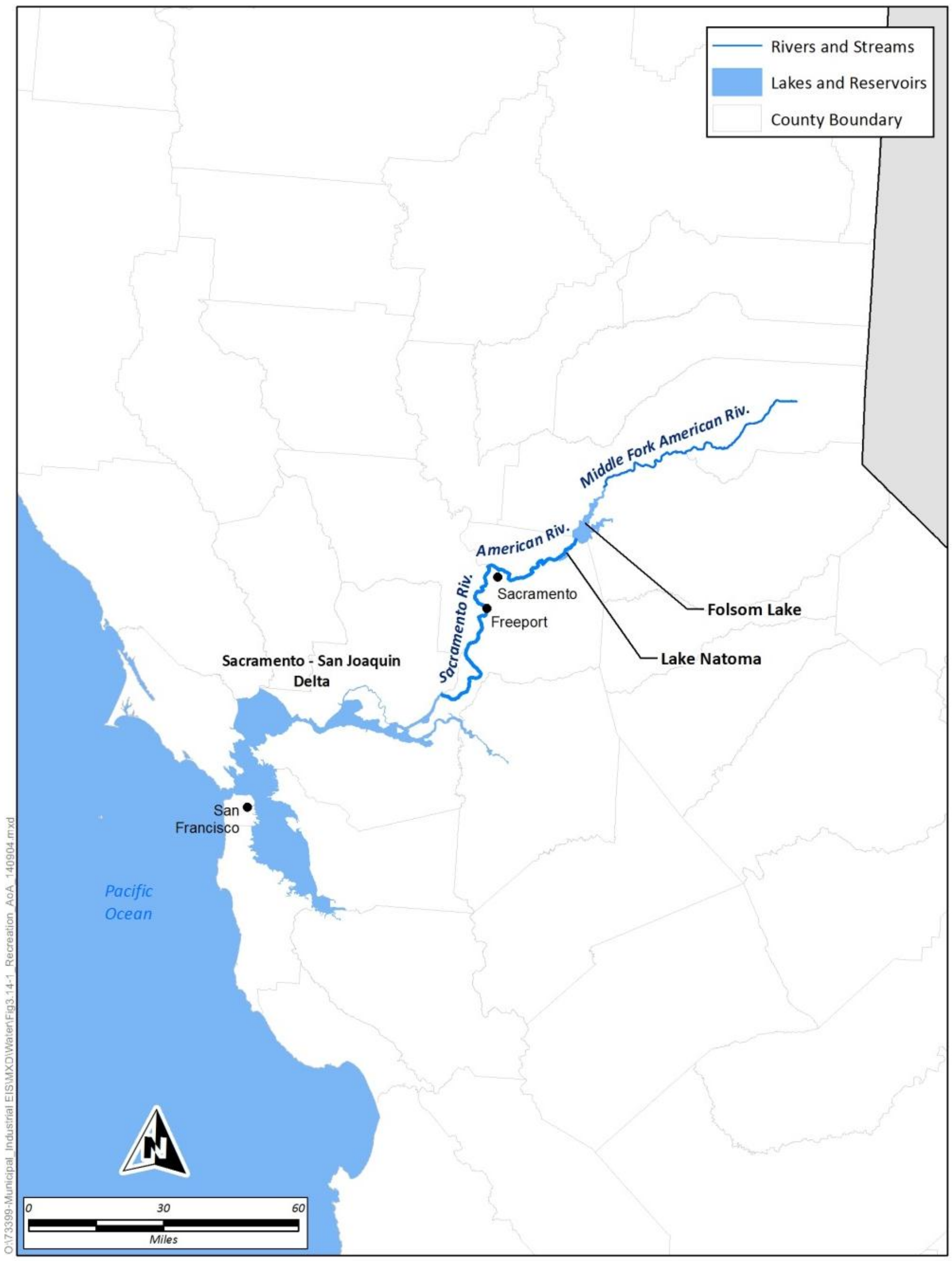

Figure 16-1. Recreation Area of Analysis

16.1.2 Regulatory Setting

16.1.2.1 Federal

National Wild and Scenic Rivers Act (NWSRA) (16 U.S.C. 1271 et seq.) The National Wild and Scenic Rivers System created in 1968 by Congress under the National Wild and Scenic Rivers Act (Public Law 90-542; 16 U.S.C. 1271 et seq.) provides for the preservation of particular rivers which exhibit “outstanding natural, cultural and recreational values in a free-flowing condition for the enjoyment of present and future generations.” While the NWSRA provides for conservation of the “special character” these rivers possess, it also acknowledges the development potential for uses that are appropriate. Management of these rivers is encouraged to cross political boundaries and involve the public when developing goals for river protection. Federal management of designated rivers is provided by either a federal or state agency.

The classification system includes wild, scenic, or recreational designations. Recreational river areas are defined as: “Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.” Each river designated as wild, scenic, or recreational is administered with the goal of protecting and enhancing the values that caused it to be designated. Existing water rights or state and federal government jurisdiction over waters according to laws already established are not affected by the National Wild and Scenic designation (National Wild & Scenic Rivers System 2014).

16.1.2.2 State

California Wild and Scenic Rivers (CSWR) Act (PRC 5093.50-5093.70) The CWSR Act is similar to the Federal act and was created to preserve certain rivers that “possess extraordinary scenic, recreational, fishery, or wildlife values” in their “free-flowing state, together with their immediate environments, for the benefit and enjoyment of the people of the state.” California has created a Wild and Scenic Rivers System within the state as part of the CSWR Act. The California Resources Agency is the administering agency for the CSWR Act. (California Legislative Council 2014).

16.1.3 Existing Conditions

The following section describes existing water-related recreation opportunities within the study area that could be affected by the alternatives.

16.1.3.1 American River Division

The American River Division encompasses portions of Sacramento, San Joaquin, Placer, and El Dorado counties and is between the northern and southern boundaries of the Central Valley. However, this division mainly serves land in the southern portion of the service area between Sacramento and Stockton (Bureau of Reclamation [Reclamation] 2014a). All recreational reservoirs within this division are shown on Figure 16-1.

Folsom Lake is the primary storage and flood control reservoir on the American River system and is situated within the Folsom Lake SRA. Recreation at Folsom Lake SRA is managed by the California Department of Parks and Recreation (CDPR). Boating, fishing and waterskiing are the primary water-related activities at Folsom Lake. Table 16-1 describes the various boat launch sites and usability according to surface water elevation. Under existing conditions there are some months where surface water elevations change and affect the usability of some boat ramps. As presented in Table 16-2, hydrologic modeling results show that all boat launch sites may be unavailable in September during critically dry years (see Appendix B for full hydrologic model results). Hiking, biking, camping, picnicking and horseback riding are also popular activities within the SRA. Lake Natoma and the California State University, Sacramento Aquatics Sports Center are located downstream of Folsom Lake and are also within the SRA. Only non-motorized boats are allowed on Lake Natoma, making this area popular for rowing and paddling (CDPR 2014). Visitor attendance at Folsom Lake SRA was 1,491,025 and included day use and camping visitors for fiscal year 2011/2012 (CDPR 2012). Table 16-2 describes the average monthly Folsom Lake surface water elevations under existing conditions by water year type according to the CalSim II model results. Under existing conditions the surface elevation may fluctuate as much as 64 feet in above normal years or as little as 38 feet in dry years with other year type fluctuations falling between these bookends.

Table 16-1. Folsom Lake Water Elevation Guidelines for Boat Launching

Boat Launch Site	Ramp Name, Number of Lanes, and Ramp Bottom and Top Elevations (in Feet)
Granite Bay	Low Water – 2 lanes between 369 and 396 Stage 1 – 2 lanes between 397and 430 Stage 2 – 8 lanes between 420 and 438 Stage 3 – 10 lanes between 430 and 452 Stage 4 – 2 lanes between 450 and 465 5% - 4 lanes between 408 and 465
Folsom Point	2 lanes between 405 and 465
Browns Ravine	Main Ramp – 4 lanes between 399 and 465 Hobie Ramp – 4 lanes between 380 and 435
Rattlesnake Bar	2 lanes between 428 and 465
Peninsula	Old Ramp – 1 lane between 410 and 465 New Ramp – 2 lanes between 434 and 465

Source: Folsom Lake Marina 2014

Table 16-2. Folsom Lake Surface Water Elevation under Existing Conditions (in feet)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	416	412	416	416	414	429	446	462	462	454	444	426
AN	404	398	402	416	417	431	446	462	460	443	437	423
BN	410	408	408	414	419	429	445	458	457	436	432	422
D	407	405	407	407	415	426	437	443	437	419	409	407
C	401	394	393	390	392	402	407	409	404	390	372	367

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

Along the entire American River, whitewater boating is ideal during the boating season with many commercial rafting operations and private boaters operating upstream from Folsom Lake. The middle and south forks are more popular during the summer months with less advanced terrain and some flat water along the south fork. Other recreational opportunities in the area include kayaking, fishing, biking, hiking, and horseback riding (The American River 2014). Table 16-3 describes flows along various sections of the American River under existing conditions. During most water year types flows are highest in February and start decreasing in March through October and then begin increasing in November. During critically dry years, peak and low flow periods are different than other water year types. Currently, boating and fishing is already affected during periods of low flow. Warmer water temperatures could affect fishing and flat water offers less advanced rafting during low flow periods.

Table 16-3. American River Flow under Existing Conditions (cubic feet per second [cfs])

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River Below Nimbus Dam												
W	1,775	3,618	5,873	8,721	9,251	6,095	5,317	6,178	6,071	4,117	3,427	4,690
AN	1,589	3,427	3,144	4,751	6,340	5,422	3,591	3,885	3,449	4,503	2,521	3,754
BN	1,665	2,286	2,546	2,335	4,202	2,581	3,006	3,078	2,806	4,760	2,052	3,054
D	1,553	2,006	1,745	1,651	1,962	2,252	1,999	1,945	2,419	3,554	2,317	1,660
C	1,411	1,953	1,491	1,308	1,191	964	1,112	1,234	1,710	1,943	1,937	1,110
American River at H Street												
W	1,656	3,562	5,826	8,665	9,136	5,974	5,150	5,965	5,806	3,852	3,202	4,512
AN	1,477	3,347	3,077	4,721	6,288	5,325	3,411	3,691	3,203	4,263	2,293	3,584
BN	1,533	2,208	2,478	2,269	4,146	2,486	2,852	2,880	2,569	4,526	1,822	2,893
D	1,424	1,923	1,680	1,582	1,891	2,179	1,825	1,756	2,193	3,324	2,099	1,498
C	1,289	1,856	1,411	1,236	1,122	884	944	1,066	1,507	1,728	1,741	956

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

The American River Parkway, managed by Sacramento County Regional Parks, is 23 miles long and includes many recreational opportunities, such as fishing, boating and rafting, picnicking, golfing, guided natural and historic tours, and a paved bike trail. The parkway is comprised of many individual parks and recreation areas (Sacramento County 2014). The American River reach through Sacramento (i.e., the lower American River) is a state- and federally-designated wild and scenic river with a classification of “recreational” (California Department of Transportation [Caltrans] 2014).

Flow study information is not readily available regarding minimal flow requirements for rafting or kayaking. However, minimal flow requirements are established for fish concerns by the Lower American River Flow Management Standard (LARFMS) (Reclamation et. al 2006). Reclamation is a partner in the establishment of these flow requirements and is the operator of Nimbus Dam. The minimal flow requirements stated in the LARFMS are between 800 cfs and 1,750 cfs for June through Labor Day, and flow requirements for the rest of September are between 800 cfs and 1,500 cfs. An exception may be granted during dry or critically dry years to allow a reduced Nimbus release below 800 cfs.

16.1.3.2 Delta Division

The Delta Division transports water from the Delta into portions of the Central Valley through pumps and canals. No public recreation is available in the canals. Some of the many Delta Division recreational opportunities available are shown in Figure 16-2. Large recreation areas include the Brannan Island and Franks Tract SRAs. Visitor attendance at Brannan Island SRA was 66,680 visitors including day use and campers during fiscal year 2011/2012. During the same period, visitor attendance at Franks Tract SRA was recorded as 62,089 visitors (CDPR 2012). Visitor attendance at Brannan Island SRA was 66,680 visitors including day use and campers during fiscal year 2011/2012. During the same period, visitor attendance at Franks Tract SRA was recorded as 62,089 visitors (CDPR 2012).

Boating, fishing, windsurfing, water skiing and kayaking are some of the water-related recreational opportunities in the Delta. An extensive road network exists for driving tours and bicycling around this scenic area and provides access to local vineyards and wineries. Bird watching is another popular activity since the area attracts over 200 species of birds at various times during the year. Within the Delta region, over 2,800 camp sites are available within over 50 different campgrounds and recreational vehicle parks. Most of these sites are within walking distance to the water (CA Delta Chambers & Visitor’s Bureau 2014).

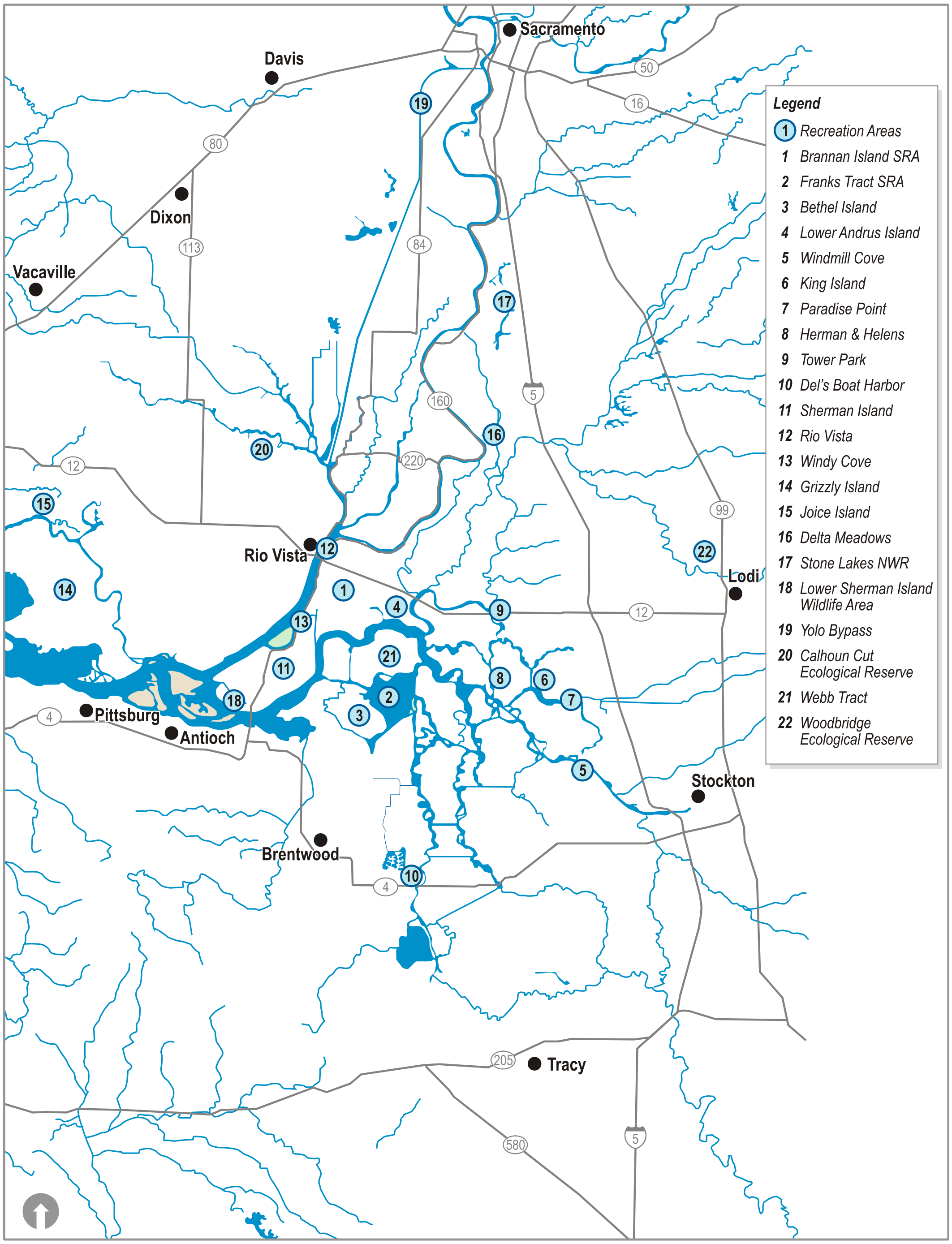

Figure 16-2. Sacramento-San Joaquin River Delta Major Recreation Areas

Table 16-4 describes hydrologic model results showing Delta Outflow under existing conditions. Under existing conditions outflow from the Delta fluctuates more during wetter years than during drier years as surplus water is transferred and excess water flows toward the ocean.

Table 16-4. Delta Outflow under Existing Conditions (1,000 acre feet)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	484	1,051	2,740	5,176	5,328	4,829	3,263	2,540	1,404	692	330	1,168
AN	325	749	1,135	2,907	3,407	3,298	1,927	1,509	718	584	246	703
BN	340	508	748	1,328	2,022	1,421	1,319	1,021	472	437	246	239
D	321	504	538	871	1,173	1,215	868	653	397	308	246	220
C	288	375	342	653	729	726	537	379	319	249	219	179

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

16.2 Environmental Consequences

This section describes the assessment methods and environmental consequences associated with each alternative.

16.2.1 Assessment Methods

The effects analysis uses both quantitative and qualitative methods to assess changes in recreational opportunities and use of affected facilities. Quantitative methods include consideration of thresholds at which recreational opportunities are affected (e.g., the reservoir level at which boat ramps become unusable). Qualitative methods used to assess recreation effects include consideration of potential effects on the availability, accessibility, and quality of recreation sites.

Every Reclamation project that is managed by a partner agency has the ability to provide recreation opportunities subject to Reclamation's water-related needs and uses. As such, recreation has been treated as a secondary resource and not a primary purpose of the construction and provision of recreation by the project. This is specifically noted in each agreement with the recreation management partner (Reclamation 2014b).

This analysis uses CalSim II hydrologic modeling output that estimates changes to river flow rates and reservoir water surface elevations under the alternatives. Surface water elevation data is not available for all reservoirs included in the area of analysis. Where data is not available, effects are evaluated based on transfer quantities, changes in water storage, and the timing of proposed transfers under the various action alternatives. Appendix B describes the modeling efforts to quantify changes in reservoir surface water elevation and river flow rates.

Recreational opportunities at reservoirs would be affected if reservoir levels decline such that boat ramps become unusable. Boat ramp usability was chosen as the limiting factor because it is a quantifiable measurement and lower reservoir levels would generally affect boat ramps prior to affecting other recreational activities (e.g., swimming or fishing). If boat ramps remained usable, it is assumed that there would be sufficient water levels in the reservoir to sustain all other recreational activities. In those cases where boat ramp usability is not a good indicator of ability to use other recreational facilities, this assessment includes a qualitative discussion.

Recreational opportunities in rivers and streams would be affected if flow rates were to increase or decrease substantially, affecting whitewater rafting, kayaking, fishing, swimming, and other water-dependent activities. Change in flow rates is a quantifiable measurement and drastic increases or decreases would affect water-related activities. A substantial increase in flow rates could also affect camping areas in close proximity to rivers and streams if such increases were to result in flooding in those areas. Changes in flows could also affect water temperature. In general, substantial increases in flow result in lower water temperatures and could make the river unsuitable for direct water contact recreation. Decreases in flow could increase water temperatures and could adversely affect fishing opportunities. Changes in water temperatures relative to recreation are discussed qualitatively. Typically, the flow needed for fish is the benchmark for existing recreation uses. As such, any flow that still allows fish is meeting the current need for recreation.

A federal Wild and Scenic designation for recreation has been established for the Lower American River. The effects analysis shall consider adverse effects that may diminish recognized outstanding or remarkable values by the various alternatives. The designation for recreation is described in Chapter 16.1.2.1. Under this designation, changes to flows affecting whitewater rafting would not alone diminish the federal Wild and Scenic designation.

16.2.2 Alternative 1: No Action Alternative

16.2.2.1 American River Division

Changes in surface water elevations at Folsom Lake and Lake Natoma as a result of the No Action Alternative could affect reservoir-based recreation. Table 16-5 presents the change in Folsom Lake surface water elevations under the No Action Alternative compared to existing conditions, ranging from increases of up to eight feet to decreases of up to three feet. These slight changes in elevation would adversely affect the usability of some boat launch sites in some water year types and may increase the usability of the Browns Ravine boat launch site in critically dry years by one month (November). Even though one or two boat launch sites may be adversely affected in a particular month during a particular water year type, there would still be other boat launch sites available for use at Folsom Lake. The projected increases in surface water elevation in some water year types are within normal elevation fluctuations and would not result in flooding at Folsom Lake. The surface water elevation at Lake Natoma, which is just downstream of Folsom Lake, would also remain within normal fluctuation levels and recreation would not be adversely affected at Folsom Lake and Lake Natoma. Therefore, there would be no adverse effect to recreation opportunities at reservoirs within the American River Division.

Table 16-5. Changes to Folsom Lake Surface Water Elevation between the No Action Alternative and Existing Conditions (in feet)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-2	-1	0	0	0	0	0	0	-1	-1	-1	0
AN	-1	-2	-2	0	1	1	0	0	-1	-3	-3	-3
BN	-1	-1	-1	-1	0	0	0	0	0	-2	-3	0
D	0	-1	-2	-2	-1	0	0	0	-1	-1	-1	-1
C	0	1	-1	-2	-2	-1	-1	0	-1	0	8	8

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

Changes in American River flow as a result of the No Action Alternative could affect river-based recreation and recreational opportunities along the American River Parkway. Table 16-6 presents the estimated changes in river flow across different water year types when compared to existing conditions, ranging from increases of approximately 9 percent to decreases of approximately 39 percent below Nimbus Dam, and increases of approximately 8 percent to decreases of approximately 48 percent at H Street. American River flow upstream of Folsom Lake would be unaffected by the project. The greatest increases in flow would occur during periods where flow rates are normally low so these increases would not cause any flooding affecting camping or other land-based recreational opportunities. Most of the predicted decreases in flows would be minor and would not affect any land-based or water-based recreational opportunities along the American River or the American River Parkway. Larger decreases in flow would occur in July, August, and September during some water year types; however, flow rates would still provide for water based recreational activities. Under the No Action Alternative, critical year flows in August (899 cfs) and September (782 cfs) would be lower than the lowest flow rates recorded under critical year existing conditions (shown in Table 16-3) at H Street (March flow of 884 cfs and April flow of 944 cfs).

Table 16-6. Changes to American River Flow between the No Action Alternative and Existing Conditions (cfs change)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River Below Nimbus Dam												
W	-6%	-5%	-3%	-1%	-2%	-1%	-3%	-4%	-5%	-7%	-9%	-7%
AN	2%	-1%	-4%	-4%	-3%	-2%	-4%	-7%	-6%	-2%	-7%	-9%
BN	9%	-6%	-1%	-5%	-4%	-4%	-5%	-9%	-6%	-0%	-10%	-24%
D	1%	-1%	-2%	-1%	-7%	-10%	-6%	-12%	-2%	-10%	-12%	-12%
C	5%	-7%	0%	0%	1%	-6%	-5%	-9%	-9%	-17%	-39%	-13%

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River at H Street												
W	-9%	-7%	-4%	-2%	-3%	-2%	-3%	-4%	-5%	-17%	-20%	-8%
AN	-1%	-3%	-7%	-6%	-4%	-3%	-5%	-8%	-7%	-12%	-23%	-11%
BN	8%	-9%	-6%	-9%	-5%	-6%	-6%	-10%	-8%	-7%	-27%	-26%
D	-1%	-3%	-8%	-5%	-11%	-14%	-7%	-13%	-3%	-16%	-21%	-16%
C	2%	-11%	-5%	-6%	-6%	-14%	-7%	-11%	-11%	-24%	-48%	-18%

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

Historically, there have been no reported periods where flow is too low for normal late summer water recreation downstream of Nimbus Dam even during drought conditions. The flows under the No Action Alternative would be acceptable based on the LARFMS requirements and a flow at 782 cfs would still be adequate to meet needs of most water recreation uses. The predicted decreases in flow would not adversely affect recreational opportunities during most year types. During critically dry years float boating would still be possible under the No Action Alternative in August and September. Moreover, the decreases in flow would not adversely affect the National Wild and Scenic river values of the lower American River in any water year type since the recreational use is not dependent on river flow (see Chapter 16.2.1).

16.2.2.2 Delta Division

Changes in Delta outflow as a result of the No Action Alternative could affect recreational opportunities in the Delta. Table 16-7 presents the estimated changes in Delta outflow across different water year types ranging from increases of approximately five percent and decreases of approximately six percent when compared to existing conditions. These changes would not be noticeable and would have no impact to the recreational setting or visitor attendance in the Delta. The No Action Alternative would have no effect on Delta recreation.

Table 16-7. Changes to Delta Outflow between the No Action Alternative and Existing Conditions (1,000 acre feet change)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-3%	1%	0%	0%	-1%	0%	1%	-2%	-2%	-1%	-5%	0%
AN	4%	-3%	1%	0%	0%	-1%	2%	0%	-2%	0%	0%	0%
BN	0%	1%	2%	2%	-1%	-0%	2%	-4%	0%	2%	0%	0%
D	0%	-1%	0%	2%	0%	-1%	-1%	-4%	1%	1%	3%	-6%
C	0%	-2%	4%	5%	2%	1%	-2%	-3%	0%	1%	5%	0%

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

16.2.3 Alternative 2: Equal Agricultural and M&I Allocation

16.2.3.1 American River Division

Changes in surface water elevations at Folsom Lake and Lake Natoma as a result of equal agricultural and M&I water service contractor allocation could affect reservoir-based recreation. Table 16-8 presents the change in Folsom Lake surface water elevations under Alternative 2 compared to the No Action Alternative. These increases in elevation would have no adverse effect to the usability to boat launch sites and may increase the usability of some boat ramps during some year types. California State Parks enforces a 5 miles per hour (mph) speed limit on all of Folsom Lake when the lake level nears 390 feet in surface water elevation (CDPR and Reclamation 2009). The increases in surface water elevation under Alternative 2 would allow for more days where the 5 mph speed limit would not be enforced especially during dry and critically dry years. The increases in surface water elevation are within normal elevation fluctuations and would not result in flooding at Folsom Lake. The surface water elevation at Lake Natoma, which is just downstream of Folsom Lake, would also remain within normal fluctuation levels and recreation would not be adversely affected. These changes would have no adverse impact to the recreational setting or visitor attendance at Folsom Lake and Lake Natoma. There would also be a positive effect to recreation opportunities at Folsom Lake which may increase user days. There would be no adverse effects to other reservoirs within the American River Division under Alternative 2.

Table 16-8. Changes to Folsom Lake Surface Water Elevation between Alternative 2 and the No Action Alternative (in feet)

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

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

Changes in American River flow as a result of equal agriculture and M&I water service contractor allocations could affect river-based recreation and recreational opportunities along the American River Parkway. Table 16-9 presents the predicted changes in river flow across different water year types when compared to the No Action Alternative, ranging from increases of approximately 17 percent to decreases of approximately 2 percent below Nimbus Dam, and increases of approximately 23 percent to decreases of approximately 2 percent at H Street. The greatest increases in flow would occur during periods where flow rates are normally low so these increases would not cause any flooding affecting camping or other land-based recreational opportunities. During dry and critically dry years increases in flow could benefit recreation in July and August when under the No Action Alternative recreation could be adversely affected. The decreases in flows would be infrequent and small and would not affect any land-based or water-based recreational opportunities along the American River or the American River Parkway.

Table 16-9. Changes to American River Flow between Alternative 2 and the No Action Alternative (cfs change)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River Below Nimbus Dam												
W	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%
AN	5%	0%	2%	2%	0%	0%	0%	0%	0%	0%	0%	0%
BN	2%	0%	1%	1%	1%	1%	6%	2%	2%	1%	-2%	5%
D	0%	1%	1%	1%	4%	4%	3%	1%	2%	4%	11%	-1%
C	1%	2%	4%	3%	0%	0%	0%	1%	-2%	9%	17%	5%
American River at H Street												
W	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%
AN	6%	0%	1%	2%	0%	0%	0%	0%	1%	1%	0%	1%
BN	2%	0%	1%	1%	1%	1%	7%	2%	3%	1%	-2%	5%
D	0%	1%	1%	1%	4%	4%	3%	1%	2%	4%	12%	-2%
C	1%	2%	5%	3%	0%	0%	0%	1%	-2%	11%	23%	6%

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

16.2.3.2 Delta Division

Changes in Delta outflow as a result of equal agriculture and M&I water service contractor allocations could affect recreational opportunities in the Delta.

Table 16-10 presents the predicted changes in Delta outflow across different water year types ranging from increases of approximately four percent and decreases of approximately six percent when compared to the No Action Alternative. These slight changes would not be noticeable. These changes would have no impact to the recreational setting or visitor attendance in the Delta. Alternative 2 would have no effect on Delta recreation.

Table 16-10. Changes to Delta Outflow between the Alternative 2 and the No Action Alternative (1,000 acre feet change)

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%	0%	0%
AN	1%	0%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%
BN	0%	0%	-2%	0%	1%	0%	1%	1%	0%	3%	0%	1%
D	0%	-1%	1%	0%	0%	0%	1%	1%	0%	0%	4%	3%
C	2%	0%	1%	1%	0%	0%	2%	3%	1%	-1%	-6%	0%

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

16.2.4 Alternative 3: Full M&I Allocation Preference

16.2.4.1 American River Division

Changes in surface water elevations at Folsom Lake and Lake Natoma as a result of 100 percent M&I water service contractor allocations could affect reservoir-based recreation. Table 16-11 presents the change in Folsom Lake surface water elevations under Alternative 3 compared to the No Action Alternative. Under Alternative 3, the predicted changes would be less than the predicted changes under Alternative 2. These slight changes in surface water elevation would have no adverse effect to the usability of boat launch sites. The surface water elevation at Lake Natoma, which is just downstream of Folsom Lake, would remain within normal fluctuation levels and recreation would not be adversely affected. These changes would have no impact to the recreational setting or visitor attendance at Folsom Lake and Lake Natoma. Therefore, there would be no adverse effect to recreation opportunities at reservoirs within the American River Division under Alternative 3.

Table 16-11. Changes to Folsom Lake Surface Water Elevations between Alternative 3 and the No Action Alternative (in feet)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	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
BN	0	0	0	-1	0	0	0	0	0	0	0	0
D	0	-1	0	0	0	0	0	0	0	-1	0	0
C	-1	-2	-2	-2	-2	-1	-1	-1	-1	-2	-2	-2

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

Changes in American River flow as a result of 100 percent M&I water service contractor allocations could affect river-based recreation and recreational opportunities along the American River Parkway. Table 16-12 presents the estimated changes in river flow across different water year types when compared to the No Action Alternative, ranging from increases of approximately 2 percent to decreases of approximately 9 percent below Nimbus Dam in March, and increases of approximately 4 percent to decreases of approximately 12 percent at H Street in August. A flow decrease in March during critically dry years would have little effect to flat-water boating and kayaking because this is not a popular time for water related activities due to cold water temperatures. The greatest decrease in flow would occur in August during dry years. However, the flow would be at 1,454 cfs which is adequate for river recreation and still higher than lowest predicted flows during other year types under the No Action Alternative and Alternative 3. These changes in flow would be minor and would have minimal effect to any land-based or water-based recreational opportunities along the American River or the American River Parkway.

Table 16-12. Changes to American River Flow between Alternative 3 and the No Action Alternative (cfs change)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River Below Nimbus Dam												
W	0%	0%	0%	0%	0%	0.%	0%	0%	0%	0%	0%	-1%
AN	-3%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BN	-3%	0%	0%	2%	-1%	-1%	-2%	-2%	-2%	0%	0%	-3%
D	-0%	1%	0%	0%	-2%	-3%	-2%	-2%	-3%	1%	-10%	-4%
C	2%	2%	0%	0%	-3%	-9%	-6%	-7%	-3%	0%	-6%	2%
American River at H Street												
W	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	-1%
AN	-4%	0%	-2%	0%	0%	0%	0%	0%	0%	0%	0%	1%
BN	-3%	0%	0%	2%	-1%	-1%	-3%	-2%	-2%	0%	0%	-4%
D	-0%	1%	0%	0%	-2%	-3%	-2%	-2%	-4%	1%	-12%	-5%
C	2%	2%	0%	0%	-3%	-10%	-6%	-8%	-4%	0%	-8%	4%

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

16.2.4.2 Delta Division

Changes to Delta outflow as a result of 100 percent M&I water service contractor allocations could affect recreational opportunities in the Delta. Table 16-13 presents the estimated changes in Delta outflow across different water year types, which would range from increases of approximately three percent to decreases of approximately five percent when compared to the No Action Alternative. The predicted changes would be less than those predicted under Alternative 2. These changes would not be noticeable and would have no impact to the recreational setting or visitor attendance in the Delta. Alternative 3 would have no effect on Delta recreation.

Table 16-13. Changes to Delta Outflow between Alternative 3 and the No Action Alternative (1,000 acre feet change)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
AN	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BN	0%	0%	0%	0%	-1%	0%	0%	0%	2%	-1%	0%	-1%
D	1%	-1%	3%	0%	0%	0%	0%	-1%	0%	-1%	-5%	-2%
C	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	-4%	0%

Note: Negative numbers indicate that the action would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.

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

16.2.5 Alternative 4: Updated M&I WSP

Alternative 4 is similar to the No Action Alternative. There would be no difference in reservoir surface elevations or river flows between the No Action Alternative and Alternative 4. Therefore, there would be no effects to recreation within the area of analysis under Alternative 4, including the designation of the lower American River as a recreational river.

16.2.6 Alternative 5: M&I Contractor Suggested WSP

Under Alternative 5, there would be very slight changes to surface water elevations and flows (percent change) at the modeled reservoirs, American River, and Delta compared to the No Action Alternative. The predicted changes under Alternative 5 would be substantially less than those predicted under Alternatives 2 and 3 and would only occur during a few months in some water year types. Therefore, there would be no adverse effects to recreation within the area of analysis under Alternative 5, including the designation of the lower American River as a recreational river.

16.3 Mitigation Measures

The action alternatives would not have adverse effects to recreational opportunities in the area of analysis. Therefore, no mitigation measures are required.

16.4 Unavoidable Adverse Impacts

None of the action alternatives would result in unavoidable adverse impacts to recreation.

16.5 Cumulative Effects

The timeline for the recreation cumulative effects analysis extends through 2030. The relevant geographic study area for the cumulative effects analysis is the same area of analysis as described above in Chapter 16.1. The cumulative analysis for recreation considers projects that could affect reservoir surface water elevations, river flows, or could result in physical impacts on recreation areas within the area of analysis that might restrict or reduce recreational opportunities.

The projects identified in Chapter 20, Cumulative Effects Methodology, which have the potential for cumulative effects to recreation within the area of analysis include the following:

- Bay Delta Conservation Plan (BDCP) – Delta Division. The BDCP project components that could have cumulative recreation effects include: construction and operation of a new conveyance facility bringing water from the Sacramento River; operation and maintenance of State Water Project (SWP) facilities in the Delta; habitat improvement activities; and long-term effects to CVP and SWP deliveries.

- North Delta Flood Control and Ecosystem Restoration Project – Delta Division. Construction of ecosystem improvements may have temporary effects on recreation area access.

- Long-Term Water Transfers – American River Division and Delta Division. Water transfers could affect river flows and reservoir surface water elevations.

- Folsom Dam Safety and Flood Damage Reduction Project (Joint Federal Project) and Folsom Water Control Manual Update – American River Division. Construction at Folsom Dam could affect recreation access.

16.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Alternative 2, in combination with other cumulative projects, could affect river- and reservoir-based recreation.

Changes associated with the equal allocation of agricultural and M&I water service contractor supplies under Alternative 2 to surface water elevations and river flows would have no effect on recreation. The other projects identified with the potential to contribute to the cumulative condition listed above have the potential to affect reservoir levels and river flows within the area of analysis. The BDCP could potentially result in increased flow for south-of-Delta export. Water transfers under the Long-Term Water Transfers project could affect river flows and reservoir surface water elevations at some of the same CVP and other local facilities within the area of analysis for the M&I WSP. However, the sellers under the Long-Term Water Transfers project would be unlikely to transfer water if they are operating in a ~~shortage condition~~Condition of Shortage. These projects would be implemented to increase water supplies for agriculture and municipal uses. As storage projects are being planned and developed, these projects would need to go through an environmental analysis related to river recreation and fisheries, among other topics. It is unlikely that a project would be approved that would substantially affect flows along the American River because there are already policies in place to maintain specific river flow rates for fish and water supply concerns.

Future projects associated with the North of Delta Ecosystem Restoration Project that could substantially affect flows are also unlikely to be approved due to the policies in place to maintain specific river flows. Construction of these projects could cause temporary affects to recreation related to access; however, other recreation opportunities would be available nearby and mitigation measures may be implemented to maintain adequate access to recreation resources during construction.

The cumulative projects in combination with Alternative 2 have minimal cumulative effects to recreation.

16.5.2 Alternative 3: Full M&I Allocation Preference

The recreation effects under Alternative 3 would be very similar to those under Alternative 2.

16.5.3 Alternative 4: Updated M&I WSP

The recreation effects under Alternative 4 would be very similar to those under Alternative 2. Therefore, there would be no adverse cumulative effects on recreation.

16.5.4 Alternative 5: M&I Contractor Suggested WSP

The recreation effects under Alternative 5 would be very similar to those under Alternatives 2 and 3. Therefore, there would be no adverse cumulative effects on recreation.

16.6 References

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Chapter 17
Power

This chapter presents the existing power generation facilities within the area of analysis and discusses potential effects on power generation from the proposed alternatives. The discussion of potential impacts of the alternatives includes the power generation from Central Valley Project (CVP) water service contractor facilities and the hydroelectric facilities of the CVP.

17.1 Affected Environment

Water storage within the CVP service area is extensively developed for hydroelectric generation and the release of water from reservoirs is coordinated to optimize power generation along with other reservoir operational considerations. In the project area, hydropower is generated by CVP storage facilities. The Municipal and Industrial Water Shortage Policy (M&I WSP) has the potential to change allocations and deliveries of CVP water to M&I and agricultural water service contractors under a Condition of Shortage ~~shortage conditions~~ and to alter the head elevation of the hydroelectric power reservoirs. This resulting head change can affect hydroelectric power generation efficiency.

17.1.1 Area of Analysis

The area of analysis for the evaluation of potential effects on power generation from the implementation of the proposed alternatives includes the reservoirs and power generation facilities of the CVP American River and San Luis systems. Also in the area of analysis are power generation facilities belonging to Sacramento Municipal Utility District (SMUD). The power generation facilities under consideration in this analysis are presented in Figure 17-1.

The area of analysis does not include six CVP power generation facilities on the Trinity and Sacramento rivers. There are only relatively small changes to Shasta and Trinity lakes as a result of the different agricultural and M&I water service contractor allocations in the alternatives. The changes in storage and elevation 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 No Action of more than +/- one percent of total storage. This is further discussed in Appendix B, Water Operations Model Documentation. Due to these minimal changes, power facilities at Shasta and Trinity lakes are not discussed in further detail in this chapter.

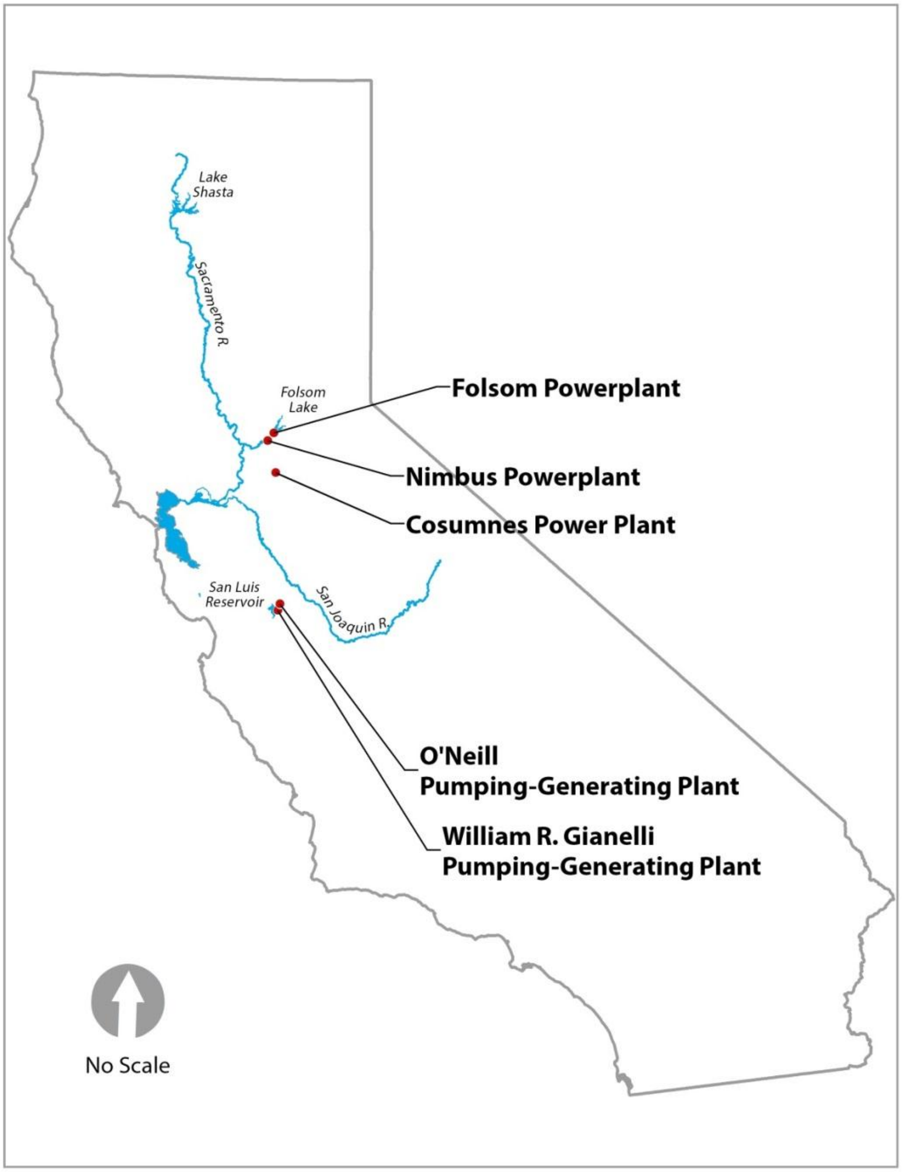

Figure 17-1. Power Facilities in the CVP

17.1.2 Regulatory Setting

Power generation is regulated by the Federal and State governments. The United States Army Corps of Engineers (USACE) has responsibility to ensure that reservoirs used for hydropower will continue to be operated for flood control. The California Energy Commission certifies and regulates thermal powerplants generating 50 megawatts (MW) or more, ensuring plants meet regulatory requirements. The California Independent System Operator Corporation is an impartial operator of the statewide wholesale power grid with responsibility for system reliability through scheduling available transmission capacity.

There are many other regulatory requirements, including water quality, ecosystem health, flood control, and water system operations, which affect how reservoirs and hydroelectric projects are operated which are described in other chapters of this document.

17.1.3 Existing Conditions

The following section describes the existing power generation facilities in the study area.

17.1.3.1 Folsom Lake

The Folsom Lake area include the American River and the facilities at Folsom and Nimbus dams. These dams provide M&I and agricultural water supplies to a number of water agencies and municipal utility districts in the American river drainage and the CVP.

Folsom Powerplant The Folsom Powerplant is part of the CVP's Folsom Unit on the American River. Folsom Lake is a major water management facility located within the greater Sacramento metropolitan area with a storage capacity of 977,000 acre-feet (AF). Folsom Powerplant is a peaking hydroelectric facility located at the foot of Folsom Dam. Folsom Dam was constructed by USACE and, on completion, was transferred to Reclamation for coordinated water supply and flood control operations. It is an integral part of the CVP and is a key flood control structures protecting the Sacramento metropolitan area. Folsom Powerplant provides a large degree of local voltage control and is increasingly relied on to support local loads during system disturbances. The facility has an installed capacity of 198 MW with a net average of 425,862 megawatt-hours (MWh) annually (Reclamation 2013a).

Nimbus Powerplant Nimbus Dam forms Lake Natoma and acts as an afterbay for Folsom Powerplant, allowing dam operators to coordinate power generation and flows in the lower American River during normal reservoir operations. Lake Natoma has a surface area of 500 acres and its elevation fluctuates between 4 to 7 feet daily. The powerplant has an installed capacity of 13.5 MW with a net average of 51,097 MWh annually. The powerplant is a run-of-the-river plant providing baseload and station service backup for Folsom Powerplant. (Reclamation 2013b).

Cosumnes Powerplant The Cosumnes Powerplant is a gas-fired powerplant owned and operated by SMUD located approximately 25 miles southeast of Sacramento. The plant went online in February 2006 with an installed capacity of 500 MW (California Energy Commission 2014). SMUD has an M&I water service contract for 30,000 AF per year of CVP water for powerplant cooling and other operational uses.

17.1.3.2 San Luis Reservoir

O'Neill Pumping-Generating Plant The O'Neill Pumping-Generating Plant lifts water from the CVP Delta-Mendota Canal into the O`Neill Forebay. When water is released from the forebay to the Delta-Mendota Canal, these units operate as generators. O'Neill Pumping-Generating Plant has an installed capacity of 25 MW and an average annual generation of approximately 5,400 MWh.

Gianelli Pumping-Generating Plant The Gianelli Pumping-Generating Plant, a State Water Project (SWP) facility, lifts water from the O'Neill Forebay and discharges it into San Luis Reservoir which has a storage capacity of approximately 2,041,000 AF. The Gianelli Pumping-Generating Plant has an installed capacity of 424 MW. When water is released from San Luis Reservoir it is directed through the Gianelli Pumping-Generating Plant. The average annual generation of the plant is approximately 126,400 MWh, with the monthly generation at zero through most of the winter, spiking to over 50,000 MWh in May, and dropping slowly back to zero by September (Reclamation 2008).

17.2 Environmental Consequences

These sections describe the environmental consequences associated with each alternative.

17.2.1 Assessment Methods

Hydroelectric power generation is dependent on changes in storage and water releases. If water releases out of hydroelectric facilities are reduced or increased, power generation may be reduced or increased, respectively. Changes in CVP deliveries could similarly affect CVP contractor power generation facilities.

To analyze these impacts, potential changes to storage and water releases out of hydroelectric facilities and CVP deliveries are evaluated within the area of analysis. The CalSim II hydrologic model was used to evaluate changes in reservoir storage and river flows for each alternative. For potential changes to the San Luis Reservoir powerplants, changes in overall storage were analyzed as opposed to changes in elevation or water releases. The CalSim II model did not look at impacts to the elevation of the reservoir or releases for the alternatives. See Appendix B for model documentation and full modeling results.

17.2.2 Alternative 1: No Action

Changes in CVP deliveries may cause changes in power generation from hydroelectric facilities by changing reservoir releases or by changing reservoir storage (as represented by changes in reservoir elevations). Under the No Action Alternative, there be could changes in reservoir releases at Folsom Dam compared to existing conditions. Changes in river flows are due to changes in CVP deliveries to M&I and agricultural water service contractors driven by population growth and changes in land use under future conditions. As shown in Table 17-1, releases from Folsom Dam would decrease in most months for all the year types. The maximum percent decrease in flows, approximately 39 percent, would occur in August of critical years. These decreases in flows in the summer of drier years would have an adverse impact on the amount of power generated by both the Folsom and Nimbus powerplants.

Table 17-1. Percent Change in American River flow below Nimbus Dam between the No Action Alternative and Existing Conditions

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-6%	-5%	-3%	-1%	-2%	-1%	-3%	-4%	-5%	-7%	-9%	-7%
AN	2%	-1%	-4%	-4%	-3%	-2%	-4%	-7%	-6%	-2%	-7%	-9%
BN	9%	-6%	-1%	-5%	-4%	-4%	-5%	-9%	-6%	-0%	-10%	-24%
D	1%	-1%	-2%	-1%	-7%	-10%	-6%	-12%	-2%	-10%	-12%	-12%
C	5%	-7%	0%	0%	1%	-6%	-5%	-9%	-9%	-17%	-39%	-13%

Note: Negative numbers indicate that No Action Alternative would decrease river flows compared to the existing conditions; positive numbers indicate that the No Action Alternative would increase river flows.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

The No Action Alternative would change elevations in Folsom Lake compared to existing conditions. It is expected that under the No Action Alternative, reservoir elevations would slightly decrease compared to existing elevations for most months of most year types, as shown in Table 17-2. The lower surface elevations would translate to reduced head and would therefore slightly decrease the head component of generation efficiency at each facility. Although the loss of head pressure would reduce the efficiency of the turbines, and therefore the amount of electricity that can be produced, the power loss would be minimal because of the small differences in elevations.

Table 17-2. Changes in Folsom Lake Elevations between the No Action Alternative and Existing Conditions (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-2	-1	0	0	0.5	0	0	-0.5	-0.5	-1	-1	-0.5
AN	-1.5	-2	-2	-0.5	0.5	1	0	0	-1	-2.5	-3.5	-2.5
BN	-1.0	-1	-1.5	-1	0	0	0	0.5	-0.5	-2.5	-3	0
D	0	-1	-2	-2	-1.5	0	0	0.5	-1	-1	-1	-1
C	0	1	-1	-1.5	-2	-1	-1	0	-1	0.5	8	7.5

Note: Negative numbers indicate that No Action Alternative would decrease reservoir elevations compared to existing conditions; positive numbers indicate that the No Action Alternative would increase reservoir elevations. Elevations have been rounded to the nearest 0.5 feet.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

The No Action Alternative would also change elevations, which is related to change in storage, in the San Luis Reservoir compared to existing conditions because of the changes in agricultural and M&I water service contractor deliveries. In general, it is expected that the San Luis Reservoir would be operated differently in the future than under existing conditions due changes in population growth and land use. The change in storage at San Luis Reservoir would range between a decrease of 23 percent to an increase of 17 percent, as shown in Table 17-3. These changes in storage would impact reservoir elevations and, therefore, impact the head component of the power generation for the powerplants. In dry and critical water year types, increases in surface elevations would increase the amount of head and slightly increase the amount of power generation. In wetter year types, decreases in surface elevations could cause adverse decreases in the amount of power generated as compared to existing conditions in certain months. However, during wetter year types, there would be more water in the CVP system, and therefore more energy produced throughout the system.

Table 17-3. Percent Change in Storage at San Luis Reservoir between the No Action Alternative and Existing Conditions

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-17%	-15%	-13%	-8%	-6%	-5%	-6%	-11%	-14%	-20%	-23%	-20%
AN	-5%	-1%	-2%	2%	2%	1%	1%	-4%	-9%	-18%	-20%	-8%
BN	-15%	-13%	-11%	-6%	-4%	-3%	-3%	-6%	-6%	-8%	-7%	-2%
D	-7%	-7%	-5%	0%	3%	4%	4%	5%	11%	6%	3%	-6%
C	-1%	-1%	-1%	3%	5%	6%	7%	9%	17%	16%	12%	11%

Note: Negative numbers indicate that the No Action Alternative would decrease reservoir storage compared to the existing conditions; positive numbers indicate that the No Action Alternative would increase reservoir storage.

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

17.2.3 Alternative 2: Equal Agricultural and M&I Allocation

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). Alternative 2 would change reservoir releases at Folsom Dam compared to the No Action Alternative. The decreased water deliveries to M&I water service contractors under Alternative 2 would allow Reclamation to use storage in Folsom Lake to increase deliveries to agricultural contractors south of the Sacramento-San Joaquin River Delta (Delta). Increases in flows to the Delta would increase power generation from both the Folsom and Nimbus powerplants. Table 17-4 shows the changes in reservoir releases below Nimbus Dam (the power regulating facility associated with Folsom Lake). For this facility, reservoir releases would increase in most months for most types of years, resulting in increased power generation. The decreases in certain months and year types would represent minor decreases in flow (a maximum of two percent decrease in critical years) and would not result in adverse impacts on power generation.

Table 17-4. Percent Change in American River flow below Nimbus Dam between Alternative 2 and the No Action Alternative

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	1%	1%	1%	0%	0%	0%	0%	0%	0%	0%	0%	1%
AN	5%	0%	2%	2%	0%	0%	0%	0%	0%	0%	0%	0%
BN	2%	0%	1%	1%	1%	1%	6%	2%	2%	1%	-2%	5%
D	0%	1%	1%	1%	4%	4%	3%	1%	2%	4%	11%	-1%
C	1%	2%	4%	3%	0%	0%	0%	1%	-2%	9%	17%	5%

Note: Negative numbers indicate that Alternative 2 would decrease reservoir releases compared to the No Action Alternative; positive numbers indicate that Alternative 2 would increase reservoir releases.

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

Alternative 2 would also change elevations in Folsom Lake compared to the No Action Alternative because less water would be delivered for M&I water service contractors, thereby increasing the reservoir storage, as shown in Table 17-5. The higher surface elevations would translate to increased head and therefore slightly increase the head component of the generation efficiency at the facility. Although the increase in head pressure would increase the efficiency of the turbines and, therefore, the amount of electricity that would be able to be produced, the power increase would be minimal because of the small differences in elevations.

Table 17-5. Changes in Folsom Lake Elevations between Alternative 2 and the No Action Alternative (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0.5	0.5	0	0	0	0	0	0	0	0	0	0
AN	2	2	1	0	0	0	0	0	0	0	0	0
BN	2.5	2	2	1.5	1	1	0	0	0	0.5	1.0	1
D	1	1	1	1	1	0.5	0.5	1	1	1	0	0.5
C	2	2	2	2	3	2.5	3	3.5	5	5.5	5	6

Note: Negative numbers indicate that Alternative 2 would decrease reservoir elevations compared to the No Action Alternative; positive numbers indicate that Alternative 2 would increase reservoir elevations. Elevations have been rounded to the nearest 0.5 feet.

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

Alternative 2 would also change storage and elevations in the San Luis Reservoir compared to the No Action Alternative because of the changes in agricultural and M&I water service contractor deliveries. Overall it is expected that the change in reservoir storage, as compared to the No Action Alternative, would range from a decrease in up to 5 percent in dry years to an increase of up to 10 percent in critical years (see Table 17-6). This potential slight decrease in storage, which would correspond to a decrease in reservoir elevations, could slightly decrease power generation during that time as a result of decreased head, however it would be temporary.

Table 17-6. Percent Change in Storage at San Luis Reservoir between Alternative 2 and the No Action Alternative

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	2%	2%	2%	1%	1%	0%	0%	0%	0%	0%	0%	0%
AN	0%	1%	1%	0%	0%	0%	0%	0%	-1%	-1%	-1%	0%
BN	0%	1%	2%	2%	0%	0%	-1%	-1%	-1%	-1%	1%	1%
D	2%	3%	2%	2%	1%	0%	0%	-1%	-4%	-5%	0%	3%
C	6%	7%	6%	5%	4%	3%	3%	3%	2%	3%	8%	10%

Note: Negative numbers indicate that Alternative 2 would decrease reservoir storage compared to the No Action Alternative; positive numbers indicate that Alternative 2 would increase reservoir storage.

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

Changes in CVP deliveries to the American River Division contractors could affect power generation facilities in the American River Division. Table 17-7 presents expected changes in the M&I deliveries to American River Division contractors under Alternative 2. As shown in Table 17-7, Alternative 2 would provide less water overall for M&I water service contractors in the American River Division compared to the No Action Alternative, which could lead to reduced power generation if water supplies are not sufficient for the cooling and operational needs of powerplants in this region. Under Alternative 2, less of Folsom Lake's water supply would be delivered to M&I water service contractors than under the No Action Alternative and more of the reservoir's supply would be delivered to agricultural contractors. In general, changes in CVP deliveries to SMUD would follow the trend of those changes for the entire American River Division.

Table 17-7. Changes in American River Division Deliveries between Alternative 2 and the No Action Alternative (thousand AF [TAF])

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
W	-0.5	-0.5	-0.5	-0.5	-0.5	-1	-3	-3.5	-4	-4.5	-4.5	-3.5	-26.5
AN	-0.5	-0.5	-0.5	-0.5	-0.5	-1	-2.5	-3	-3.5	-4	-4	-3	-23.5
BN	-2.5	-2	-2	-2	-2	-1	-3	-4	-4.5	-4.5	-4	-3.5	-35
D	-3	-2.5	-2.5	-2.5	-2.5	-2	-5	-6.5	-7	-7	-6.5	-5	-52
C	-3.5	-2.5	-2.5	-2.5	-2.5	-4	-9	-12	-12	-10	-9	-7.5	-77

Note: Negative numbers indicate that Alternative 2 would decrease deliveries compared to the No Action Alternative; positive numbers indicate that Alternative 2 would increase deliveries.

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

Over all year types, American River Division deliveries would be reduced in all months compared to the No Action Alternative. The delivery reductions would be greater from April through September than in other months. The total delivery reduction compared to the No Action Alternative would range from 26,400 AF in an above normal year to 76,800 AF in critical years, or about 12 percent to 46 percent reductions from deliveries under the No Action Alternative.

However, all of the American River Division contractors have additional non-CVP water supplies to help meet their water demands, particularly in times of water shortage. As discussed in Chapter 4, Reclamation has calculated the Public Health and Safety (PHS) needs of the M&I water service contractors. PHS need is a calculation of the amount of water determined to be necessary to sustain public health and safety. These values include consideration for industrial use, which include powerplant cooling and operations. The unmet PHS need is the amount of PHS need remaining after accounting for anticipated available CVP deliveries and available non-CVP supplies. In the American River Division, the total, maximum annual unmet PHS need in Alternative 2 would be 1,100 AF over all year types. That amount of water represents approximately six ~~less than one~~ percent of the American River Division's total CVP contract amount. Therefore, there would not be a depreciable decrease in power generation in the American River Division due to this change in water supply.

17.2.4 Alternative 3: Full M&I Allocation Preference

Changes in CVP deliveries may cause changes in power generation from hydroelectric facilities by changing reservoir releases or by changing reservoir storage (as represented by changes in reservoir elevations). Similar to Alternative 2, Alternative 3 could affect power generation by changing reservoir releases or by changing reservoir elevations.

Alternative 3 would change reservoir releases at Folsom Dam compared to the No Action Alternative. Because many M&I customers take water directly from Folsom Lake, increased M&I deliveries would decrease the flows released from Folsom Dam. The deceases in flows would decrease power generation from both the Folsom and Nimbus powerplants. Table 17-8 shows the changes in reservoir releases below Nimbus (the power regulating facility associated with Folsom Lake). For this facility, reservoir releases would decrease in most months for most types of years. However, it is estimated that would be a maximum of a 10 percent decrease in flows, which is not anticipated to have an adverse effect.

Table 17-8. Percent Change in American River flow below Nimbus Dam 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%	0%	0%	0%	0%	0.%	0%	0%	0%	0%	0%	-1%
AN	-3%	0%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
BN	-3%	0%	0%	2%	-1%	-1%	-2%	-2%	-2%	0%	0%	-3%
D	-0%	1%	0%	0%	-2%	-3%	-2%	-2%	-3%	1%	-10%	-4%
C	2%	2%	0%	0%	-3%	-9%	-6%	-7%	-3%	0%	-6%	2%

Note: Negative numbers indicate that Alternative 3 would decrease reservoir releases compared to the No Action Alternative; positive numbers indicate that Alternative 3 would increase reservoir releases.

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

Alternative 3 would also decrease reservoir elevations in Folsom Lake compared to the No Action Alternative because more water would be delivered from this reservoir for M&I water service contractors, as shown in Table 17-9. The lower surface elevations would translate to reduced head and would therefore slightly decrease the head component of generation efficiency at each facility. Although the loss of head pressure would reduce the efficiency of the turbines, and therefore the amount of electricity that could be produced, the power loss would be minimal because of the small differences in elevations.

Table 17-9. Changes in Folsom Lake Elevation between Alternative 3 and the No Action Alternative (feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	0	0	0	0	0	0	0	0	0	0	0	0
AN	-0.5	0	0	0	0	0	0	0	0	0	0	0
BN	0	-0.5	-0.5	-0.5	-0.5	-0.5	0	0	0	0	-0.5	0
D	-0.5	-0.5	0	0	0	0	0	0	0	-0.5	0.5	0.5
C	-1	-1.5	-2	-2	-2	-1	-1	-1	-1	-2.5	-2	-2

Note: Negative numbers indicate that Alternative 3 would decrease reservoir elevations compared to the No Action Alternative; positive numbers indicate that Alternative 3 would increase reservoir elevations. Elevations have been rounded to the nearest 0.5 feet.

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

Alternative 3 would also change elevations in San Luis Reservoir compared to the No Action Alternative because of the changes in agricultural and M&I water service contractor deliveries (see Table 17-10). Under Alternative 3 storage in San Luis Reservoir would vary between decreases of up to 3 percent to increases of up to 10 percent. These changes in storage would correspondingly slightly decrease and increase elevations in the reservoir and impact the power generation facilities. As shown in Table 17-10, there would be minimal decreases in the amount of power generation under Alternative 3. Slight to moderate increases in the amount of power generated could occur under Alternative 3.

Table 17-10. Percent Change in Storage at San Luis Reservoir 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%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
AN	0%	0%	0%	1%	1%	1%	1%	0%	0%	0%	0%	0%
BN	-3%	-2%	-2%	-2%	-1%	0%	-1%	-1%	-2%	-2%	-3%	-3%
D	-1%	1%	-1%	-1%	-1%	-1%	-1%	-1%	0%	3%	3%	-2%
C	0%	0%	0%	0%	1%	0%	1%	2%	3%	5%	10%	7%

Note: Negative numbers indicate that Alternative 3 would decrease reservoir storage compared to the No Action Alternative; positive numbers indicate that Alternative 3 would increase reservoir storage.

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

Changes in CVP deliveries to the American River Division M&I water service contractors could affect power generation facilities in the American River Division. Similar to Alternative 2, changes in M&I deliveries could affect power generation at facilities in the American River Division. Alternative 3 would provide an overall increase in water deliveries for M&I water service contractors in the American River Division compared to the No Action Alternative. In general, changes in CVP deliveries to SMUD would follow the trend of those changes for the entire American River Division.

For all year types, there would be an increase in American River Division deliveries, ranging from a total delivery increase of 11,000 AF in wet years to 31,100 AF in critical years**,** as shown in Table 17-11. Therefore, there would be no adverse impact to power generation.

Table 17-11. Changes in American River Division M&I Deliveries between Alternative 3 and 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	1	1.5	1.5	2	2	1.5	1	10.5
AN	0	0	0	0	0	1	2	2	2.5	3	2.5	1.5	14.5
BN	1.5	1	1	1	1	1.5	2	2.5	2.5	2.5	2	1.5	20
D	1	1	1.5	1	1	3	4	4.5	4.5	4.5	3.5	2	31.5
C	2	1.5	1.5	1.5	1.5	2	2.5	2.5	3	3	2	1.5	24.5

Note: Negative numbers indicate that Alternative 3 would decrease water deliveries compared to the No Action Alternative; positive numbers indicate that Alternative 3 would increase water deliveries.

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

17.2.5 Alternative 4: Updated M&I WSP

The amount of CVP deliveries under Alternative 4 would be similar to the No Action Alternative and no changes to reservoir levels, reservoir storage or river flows are anticipated. Therefore, there would be no adverse effects on power generation within the area of analysis under Alternative 4 compared to the No Action Alternative.

17.2.6 Alternative 5: M&I Contractor Suggested WSP

Power generation under Alternative 5 would be similar to generation under the No Action Alternative; therefore, there would be no changes to power within the area of analysis under Alternative 5 compared to the No Action Alternative.

17.3 Mitigation Measures

There are no mitigation measures identified for the adverse impacts expected in the No Action Alternative.

17.4 Unavoidable Adverse Impacts

None of the action alternatives would result in unavoidable adverse impacts to power.

17.5 Cumulative Effects

The timeframe for the M&I WSP cumulative analysis extends to 2030. The cumulative effects analysis for power considers CVP and SWP water transfers and the San Joaquin River Restoration Program. Chapter 20, Cumulative Effects Methodology, further describes these projects and policies.

17.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Changes in agricultural water deliveries may cause changes in power generation from hydroelectric power generation facilities. The cumulative projects could result in small operational changes that could affect power generation. With the exception of the Shasta Lake Water Resources Investigation project, these projects do not focus on the reoperation of reservoirs with hydroelectric facilities or impact power generation. However, small changes could result from these cumulative projects.

The Shasta Lake Water Resources Investigation evaluates raising Shasta Lake reservoir levels to increase water supply reliability and anadromous fish survival. The increased reservoir storage (from 256,000 AF to 654,000 AF) would increase the reservoir elevation and, therefore, hydroelectric power generation at the Shasta Powerplant facility.

Operational changes under from Alternative 2, as described above, are not likely to have a substantial effect on power generation. Therefore, Alternative 2 would not have an adverse cumulative effect on power generation.

17.5.2 Alternative 3: Full M&I Allocation Preference

Cumulative effects would be the same or less than those described for Alternative 2. There would be no adverse cumulative effects on power.

17.5.3 Alternative 4: Updated M&I WSP

Cumulative effects would be the same or less than those described for Alternative 2. Therefore, there would be no adverse cumulative effects on power.

17.5.4 Alternative 5: M&I Contractor Suggested WSP

Cumulative effects would be the same or less than those described for Alternative 2. There would be no adverse cumulative effects on power.

17.6 References

California Energy Commission. 2014. *SMUD Cosumnes Power Plant Licensing Case*. Accessed on: 07/21/2014. Available: http://www.energy.ca.gov/sitingcases/smud/.

Reclamation. 2008. *San Luis (William R. Gianelli) Powerplant*. Accessed on: 05/27/2014. Available: http://www.usbr.gov/projects/Powerplant.jsp?fac_Name=San+Luis+%28William+R.+Gianelli%29+Powerplant+*.

______. 2013a. *Folsom Powerplant*. Accessed on: 05/27/2014. Available: http://www.usbr.gov/projects/Powerplant.jsp?fac_Name=Folsom Powerplant.

______. 2013b. *Nimbus Powerplant*. Accessed on: 05/27/2014. Available: http://www.usbr.gov/projects/Powerplant.jsp?fac_Name=Nimbus+Powerplant.

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Chapter 18
Flood Hydrology

This chapter presents the existing flood control conditions within the area of analysis and discusses potential effects on flooding and flood control from the proposed alternatives.

18.1 Affected Environment

This section provides a description of the current flood control and hydrologic systems to be affected by the action alternatives. Pertinent regulatory requirements are described below.

18.1.1 Area of Analysis

This section describes the existing flood control infrastructure within the service boundaries of the Central Valley Project (CVP) municipal and industrial (M&I) and agricultural water service contractors affected by the M&I Water Shortage Policy (WSP) alternatives. This includes conveyance and storage facilities that help protect against flood hazards within the American River, Sacramento-San Joaquin River Delta (Delta), and the West San Joaquin and San Felipe divisions. Figure 18-1 shows the major water bodies and locations of flood control facilities in the area of analysis, including:

- American River Division: Folsom Lake, Folsom Dam, Lake Natoma, Nimbus Dam, and Lower American River.
- Delta Division: Sacramento and San Joaquin River confluence and parts of the Bay Area.
- West San Joaquin River/San Felipe Division: San Joaquin River, Delta-Mendota Canal (DMC), O'Neil Dam and Forebay, B.F. Sisk Dam, San Luis Reservoir, Los Banos and Little Panoche Detention Dams and Reservoirs, Los Banos and Little Panoche Creeks, and various tunnels, pumping plants, and conduits.

The area of analysis does not include CVP facilities on the Trinity and Sacramento rivers. As discussed in Chapter 3, Resources Introduction, there are only relatively small changes to flows for these rivers as a result of the different agricultural and ~~municipal and industrial~~ M&I water service contractor allocations in the alternatives. The changes in flow 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.

Results from the CalSim II hydrologic modeling concluded the changes in storage at Trinity and Shasta lakes and the resulting changes to Sacramento River flows, which would have the potential to affect flood hydrology, would be very minor. As discussed in Chapter 3, changes of this small a magnitude are assumed not to result in substantial impacts. Appendix B, Water Operations Model Documentation, describes the hydrologic modeling efforts to quantify changes in reservoir storage and river flow rates and full modeling results.

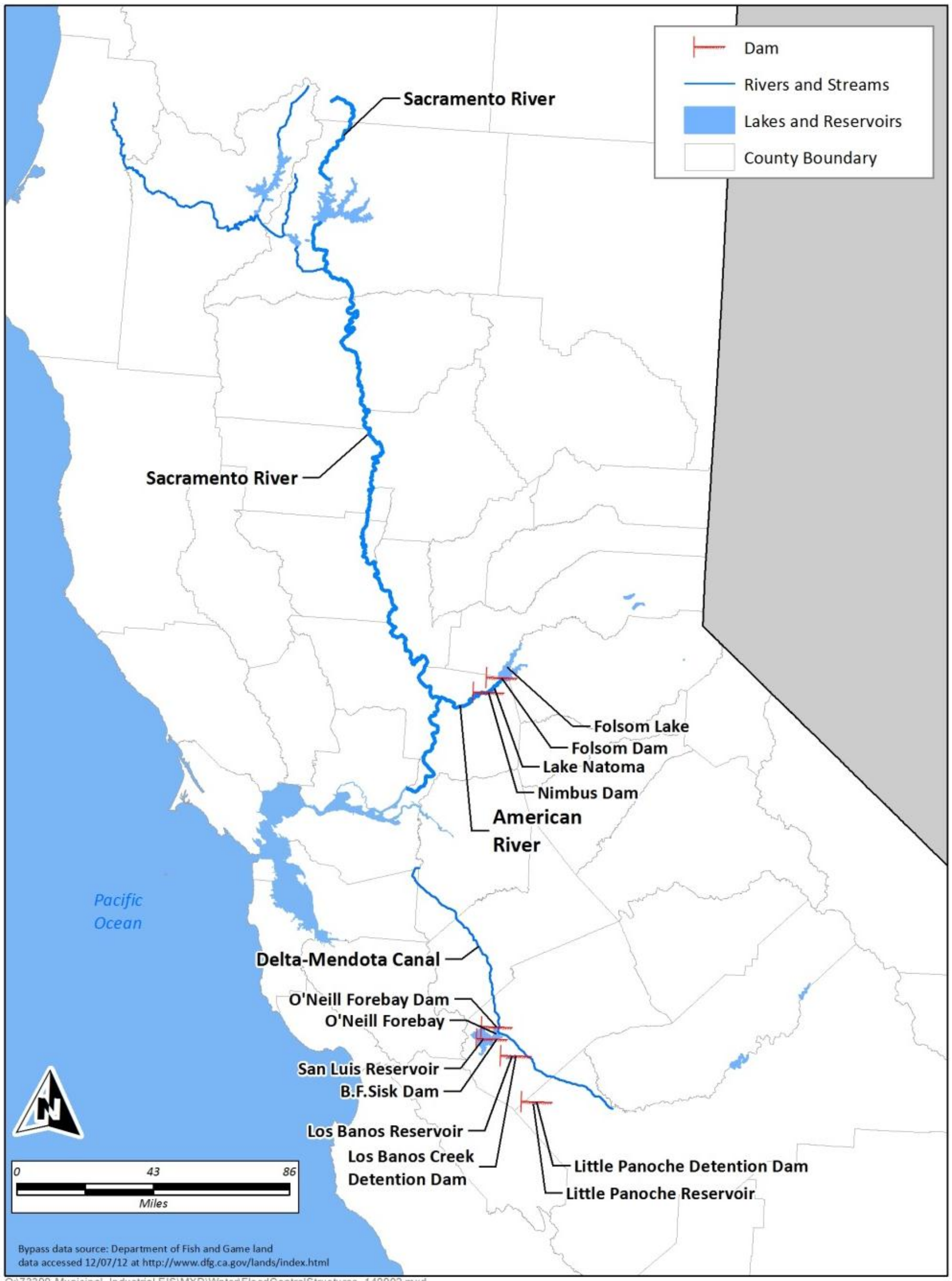

Figure 18-1. Flood Control Area of Analysis

18.1.2 Regulatory Setting

The following section describes applicable flood control laws, rules, regulations and policies.

18.1.2.1 Federal Regulations

The National Flood Insurance Program The National Flood Insurance Program (NFIP) is administered by the Flood Insurance and Mitigation Administration under the Federal Emergency Management Agency (FEMA). The program was established as part of the National Flood Insurance Act of 1968 and includes three components: Flood Insurance, Floodplain Management and Flood Hazard Mapping (FEMA 2002).

Communities across the United States (U.S.) participate in the NFIP through the voluntary adoption and enforcement of floodplain management ordinances. The NFIP makes available federally backed flood insurance to homeowners, renters and business owners in participating communities. The NFIP promotes regulations designed to reduce flood risks through sound floodplain management. NFIP maps identify floodplains and assist communities when developing floodplain management programs and identifying areas at risk of flooding.

In 1973, the Flood Disaster Protection Act was passed by Congress. The result of this was the requirement for community participation in the NFIP to receive federal financial assistance for acquisition or construction of buildings and disaster assistance in floodplains. It also "required federal agencies and federally insured or regulated lenders to require flood insurance on all grants and loans for acquisition or construction of buildings in designated Special Flood Hazard Areas" within participating communities (FEMA 2002).

Later, in 1994, the two acts were amended by the National Flood Insurance Reform Act, which included a requirement for FEMA to assess its flood hazard map inventory at least once every five years. FEMA prepares floodplain maps based on the best available science and technical information available. However, changes to the watershed or the availability of new information may cause the need for a map revision. When a revision is required, the applicable community works with FEMA to develop the map revision through a Letter of Map Amendment or a Letter of Map Revision (FEMA 2002).

In order for communities to participate in the NFIP, they must adopt and enforce floodplain management criteria.

18.1.3 Existing Conditions

Flood risk in California is generally highest from late October through March, which marks the rainy season. Levees, rivers, channels, dams, and reservoirs are common structural measures for flood damage reduction throughout the State. Levees confine water flows within a channel. The integrity of a levee and the maximum design flow capacity of the channel dictate a levee's effectiveness.

Dams and reservoirs can be operated to reduce flows downstream by capturing inflows and controlling releases. The amount of water stored in a flood control project reservoir at any point in time (conservation storage) is governed by U.S. Army Corps of Engineers (USACE) criteria stated in the ~~flood control~~ project's water control manual. The water elevation associated with the top of conservation storage can vary depending on time of year, upstream storage, and the type of storm (rain or snow) that is occurring. In addition to the conservation storage, each reservoir that provides flood control must reserve flood damage reduction space at certain times of the year. This amount varies by flood control project and ensures that, during a large storm event, high amounts of precipitation and runoff can be captured and stored in the reservoir without overtopping the dam or requiring the release of more water than the downstream channels and levees have been designed to convey (Resources Agency 1999).

Many agencies have a role in designing, constructing, managing, regulating, and/or operating flood damage reduction facilities, including the Bureau of Reclamation (Reclamation), USACE, California Department of Water Resources (DWR), and Central Valley Flood Protection Board. As noted above, FEMA oversees the NFIP, which helps provide protection from flood-related damages through its flood insurance program, floodplain management, and flood hazard mapping.

18.1.3.1 American River Division

Folsom Lake is located in the foothills of the Sierra Nevada about 25 miles northeast of Sacramento's metropolitan area. Folsom Lake was created by the completion of the Folsom Dam in 1956 by USACE. The reservoir is located on the American River downstream of the convergence of the North Fork and Middle Fork American River. Reclamation jointly operates Folsom Dam with USACE for flood control and water supply as part of the CVP. Folsom Lake impounds approximately 977,000 acre-feet (AF) at a reservoir water surface elevation of 466 feet on the American River. The design surcharge pool is 1,084,780 AF at an elevation of 475.4 feet (ft) with 5.1 ft of existing freeboard (Reclamation 2012).

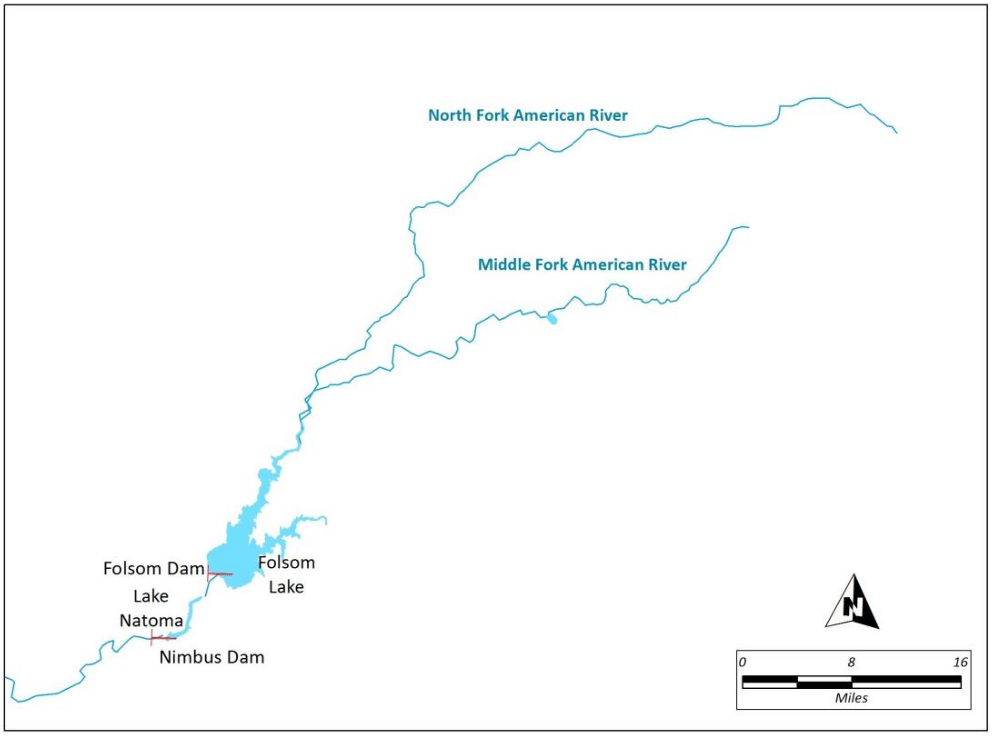

Figure 18-2. American River Division

Folsom Lake is a key unit in the CVP and provides flood control protection for the entire Sacramento region. Management of the reservoir space reserved for flood control is seasonal. According to the Folsom Dam and Reservoir Water Control Manual of 1987, from June 1 through September 30 there is no space designated for flood control. From October 1 through February 7, the amount of space reserved for flood control increases uniformly until February 7. From February 8 through April 20, the flood reservation space is 400,000 AF, which can be reduced after March 15 if basin conditions are dry. From April 21 through May 31, the required flood space decreases uniformly until no flood space is required (Reclamation 2012). A series of dam safety and flood damage reduction structural modifications are underway at Folsom Lake, including construction of a new auxiliary spillway. When complete, the modifications have the potential to increase the amount of water that can be released from Folsom Dam. USACE is currently revising the water control manual to incorporate these modifications.

Approximately seven miles downstream of Folsom Dam on the American River is Nimbus Dam. Nimbus Dam forms Lake Natoma and helps normalize the releases made through the Folsom Powerplant at Folsom Dam. Lake Natoma has a capacity of 8,760 AF at elevation 125 ft and a surface area of 540 acres (Reclamation and California Department of Parks and Recreation [CDPR] 2007; Reclamation 2009).

The main stem of the American River generally flows southwest from Folsom Dam. The downstream portions of the American River have levees from the confluence with the Sacramento River up to Sunrise Boulevard on the south bank and to Carmichael Bluffs on the north bank. The levees were constructed by USACE in 1958 and are designed to accommodate a sustained flow rate of 115,000 cubic feet per second (cfs) and a maximum capacity of 160,000 cfs for a short duration during emergencies, without resulting in levee failure and downstream flooding (Reclamation 2012; Reclamation and CDPR 2007).

18.1.3.2 Delta Division

The Delta includes over 700 miles of sloughs and winding channels and approximately 1,100 miles of levees. These levees are operated and maintained by various agencies including Federal, State, and local reclamation boards. Unlike the system of reservoirs and weirs that control the magnitude of flooding on the rivers upstream from the Delta, the flooding damage reduction system in the Delta, (with exception of the Delta Cross Channel control gates) operates passively.

Since the construction of the CVP and the State Water Project (SWP), and, more importantly, the Yolo Bypass system, flood flows in the Delta have been more controlled than in earlier years; nevertheless, Delta pumping is not a flood damage reduction operation. Flooding still occurs, but has been confined to individual islands or tracts and is due mostly to levee instability or overtopping. The major factors influencing Delta water levels include high flows, high tide, and wind. The highest water stages occur between December and February when these factors are compounded (Reclamation 2012).

18.1.3.3 West San Joaquin River and San Felipe Divisions

A portion of the water from the Delta is diverted by the DMC and travels either to the San Luis Reservoir in the San Felipe Division, or is delivered to the San Joaquin River at the Mendota Pool.

The Mendota Dam is owned and operated by the Central California Irrigation District (ID) and forms the Mendota Pool downstream from the confluence of the Fresno Slough and the San Joaquin River. The DMC supplies water to the Mendota Pool, which holds approximately 8,500 AF at an average depth of 10 ft. There are no formal flood damage reduction operations at Mendota Pool and the Mendota Pool does not provide any flood damage reduction storage. The San Joaquin River has levees from the Delta upstream to the mouth of the Merced River and along several San Joaquin River tributaries.

Water is also conveyed to the San Felipe Division from the Delta through the DMC to O'Neil Forebay and the remaining San Luis Unit. The San Luis Unit includes the O'Neil Dam and Forebay, B.F. Sisk Dam, San Luis Reservoir, Los Banos Creek and Little Panoche Creek Detention Dams and Reservoirs, along with various pumping plants, canals, and conduits. The San Felipe Division provides supplemental water to 63,500 acres, in addition to 132,400 AF of water annually for M&I uses.

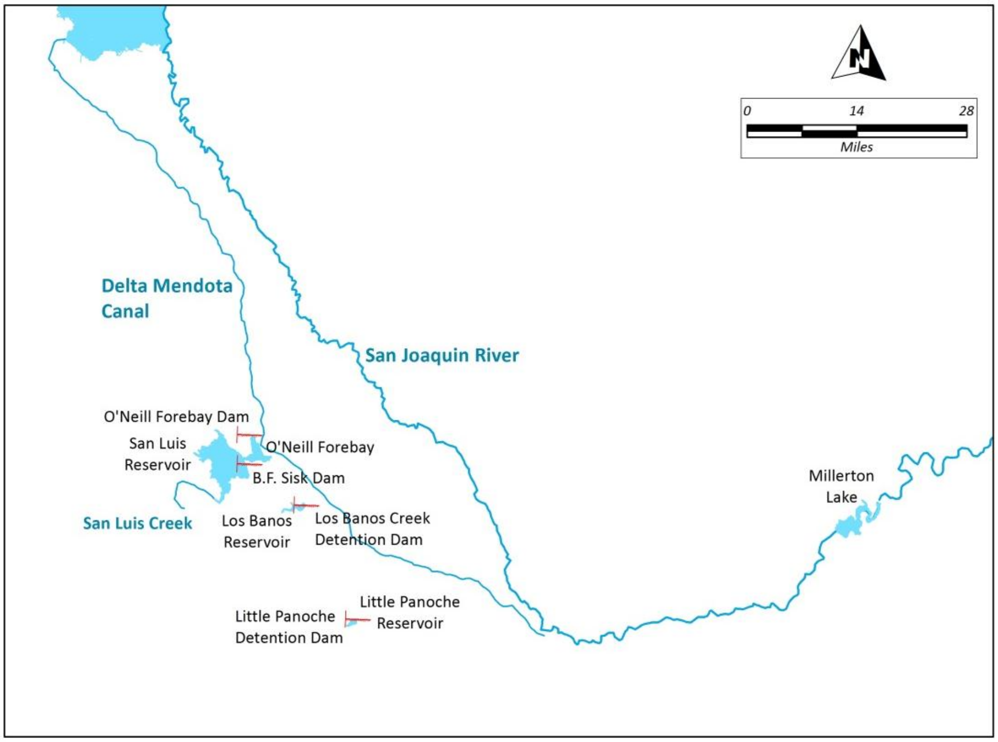

Figure 18-3. West San Joaquin & San Felipe Divisions

The San Luis Unit was dedicated in 1967. The O'Neill Dam has a structural height of 87.5 ft and a normal operating depth of 57 ft. The O'Neill Forebay has a normal surface water elevation of 225 ft and a spillway capacity of 3,250 cfs at an elevation of 228 ft. The B.F. Sisk Dam impounds the San Luis Reservoir, jointly operated by both the State and Federal government. The dam has a structural height of 300 ft and is over 3.5 miles long.

San Luis Reservoir is the largest off-stream storage reservoir in the U.S. San Luis Reservoir provides approximately 2,041,000 AF of off-stream storage capacity. Reclamation manages 47.6 percent (972,000 AF) of the reservoir’s capacity for the CVP, and the remainder is managed by the SWP. The reservoir has a maximum water surface elevation of 544 ft[1] and a minimum operating pool elevation of 326 ft (79,000 AF). Reclamation owns and jointly operates San Luis Reservoir with DWR to provide seasonal storage for the CVP. San Luis Reservoir is capable of receiving water from both the DMC and California Aqueduct, which enables the CVP to pump water into the reservoir during the wet season (October through March) and release water into the conveyance facilities during the dry season (April through September) when demands are higher.

[1] Relative to mean sea level.

San Luis Creek is the major drainage in the San Luis Reservoir area. San Luis Creek once flowed into the San Joaquin River. However, after completion of B.F. Sisk Dam, runoff from San Luis Creek is now captured in San Luis Reservoir and diverted for SWP and CVP uses. The potential for flooding in San Luis Reservoir is low because it is an off-stream storage reservoir (Reclamation and CDPR 2013).

The Los Banos Creek Detention Dam is located on Los Banos Creek. The Los Banos Creek drains approximately 160 square miles of the Diablo Range. The dam is located at a constriction in the Los Banos Creek Canyon where the creek leaves the range and flows into the San Joaquin River. The dam has a structural height of 167 ft and a hydraulic height of 126 ft. The dam has a normal water elevation of 327.8 ft, spillway capacity of 8,600 cfs at 378 ft and a drainage area of 156 square miles.

Little Panoche Creek Detention Dam is located on Little Panoche Creek in Fresno County. The dam has a structural height of 151 ft and a hydraulic height of 85 ft. The dam has a spillway capacity of 3,220 cfs at 670.4 ft and drainage area of 81.1 square miles (Reclamation 2012).

18.2 Environmental Consequences

The following sections describe the environmental consequences associated with flood control for each alternative.

18.2.1 Assessment Methods

This section describes the assessment methods used to analyze potential flood control effects of the alternatives, including the No Action Alternative.

The effects analysis uses both quantitative and qualitative methods to assess changes in flood control. The quantitative assessment method of determining impacts on flood controls is based on hydrologic modeling and determines whether changes in stream flows could cause flooding or inundation areas in the watershed. Increased flows and increased storage levels at reservoirs under the No Action Alternative were compared to existing reservoir capacities. Future flows and storage levels associated with the action alternatives were compared to the No Action Alternative. See Appendix B for the hydrologic model documentation. Modeling results are not available for several rivers; therefore, flows for these rivers are addressed qualitatively.

18.2.2 Alternative 1: No Action

Reservoir operations would remain the same as existing conditions with regards to flood control, including flood storage capacity and timing of releases. Under the No Action Alternative (Alternative 1), CVP deliveries would change compared to existing conditions due to changes in land use and population that are not a result of the M&I WSP. Table 18-1 below shows the changes in storage within Folsom Lake and San Luis Reservoir under the No Action Alternative compared to existing conditions.

Table 18-1. Changes in Reservoir Storage between the No Action Alternative and Existing Conditions (in thousands of AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Lake												
W	-14	-6	-1	0	3	1	-2	-3	-5	-10	-10	-3
AN	-12	-14	-12	-3	4	7	0	-3	-10	-24	-31	-22
BN	-13	-8	-10	-5	-1	1	0	3	-5	-23	-28	2
D	-8	-12	-15	-15	-11	1	-1	4	-10	-10	-10	-12
C	-7	-2	-5	-5	-6	-3	-4	0	-7	-3	27	24
All	-11	-8	-8	-6	-2	1	-2	0	-7	-13	-11	-3
San Luis Reservoir												
W	-148	-153	-169	-112	-97	-84	-93	-137	-142	-170	-187	-182
AN	-26	-9	-26	20	24	22	10	-37	-53	-87	-94	-47
BN	-108	-112	-134	-83	-60	-43	-46	-60	-35	-43	-36	-13
D	-43	-59	-61	3	46	59	52	46	57	27	9	-28
C	-5	-8	-10	32	58	78	79	80	93	71	38	35
All	-79	-83	-95	-42	-19	-6	-13	-37	-33	-57	-72	-68

Note: Negative numbers indicate that the No Action Alternative would decrease water in storage compared to existing conditions; positive numbers indicate that the action would increase water in storage.
Key: W = wet, AN = above normal, BN = below normal, D = dry, C = critical, All = average of all years

As indicated in Table 18-1, decreases and increases in reservoir storage would both occur, depending upon the year type and the month. In general, Folsom Lake would experience a decrease in water storage in most months and year types. The notable exception would be August and September during a critical year. San Luis Reservoir would experience a reduction in water storage in most months and year types. The reservoir would experience an increase in storage in dry and critical years during the months of January and August. The seasonal increases in storage at Folsom Lake would not affect flood control because they would generally not occur during the flood season or in the wetter years when reservoir levels are high. The reductions in storage could provide additional room to store flood flows, which could potentially benefit flood control. The decreased storage levels during flood season months, however, are projected to be small and would not provide a substantial benefit.

There would be no changes in river flows that could potentially compromise levee stability. Under the No Action Alternative, CVP deliveries would change compared to existing conditions due to changes in land use and population that are not a result of the M&I WSP. Table 18-2 below shows the changes in river flows compared to existing conditions.

Table 18-2. Changes in River Flows between the No Action Alternative and Existing Conditions (in cfs)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River below Nimbus												
W	-106	-191	-149	-98	-154	-52	-144	-236	-283	-270	-298	-342
AN	32	-35	-124	-200	-201	-114	-139	-286	-219	-101	-177	-352
BN	157	-134	-32	-117	-153	-89	-156	-287	-177	-12	-199	-719
D	19	-10	-34	-9	-133	-229	-120	-226	-36	-361	-275	-200
C	72	-140	2	2	10	-53	-59	-110	-146	-332	-761	-143
All	12	-111	-78	-82	-132	-107	-128	-232	-181	-230	-326	-348
American River at H Street												
W	-149	-244	-243	-173	-225	-125	-175	-246	-298	-670	-650	-376
AN	-9	-85	-223	-269	-264	-181	-161	-295	-233	-497	-526	-387
BN	118	-190	-139	-193	-223	-159	-177	-292	-193	-331	-486	-755
D	-15	-61	-135	-81	-202	-298	-134	-235	-55	-545	-446	-236
C	31	-194	-77	-75	-62	-121	-68	-120	-167	-411	-841	-174
All	-27	-164	-174	-156	-201	-176	-149	-240	-198	-521	-587	-382
OMR												
W	187	-86	-62	-57	-259	-244	18	-367	-137	27	-148	-526
AN	36	-123	161	185	-5	-251	156	-37	14	109	-176	-1,093
BN	3	21	-66	0	67	32	84	-136	-89	-32	-146	-213
D	178	85	-215	0	-28	31	-26	-69	-7	434	536	496
C	213	-25	-5	104	-103	-68	-29	6	0	620	864	197
All	135	-26	-55	24	-93	-111	33	-159	-58	205	146	-225
Delta Outflow												
W	-16	7	-7	8	-42	-5	40	-43	-30	-3	-16	4
AN	11	-19	6	-2	1	-29	36	-1	-16	-2	0	2
BN	-1	3	15	22	-13	-5	21	-39	-1	9	0	1
D	1	-3	2	17	0	-15	-4	-23	3	3	8	-14
C	-1	-9	14	34	13	6	-8	-11	0	2	11	0
All	-3	-2	4	15	-14	-9	20	-27	-11	1	-2	-1

Note: Negative numbers indicate that the No Action Alternative would decrease river flows compared to existing conditions; positive numbers indicate that the action would increase river flows.

Key: W = wet, AN = above normal, BN = below normal, D = dry, C = critical, OMR = Old and Middle River (in the Delta)

The flow increases would occur predominantly during the dry season and would occur more frequently in dry and critical years, when flood flows are not present in the system. Decreased river flows during wetter periods could provide additional capacity for flood flows; however, these changes would be small relative to overall flows and would not provide a substantial benefit. Impacts on flood control in rivers under the No Action Alternative would be minimal compared to existing conditions.

18.2.3 Alternative 2: Equal Agricultural and M&I Allocation

Providing equal CVP allocations to agricultural and M&I water service contractors during shortage conditions could change storage levels in Folsom Lake and San Luis Reservoir and potentially affect flood control. Under Alternative 2, changes in CVP deliveries to agricultural and M&I water service contractors could change storage levels in Folsom Lake and San Luis Reservoir. Table 18-3 below shows the changes in storage under Alternative 2 compared to the No Action Alternative.

Table 18-3. Changes in Reservoir Storage between Alternative 2 and the No Action Alternative (in thousands of AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Lake												
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
All	6	7	6	5	5	4	4	6	8	8	6	6
San Luis Reservoir												
W	18	21	23	18	14	0	-1	0	0	-1	1	3
AN	3	4	9	3	3	-6	-4	-3	-4	-3	-4	1
BN	3	8	29	28	6	-7	-8	-6	-5	-5	3	7
D	11	20	24	22	20	4	-1	-7	-20	-25	1	15
C	39	46	59	53	46	39	34	28	10	14	26	31
All	15	20	27	23	17	5	2	1	-4	-5	5	10

Note: Negative numbers indicate that the action would decrease water in storage compared to the No Action Alternative; positive numbers indicate that the action would increase water in storage.

Key: W = wet, AN = above normal, BN = below normal, D = dry, C = critical

As indicated in Table 18-3, decreases and increases in reservoir storage would both occur, depending upon the reservoir, year type and month. Folsom Lake would experience an increase in water storage in all months and year types for the exception of some months during wet and abnormal years where there would be no change in elevation experienced compared to the No Action Alternative. San Luis Reservoir would experience an increase in water storage in most months and year types for the exception of the months of March through August during wet, and above and below normal years, when the reservoir would experience slight reductions or no change in elevation compared to the No Action Alternative. The seasonal increases in storage at Folsom Lake and San Luis Reservoir would not affect flood control because they would not generally occur during the flood season or in the wetter years when reservoir levels are high. The reductions in storage could provide additional room to store flood flows, which could potentially benefit flood control. The decreased storage levels during flood season months, however, are projected to be small and would not provide a substantial benefit.

Providing equal CVP allocations to agricultural and M&I water service contractors during shortage conditions could change river flows that could potentially compromise levee stability. Under Alternative 2, changes in CVP deliveries to agricultural and M&I water service contractors could change river flows in the American River and in the Delta. Table 18-4 below shows the changes in river flows compared to the No Action Alternative.

Table 18-4. Changes in River Flows between Alterative 2 and the No Action Alternative (in cfs)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River below Nimbus												
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
All	24	18	32	35	32	19	44	20	24	57	74	35
American River at H Street												
W	17	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
All	24	18	31	35	32	19	44	19	23	52	70	34
OMR												
W	-68	-24	-9	3	16	35	3	-5	-2	-1	0	1
AN	23	-11	19	43	-71	-5	0	0	-1	-2	0	-28
BN	-33	-70	-286	0	127	26	0	0	-2	-28	-114	-8
D	-12	-105	15	0	-35	-3	-3	0	5	-158	-600	-179
C	-30	-74	-182	47	13	22	0	9	0	-421	-264	-83
All	-31	-55	-72	14	11	17	0	0	0	-102	-190	-57
Delta Outflow												
W	2	-7	-10	-2	2	2	-1	-1	0	0	0	0
AN	3	0	6	11	0	-3	0	4	0	3	0	-1
BN	1	-2	-17	0	17	4	12	10	-2	12	0	3
D	1	-5	3	2	4	3	6	6	0	1	9	7
C	5	-1	3	8	2	1	10	12	3	-2	-12	1
All	2	-4	-4	3	5	2	5	5	0	2	0	2

Note: Negative numbers indicate that the action would decrease river flows compared to the No Action Alternative; positive numbers indicate that the action would increase river flows.

Key: W = wet, AN = above normal, BN = below normal, D = dry, C = critical, OMR = Old and Middle River (in the Delta)

The flow increases would occur predominantly during the dry season and would occur more frequently in dry and critical years, when flood flows are not present in the system. Decreased river flows during wetter periods could provide additional capacity for flood flows; however, these changes would be small relative to overall flows and would not provide a substantial benefit. Impacts on flood control in rivers under Alternative 2 would be minimal compared to the No Action Alternative.

18.2.4 Alternative 3: Full M&I Allocation Preference

Providing 100 percent CVP allocations to M&I water service contractors during shortage conditions could change storage levels in Folsom Lake and San Luis Reservoir and potentially affect flood control. Under Alternative 3, changes in CVP deliveries to agricultural and M&I water service contractors could change storage levels in Folsom Lake and San Luis Reservoir. Table 18-5 below shows the changes in storage compared to the No Action Alternative.

Table 18-5. Changes in Reservoir Storage between Alternative 3 and the No Action Alternative (in thousands of AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Lake												
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
All	-1	-2	-2	-3	-2	-2	-1	-1	-1	-3	-2	-1
San Luis Reservoir												
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
All	-4	-4	-10	-6	-2	-1	-1	0	0	4	4	-2

Note: Negative numbers indicate that the action would decrease water in storage compared to the No Action Alternative; positive numbers indicate that the action would increase water in storage.
Key: W = wet, AN = above normal, BN = below normal, D = dry, C = critical

As indicated in Table 18-5, Alternative 3 would result mostly in relatively minor decreases in reservoir storage. When they are projected to occur, seasonal increases in reservoir storage would not affect flood control because, with limited exceptions, they would not occur during the flood season or in the wetter years when reservoir levels are high. The reductions in storage could provide additional room to store flood flows, which could potentially benefit flood control. These decreased storage levels, however, would be very small and would not provide a substantial benefit. Impacts on flood control would be minimal compared to the No Action Alternative.

Providing 100 percent CVP allocations to M&I water service contractors during shortage conditions could change river flows that could potentially compromise levee stability. Under Alternative 3, changes in CVP deliveries to agricultural and M&I water service contractors could change river flows in the American River and in the Delta. Table 18-6 below shows the changes in river flows compared to the No Action Alternative.

Table 18-6. Changes in River Flows between Alternative 3 and the No Action Alternative (in cfs)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River below Nimbus												
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
All	-11	7	-13	4	-23	-29	-29	-28	-34	3	-52	-31
American River at H Street												
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
All	-10	7	-13	4	-23	-28	-26	-26	-33	4	-52	-29
OMR												
W	-1	-21	-1	1	1	-3	-6	0	1	17	0	-11
AN	-28	-12	5	-137	-21	-3	0	0	0	-1	0	-84
BN	87	-46	35	0	-135	4	0	0	108	-32	79	40
D	26	-176	267	0	6	6	6	11	0	59	162	252
C	95	5	-11	-38	19	55	0	-1	0	176	-62	161
All	30	-54	64	-25	-22	9	-1	2	19	38	40	70
Delta Outflow												
W	1	-4	2	-3	-3	1	-1	-1	-1	1	0	0
AN	1	6	-3	-12	0	-4	1	0	0	0	0	0
BN	0	-2	0	3	-12	-1	-6	-5	9	-3	0	-2
D	3	-3	16	0	-1	-2	-3	-4	1	-3	-11	-4
C	1	0	1	0	-3	2	-3	-2	0	-1	-9	0
All	1	-2	4	-2	-4	-1	-2	-2	1	-1	-4	-1

Note: Negative numbers indicate that the action would decrease river flows compared to the No Action Alternative; positive numbers indicate that the action would increase river flows.

Key: W = wet, AN = above normal, BN = below normal, D = dry, C = critical, OMR = Old and Middle River (in the Delta)

The flow increases would be limited and would predominantly occur during the dry season of dry and critical years, when flood flows are not present in the system. Decreased river flows during wetter periods could provide additional capacity for flood flows; however, these changes would be small relative to overall flows and would not provide a substantial benefit. Impacts on flood control in rivers under Alternative 3 would be minimal compared to the No Action Alternative.

18.2.5 Alternative 4: Updated M&I WSP

Implementation of the Updated M&I WSP could change storage levels in Folsom Lake and San Luis Reservoir and potentially affect flood control. Under Alternative 4, changes in CVP deliveries to agricultural and M&I water service contractors would be the same as those under the No Action Alternative; therefore, there would be no change in reservoir storage or flood control from Alternative 4 as compared to the No Action Alternative.

Implementation of the Updated M&I WSP could change river flows that could potentially compromise levee stability. Under Alternative 4, changes in CVP deliveries to agricultural and M&I water service contractors would be the same as those under the No Action Alternative; therefore, there would be no change in river flows or levee stability from Alternative 4.

18.2.6 Alternative 5: M&I Contractor Suggested WSP

Implementation of the M&I Contractor Suggested WSP could change storage levels in Folsom Lake and San Luis Reservoir and potentially affect flood control. Under Alternative 5, changes in CVP deliveries to agricultural and M&I water service contractors would be similar to those under the No Action Alternative; differences in the amount of CVP water made available for delivery would not cause a change in reservoir storage or flood control from Alternative 4.

Implementation of the M&I Contractor Suggested WSP could change river flows that could potentially compromise levee stability. Under Alternative 5, changes in CVP deliveries to agricultural and M&I water service contractors could change river flows in the American River and in the Delta. Table 18-7 below shows the changes in river flows from Alternative 5 compared to the No Action Alternative.

Table 18-7. Changes in River Flows between Alternative 5 and the No Action Alternative (in cfs)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River below Nimbus												
W	0	0	0	0	0	0	0	0	0	0	0	0
AN	3	-1	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	-1	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	1	0	0
C	0	0	0	0	0	0	0	0	0	1	-1	0
All	0	0	0	0	0	0	0	0	0	0	0	0
American River at H Street												
W	0	0	0	0	0	0	0	0	0	0	0	0
AN	3	-1	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	-1	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	1	0	0
C	0	0	0	0	0	0	0	0	0	1	-1	0
All	0	0	0	0	0	0	0	0	0	0	0	0
OMR												
W	0	0	0	0	0	0	0	0	0	0	0	0
AN	1	-1	0	-1	-3	0	0	0	0	0	0	-4
BN	0	0	0	0	-1	0	0	0	0	0	-1	-2
D	0	0	0	0	0	0	0	0	0	-1	-3	-1
C	0	-2	4	-13	2	0	0	0	0	-2	-3	-2
All	0	-1	1	-2	0	0	0	0	0	-1	-1	-1
Delta Outflow												
W	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
BN	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
C	0	0	0	-1	0	0	0	0	0	0	0	0
All	0	0	0	0	0	0	0	0	0	0	0	0

Note: Negative numbers indicate that the action would decrease river flows compared to the No Action Alternative; positive numbers indicate that the action would increase river flows.

Key: W = wet, AN = above normal, BN = below normal, D = dry, C = critical, OMR = Old and Middle River (in the Delta)

Most year types would not see any change in river flows, and those that would have flow changes would be very minimal compared to overall river flows. Impacts on flood control in rivers from Alternative 5 would be minimal compared to the No Action Alternative.

18.3 Mitigation Measures

There would be no adverse flood control impacts under any of the alternatives; therefore, no mitigation measures are required.

18.4 Unavoidable Adverse Impacts

None of the action alternatives would result in an unavoidable adverse impact to flood hydrology.

18.5 Cumulative Effects

The timeline for the flood control 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 above in Figure 18-1. 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. The cumulative analysis for flood control considers projects that could affect reservoir storage or river flow, or could otherwise compromise flood control facilities or flood management.

In addition to the cumulative projects in Chapter 20, several other efforts could affect the cumulative condition for flood management. Multiple areas in the Central Valley do not currently have adequate flood protection. The population at risk is over one million people, and the existing level of flood protection is among the lowest for metropolitan areas in the nation (DWR 2012). In response to existing flood management concerns, multiple efforts are ongoing to improve conditions (DWR 2014):

- American River Watershed Project: construction of dam improvements at Folsom Dam (under the Folsom Joint Federal Project) and levee improvements on the American and Sacramento rivers (under the American River Common Features Project).

- Delta Levees System Integrity Program: levee repair, maintenance, and improvement within the Delta area.

- South Sacramento County Streams Program: improvements to Morrison Creek and Unionhouse Creek have improved flood management in the south Sacramento area.

- Yuba Feather Flood Protection Program: projects within the areas of the Yuba, Feather, and Bear rivers to reduce flooding and improve public safety.

- Urban Streams Protection Program: provides funding for urban flood management; recent focus has included levee improvements near Sacramento and Yuba City.

Multiple other small projects are also ongoing or planned to improve flood management in the Central Valley (DWR 2014).

18.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Providing equal CVP allocations to agricultural and M&I water service contractors during shortage conditions in conjunction with other cumulative projects could change storage levels in Folsom Lake and San Luis Reservoir and potentially affect flood control. In addition to the cumulative projects listed above, several projects in Chapter 20 have the potential to affect storage. These projects, however, would be unlikely to adversely affect storage during the flood season. Overall, the cumulative condition for flood control in the Central Valley includes many areas where existing flood management facilities are not adequate to provide flood protection to people and property. The cumulative condition has adverse effects relative to flood control. Alternative 2 would have a minor effect on reservoir storage and would be unlikely to affect flood conservation storage. Under certain conditions, Alternative 2 would have the potential to improve flood management; however, these improvements would not be sufficient to offset the multiple flood control issues and concerns in the cumulative condition. Therefore, impacts associated with Alternative 2 would not be cumulatively considerable.

Providing equal CVP allocations to agricultural and M&I water service contractors during shortage conditions in conjunction with other cumulative projects could change river flows that could potentially compromise levee stability. As described above, the cumulative condition has substantial issues and concerns related to flood management that results in a cumulative impact. Alternative 2 could seasonally increase and decrease flows in rivers and in the Delta. The flow increases would predominantly occur during the dry season of dry and critical years, when flood flows are not present in the system. Decreased river flows during wetter periods could provide additional capacity for flood flows; however, these changes would be small and would not be adequate to substantially improve the cumulative condition. Impacts associated with Alternative 2 would not be cumulatively considerable related to flood control.

18.5.2 Alternative 3: Full M&I Allocation Preference

The flood control impacts (and magnitude of those impacts) under Alternative 3 would be very similar to Alternative 2. As under Alternative 2, the cumulative condition would have impacts relative to flood control, but the impacts from Alternative 3 would not be cumulatively considerable.

18.5.3 Alternative 4: Updated M&I WSP

The flood control impacts (and magnitude of those impacts) under Alternative 4 would be the same as Alternative 2. As with Alternative 2, the cumulative condition would have effects relative to flood control, but the impacts from Alternative 4 would not be cumulatively considerable.

18.5.4 Alternative 5: M&I Contractor Suggested WSP

The flood control impacts (and magnitude of those impacts) under Alternative 5 would be very similar to Alternative 2. As with Alternative 2, the cumulative condition would have effects relative to flood control, but the impacts from Alternative 5 would not be cumulatively considerable.

18.6 References

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Chapter 19 Visual Resources

This chapter describes the existing aesthetic and visual resources within the area of analysis and discusses potential effects on visual resources from the proposed alternatives.

19.1 Affected Environment/Environmental Setting

This section describes the area of analysis and the regulatory setting for visual resources.

19.1.1 Area of Analysis

The affected environment for visual resources includes water conveyance infrastructure associated with the Central Valley Project (CVP) American River Division in the area north of the Sacramento-San Joaquin River Delta (Delta), the Delta Division, and the south of Delta area. Figure 19-1 presents the location of these facilities.

There are only relatively small changes to Shasta and Trinity lakes and Sacramento River flows as a result of the different agricultural and municipal and industrial (M&I) water service contractor allocations in the alternatives. The changes in storage and 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. Shasta and Trinity lakes never show a monthly change in storage for an alternative versus No Action of more than +/- one percent of total storage. This is further discussed in Appendix B, Water Operations Model Documentation. Due to these minimal changes, visual resources in Shasta and Trinity lakes and Sacramento River are not discussed in further detail in this chapter.

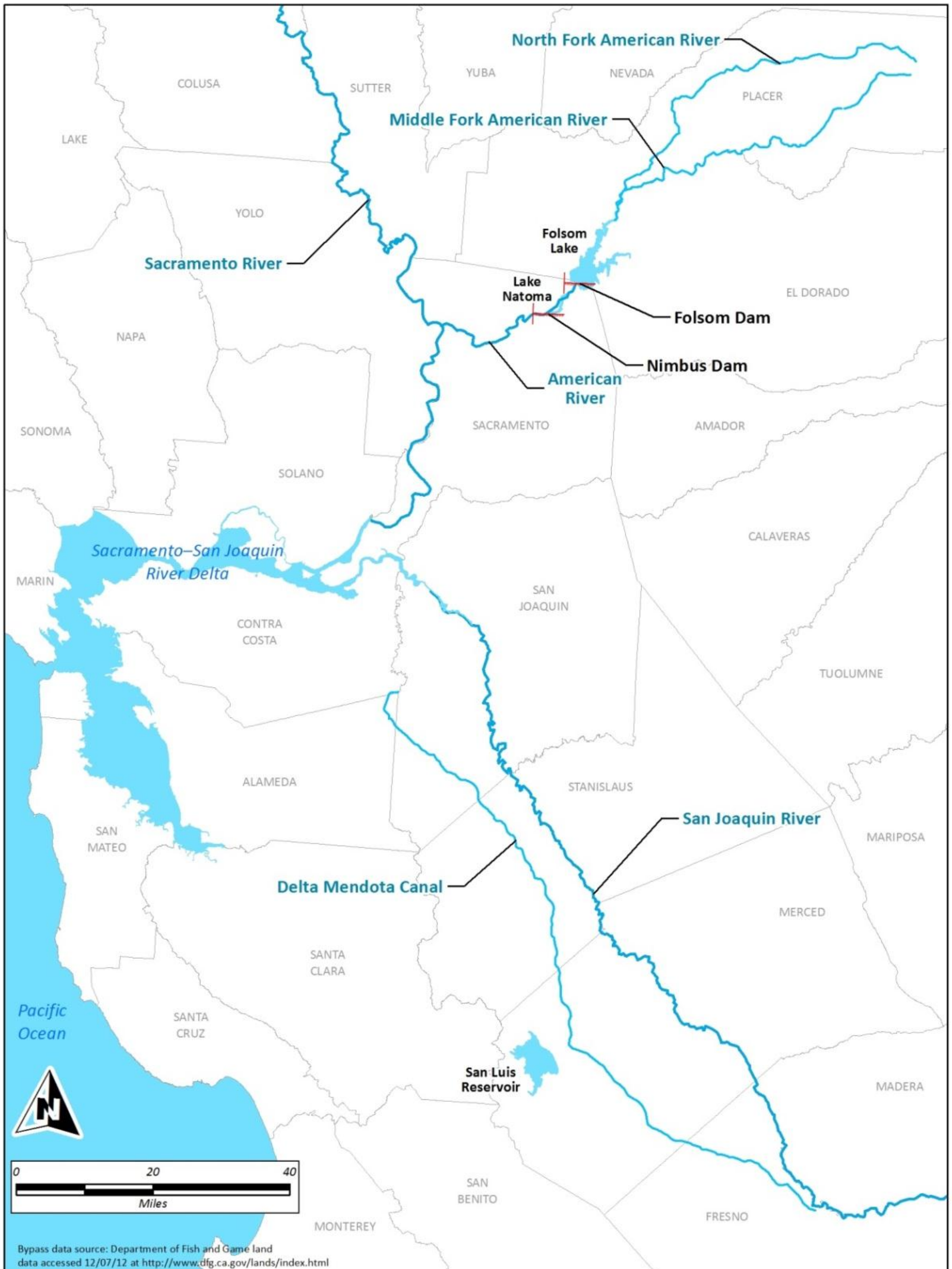

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Figure 19-1. Visual Resources Area of Analysis

19.1.2 Regulatory Setting

19.1.2.1 Federal

Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.) Created by Congress in 1968, the National Wild and Scenic Rivers Act (NWSRA) protects selected rivers which "possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values" for generational enjoyment. Rivers or river segment protected by the NWSRA are classified by the system as wild, scenic, or recreational depending on impoundments, condition of shorelines, and accessibility. Each river designated as wild, scenic, or recreational is administered with the goal of protecting and enhancing the values that caused it to be designated. Federal management of selected rivers is provided by the United States (U.S.) Bureau of Land Management ~~(BLM)~~, U.S. Forest Service (USFS), U.S. Fish and Wildlife Service ~~(USFWS)~~, and the National Park Service ~~(NPS)~~. While designation helps conserve the special character these rivers possess, it does not necessarily limit all types of developments and users. Management is encouraged to involve landowners, river users, and the general public when developing goals for river protection (National Wild and Scenic Rivers System [NWSRS] 2012). Portions of the American River are included in this analysis which are designated as part of the NWSRS and managed by the California Resources Agency.

19.1.2.2 State

California Wild and Scenic Rivers Act (PRC 5093.50-5093.70) The goal of the California Wild and Scenic Rivers (CWSR) Act states that selected rivers "which possess extraordinary scenic, recreational, fishery, or wildlife values shall be preserved in their free-flowing state, together with their immediate environments, for the benefit and enjoyment of the people of the state." Rivers or river segment protected under the CWSR Act are categorized in similar fashion as the NWSRA. A management plan is developed for the river segment and adjacent land according to its categorization. The CWSR Act is administrated by the California Resources Agency. Portions of the American River, included in this analysis, are designated as a California Wild and Scenic River System.

State Scenic Highways The goal of the California Scenic Highway Program is to preserve and enhance the State's natural scenic resources. The laws governing the program establishes the State's responsibility to protect and enhance the State's scenic resources by identifying portions of the State highway system and adjacent scenic corridors which require special conservation treatment. The California Department of Transportation (Caltrans) manages the Scenic Highway Program, but responsibility for developments along scenic corridors lies with local governmental agencies (Caltrans 2012). These state regulations are applicable to visual resources throughout the project area as seen from State scenic highways. State Scenic Highways within the area of analysis include Pacheco Pass (State Route [SR] 152) (along San Luis Reservoir).

19.1.3 Existing Conditions

This section describes visually sensitive areas, the landscape character, and scenic attractiveness of water bodies and adjacent scenic routes in the area of analysis. The presentation of information in this section is organized by river region, which discusses both the river and reservoirs. The characterization of visual resources relies on scenic attractiveness classifications established by the USFS as part of the Scenery Management System (SMS), which is described in Chapter 19.2.1.1 below. These classifications include:

- Class A, Distinctive – Areas where landform, vegetation patterns, water characteristics, and cultural features combine to provide unusual, unique, or outstanding scenic quality. These landscapes have strong positive attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.

- Class B, Typical – Areas where landform, vegetation patterns, water characteristics, and cultural features combine to provide ordinary or common scenic quality. These landscapes have generally positive, yet common, attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance. Normally they would form the basic matrix within the ecological unit.

- Class C, Indistinctive - Areas where landform, vegetation patterns, water characteristics, and cultural land use have low scenic quality. Often water and rock form of any consequence are missing in Class C landscapes. These landscapes typically lack attributes such as variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.

Class A and B visual resources typically include state or federal parks, recreation, or wilderness areas. Community parks are typically considered Class B visual resources. Several M&I water service contractors may have such parks in their service area; however, it is unknown which specifically are affected by changes in CVP deliveries, so they are discussed generally in the analysis below.

Rivers and reservoirs are typically considered Class A or B visual resources. Class C resources generally include areas that have low scenic quality and contain more common landscapes, such as agricultural lands.

19.1.3.1 North of Delta

The North of Delta (NOD) area is bordered on the east by the Sierra Nevada, on the northwest by the Coast Ranges, and on the south by the Delta. Agriculture in the Sacramento Valley, forests in the upper watersheds, and grasslands and woodlands in the foothills characterize the region visually. Other low-elevation characteristics include occasional wetlands, vernal pools, and riparian areas. Much of the upper watershed on the east side of the Central Valley is forested, which limits views for motorists traveling through the area. Reservoirs in the region increase the level of scenic attractiveness at their maximum operating levels.

Folsom Lake is surrounded by rolling grasslands and wooded foothills. Figure 19-2 provides a view of Folsom Lake. Folsom Lake State Recreation Area (SRA) and Folsom Powerhouse State Historic Park offer multiple recreational opportunities and views of the reservoir. Folsom Lake contrasts sharply with the nearby rolling grassland and wooded foothill landscapes. Normally the Folsom Lake elevation fluctuates between 405 and 449 feet (ft), a fluctuation of 44 ft.

Figure 19-2. Folsom Lake

About seven miles downstream of Folsom Dam on the American River is Lake Natoma, formed by Nimbus Dam. Lake Natoma regulates the releases from Folsom Dam made for power generation. The shoreline contains gravel banks, large boulders, and riparian vegetation. Both Lake Natoma and Folsom Lake are considered Class A and B visual resources.

The lower American River provides a variety of visual experiences, including steep bluffs, terraces, islands, backwater areas, and riparian vegetation. Figure 19-3 provides an aerial view of the lower American River. The water surface, gravel banks, natural grasses, smaller plants, and variety of trees along the river create a natural setting designated as a "protected area" in the American River Parkway Plan by Sacramento County for native plant restoration and habitat protection (Sacramento County 2008~~Placer County Water Agency 2011~~). The river flows through an urban area and the river is buffered by the American River Parkway. Sacramento County's American River Parkway Plan helps preserve the open spaces and natural resources along the American River that "provide Parkway users with a highly-valued natural setting and feeling of serenity, in the midst of a developed urban area" (Sacramento County 2008). The lower American River is considered a Class A visual resource.

Figure 19-3. Lower American River

The lower American River, from the confluence of the Sacramento River to Nimbus Dam is classified as a recreational National Wild and Scenic River (NWSR). This stretch of the river flows through the City of Sacramento, and is the most heavily used recreational river in California. It provides an urban greenway for trail and boating activities and is also known for its runs of steelhead trout and salmon (NWSRS 2012). Since the lower American River is designated as a recreational and not a scenic resource, NWSR effects are discussed in Chapter 17, Recreation.

Normally the lower American River flows below Nimbus Dam fluctuate between 1,627 cubic feet per second (cfs) and 5,183 cfs, a fluctuation of 3,556 cfs. Lower American River flows at H Street fluctuate between 1,504 cfs and 5,104 cfs, a fluctuation of 3,600 cfs.

19.1.3.2 Delta Region

The Delta forms the lowest part of the Central Valley, which lies between the Sacramento and San Joaquin rivers and extends from the confluence of these rivers inland as far as Sacramento and Stockton. The Delta comprises 738,000 acres generally bordered by the cities of Sacramento, Stockton, Tracy, and Pittsburg.

The Delta Region encompasses approximately 1,000 miles of navigable channels along the San Joaquin River and the Old and Middle River (OMR) (Class A and B visual resources) and is a patchwork of nearly 60 islands and tracts surrounded by natural and man-made sloughs and levees. The Delta is the link between the state's biggest water projects, the State Water Project (SWP) and the CVP, which depend on Delta waterways to convey water from Northern California rivers to pumping facilities in the southern Delta. Waters in the Delta also outflow to the San Francisco Bay and Pacific Ocean.

Normally OMR flows fluctuate between -9,501 cfs and 1,027 cfs, a fluctuation of 10,528 cfs. Normally Delta Outflows fluctuate between 269 cfs and 2,897 cfs, a fluctuation of 2,628 cfs.

The Delta is also an important agricultural area, specifically noted for corn, grain, hay, and pastures, which account for more than 75 percent of the region's total (State Water Resources Control Board [SWRCB] 1995). Agriculture is typically considered a Class C visual resource.

19.1.3.3 South of Delta

The majority of the South of Delta (SOD) area is primarily designated for agriculture uses, including tree and row crops, typically a Class C visual resource. The agricultural lands include tree and row crops, grain, hay, and pasture. Short-term fallow fields also make up a large portion of the ~~South of Delta~~SOD area in any given season.

San Luis Reservoir lays in the western San Joaquin Valley, along historic Pacheco Pass (SR 152), a state scenic highway. The reservoir lies within the San Luis Reservoir SRA, which is surrounded by undeveloped open space, and has views of distant rolling hills and the Diablo Range (California Department of Parks and Recreation [CDPR] 2012). Within the San Luis Reservoir SRA, a visitor center at the Romero Overlook offers information on the reservoir and provides telescopes for viewing the area around the reservoir. In the spring, the reservoir area offers wildflower-viewing opportunities (CDPR 2012). The reservoir and facilities offer Class A and B visual resources. Figure 19-4 provides an aerial view of the region surrounding San Luis Reservoir.

Figure 19-4. San Luis Reservoir and O'Neill Forebay

San Luis Reservoir is an off-stream storage reservoir. The Bureau of Reclamation (Reclamation) owns and jointly operates San Luis Reservoir with the California Department of Water Resources (DWR) to provide seasonal storage for the CVP and the SWP. Storage is highly variable throughout the year as the reservoir refills in the fall and winter months and releases water in spring and summer to meet CVP and SWP demands. In most years, the storage level in San Luis Reservoir has remained above 300 thousand acre-feet (TAF). At that elevation, the reservoir experiences a low point issue when the water levels decline and cause algae blooms to reach the Lower San Felipe Intake. Average monthly storage at San Luis Reservoir fluctuates between 527 TAF in August and 1,592 TAF in March, a fluctuation of 1,065 TAF (DWR 2013).

19.2 Environmental Consequences

The following sections describe the environmental consequences associated with each alternative.

19.2.1 Assessment Methods

This section presents the assessment methods applied to evaluate visual resources.

19.2.1.1 Scenery Management System

Assessment methods relied on the SMS developed by the U.S. Department of Agriculture in 1995, and outlined in *Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook Number 701*. The SMS helps determine landscapes and landscape character that are important for scenic attractiveness, based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, and land use patterns.

The SMS is applied to the alternatives using the following steps:

- **Identify visually sensitive areas.** Sensitivity is considered highest for views seen by people driving to or from recreational activities, or along routes designated as scenic corridors. Views from relatively moderate to high-use recreation areas are also considered sensitive. For this analysis, rivers and reservoirs are considered visually sensitive areas. The analysis also evaluates effects to views of productive agricultural lands.

- **Define the landscape character.** Landscape character gives an area its visual and cultural image, and consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable or unique. Landscape character refers to images of the landscape that can be defined with a list of scenic attributes.

  The U.S. Department of Agriculture defines these as the following:

  – Landform Patterns and Features: Includes characteristic landforms, rock features, and their juxtaposition to one another.

  – Surface Water Characteristics: The relative occurrence and distinguishing characteristics of rivers, streams, lakes, and wetlands. Includes features such as waterfalls and coastal areas.

  – Vegetation Patterns: Relative occurrence and distinguishing characteristics of potential vegetative communities and the patterns formed by them.

  – Land Use Patterns and Cultural Features: Visible elements of historic and present land use which contribute to the image and sense of place. For example, agriculture in the Central Valley contributes to the landscape character of the region.

- **Classify scenic attractiveness.** Scenic attractiveness classifications are a key component of the SMS and are used to classify visual features into three categories – Class A, Distinctive; Class B, Typical; and Class C, Indistinctive – as defined in Chapter 19.1.3 above.

This analysis assumes that when CVP allocations are reduced to M&I water service contractors, some M&I contractors may find themselves reducing the water supplied for non-critical needs, such as community parks, in order to appropriately balance their communities' water supplies available to meet public health and safety (PHS) needs. In those cases, there may be impacts to the visual quality of community parks through reduced landscape irrigation causing yellowing and browning of vegetation.

This analysis evaluates the effects to landscape character and scenic attractiveness on visual resources from changes in CVP water delivery, but does not evaluate the effects to agricultural areas because agriculture is considered a Class C scenic resource.

19.2.1.2 Water Operations Model

To determine visual effects on rivers and reservoirs, changes in reservoir elevations and river flows under the action alternatives are compared to Alternative 1, the No Action Alternative. This analysis uses hydrologic operations modeling to provide estimated changes in reservoir elevation, reservoir storage, and river flows. Appendix B describes the operations modeling methods and assumptions.

As stated above, reservoirs are generally Class A or B visual resources when their water surface elevations are near to, or at, their maximum. An adverse visual effect to reservoirs would occur if surface water elevation levels decreased to a level such that shoreline riparian vegetation were reduced or the "bathtub" ring was substantially larger than under the No Action Alternative. As drawdown occurs during the summer and fall, an increasing area of shoreline devoid of vegetation appears in the area between the normal high water mark and the actual lake level. The exposed rock and soil of the drawdown zone contrasts with the vegetated areas above the high water level and with the lake's surface. Figure 19-5 provides an example of a lake experiencing a bathtub ring effect; note the change in vegetation and exposed rock beneath the high water mark. As a consequence of reservoir operations, the level of scenic attractiveness tends to decline in July and August with increasing drawdown.

Elevation modeling results are not available for San Luis Reservoir; however, reservoir storage at San Luis Reservoir is used to determine visual quality effects for this analysis. It is assumed that fluctuations in reservoir storage would reflect similar fluctuations in reservoir elevations. Visual effects at San Luis Reservoir would occur if the proposed alternatives were to cause significant reductions in reservoir storage which could contribute to reservoirs bathtub ring or cause low points to occur more often or earlier in the year than under existing conditions.

Source: Reclamation 2014.

Figure 19-5. The "Bathtub Ring" Effect at San Luis Reservoir

A river would be adversely affected visually if the decrease in flow resulted in exposure of the riverbed, reduction of riparian vegetation along the banks, or changes to any important visual features of the river. Seasonal variations in flow levels of the rivers within this region provide for a wide range of aesthetic opportunities. Most of the rivers in this region have low flow regulations in place. Flow requirements for the various rivers and streams may be found in SWRCB water right permits or licenses, Federal Energy Regulatory Commission hydropower licenses, and interagency agreements. Because minimum flow requirements exist and the flows are managed, riparian vegetation along the rivers reflects the results of current management practices. These practices include the use of levees for flood control, managed floodplains and overflow bypasses, and controlled releases from reservoirs. These practices may result in a narrow riparian corridor. Nonetheless, riparian vegetation remains an important visual aspect to all streams and river corridors. Water, shade, and dense cover distinguish the riparian areas from the surrounding land. Increased river flows typically improve visual resources by creating a fuller river, and improving riparian habitat along the river's banks. Reductions in river flows could result in substantial exposure of the river bed, reduction of riparian vegetation along the banks or changes to important visual features of the river.

19.2.2 Alternative 1: No Action

Changes to CVP deliveries under the No Action Alternative compared to existing conditions could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at Folsom Lake and San Luis Reservoir. Under the No Action Alternative, CVP deliveries in future years would be different than existing deliveries due to changes in population and water demand. As shown in Table 19-1, Folsom Lake would experience a fluctuation in elevation between 0 and -1 ft per month for all year types. The resultant changes in Folsom Lake elevations between the No Action Alternative and existing conditions would be minor and within normal reservoir elevation fluctuation. These small reservoir elevation changes would not degrade the existing landscape character or scenic attractiveness of visual resources at Folsom Lake.

Table 19-1. Changes in Folsom Lake Elevations between the No Action Alternative and Existing Conditions (in feet)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Lake												
W	-2	-1	0	0	0	0	0	0	-1	-1	-1	0
AN	-1	-2	-2	0	1	1	0	0	-1	-3	-3	-3
BN	-1	-1	-1	-1	0	0	0	0	0	-2	-3	0
D	0	-1	-2	-2	-1	0	0	0	-1	-1	-1	-1
C	0	1	-1	-2	-2	-1	-1	0	-1	0	8	8
All	-1	-1	-1	-1	0	0	0	0	-1	-1	0	0

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

As shown in Table 19-2, the resultant changes in San Luis Reservoir water storage between the No Action Alternative and existing conditions would be within normal reservoir storage fluctuation. These small reservoir elevation changes would not degrade the existing landscape character or scenic attractiveness of visual resources at San Luis Reservoir, as operations typically result in large elevation changes within the reservoir, and would not result in the reservoir reaching the low point elevation earlier in the year or more often.

Table 19-2. Changes in San Luis Reservoir Storage between the No Action Alternative and Existing Conditions (in TAF)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
San Luis Reservoir												
W	-148	-153	-169	-112	-97	-84	-93	-137	-142	-170	-187	-182
AN	-26	-9	-26	20	24	22	10	-37	-53	-87	-94	-47
BN	-108	-112	-134	-83	-60	-43	-46	-60	-35	-43	-36	-13
D	-43	-59	-61	3	46	59	52	46	57	27	9	-28
C	-5	-8	-10	32	58	78	79	80	93	71	38	35
All	-79	-83	-95	-42	-19	-6	-13	-37	-33	-57	-72	-68

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

Changes to CVP deliveries under the No Action Alternative compared to existing conditions could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources along surface water bodies. Current river flow fluctuations would be due to changes in land use and overall water demands compared to existing conditions. As with reservoir elevations, river flows in future years would be different than existing conditions due to changes in water withdrawals associated with population growth. Table 19-3 presents the change in river flows for the No Action Alternative compared to existing conditions. Changes in river flows under the No Action Alternative would be within normal river flow fluctuation and would not result in a notable difference in the landscape character of the rivers. Compared to existing conditions, the No Action Alternative would have a minimal effect on the landscape character and scenic attractiveness of existing visual resources along the American River and in the Delta.

Table 19-3. Changes in River Flows between the No Action Alternative and Existing Conditions (in cfs)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River below Nimbus												
W	-106	-191	-149	-98	-154	-52	-144	-236	-283	-270	-298	-342
AN	32	-35	-124	-200	-201	-114	-139	-286	-219	-101	-177	-352
BN	157	-134	-32	-117	-153	-89	-156	-287	-177	-12	-199	-719
D	19	-10	-34	-9	-133	-229	-120	-226	-36	-361	-275	-200
C	72	-140	2	2	10	-53	-59	-110	-146	-332	-761	-143
All	12	-111	-78	-82	-132	-107	-128	-232	-181	-230	-326	-348
American River at H Street												
W	-149	-244	-243	-173	-225	-125	-175	-246	-298	-670	-650	-376
AN	-9	-85	-223	-269	-264	-181	-161	-295	-233	-497	-526	-387
BN	118	-190	-139	-193	-223	-159	-177	-292	-193	-331	-486	-755
D	-15	-61	-135	-81	-202	-298	-134	-235	-55	-545	-446	-236
C	31	-194	-77	-75	-62	-121	-68	-120	-167	-411	-841	-174
All	-27	-164	-174	-156	-201	-176	-149	-240	-198	-521	-587	-382
OMR												
W	187	-86	-62	-57	-259	-244	18	-367	-137	27	-148	-526
AN	36	-123	161	185	-5	-251	156	-37	14	109	-176	-1,093
BN	3	21	-66	0	67	32	84	-136	-89	-32	-146	-213
D	178	85	-215	0	-28	31	-26	-69	-7	434	536	496
C	213	-25	-5	104	-103	-68	-29	6	0	620	864	197
All	135	-26	-55	24	-93	-111	33	-159	-58	205	146	-225
Delta Outflow												
W	-16	7	-7	8	-42	-5	40	-43	-30	-3	-16	4
AN	11	-19	6	-2	1	-29	36	-1	-16	-2	0	2
BN	-1	3	15	22	-13	-5	21	-39	-1	9	0	1
D	1	-3	2	17	0	-15	-4	-23	3	3	8	-14
C	-1	-9	14	34	13	6	-8	-11	0	2	11	0
All	-3	-2	4	15	-14	-9	20	-27	-11	1	-2	-1

Note: Negative numbers indicate a reduction in reservoir elevations; positive numbers indicate an increase in reservoir elevations.

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

OMR = Old & Middle River (in the Delta)

Changes to CVP deliveries under the No Action Alternative compared to existing conditions could degrade the existing landscape character or scenic attractiveness of Class B community parks. Under the No Action Alternative, unmet PHS needs would occur in the Shasta and Trinity River Divisions, Cross Valley Canal Unit, and West San Joaquin Division in 10 percent, 15 percent, and 84 percent of years, respectively. PHS need would be fully met in all years in all other NOD and SOD divisions.

M&I water service contractors in the divisions experiencing unmet PHS needs may choose to implement reductions in water supplies for non-critical needs, including landscape irrigation of community parks, in order to appropriately balance, for their community, the water supplies available to meet PHS needs. In those cases, there may be impacts to the visual resources of community parks from reduced landscape irrigation causing yellowing or browning of vegetation.

19.2.3 Alternative 2: Equal Agricultural and M&I Allocation

Providing equal shortage allocations to agricultural and M&I water service contractors could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at Folsom Lake and San Luis Reservoir. Under Alternative 2, water supply operations could affect elevations at Folsom Lake and San Luis Reservoir. In general, decreased reservoir elevations could affect the landscape character and scenic attractiveness of the reservoir and increased reservoir elevations could improve the landscape character and scenic attractiveness of the reservoir. Table 19-4 presents the change in reservoir elevation at Folsom Lake for Alternative 2 compared to the No Action Alternative. As shown in Table 19-4, Folsom Lake would experience an increase in elevation of 1ft for all year types.

Elevation increases as compared to the No Action Alternative would be minor and would not likely substantially benefit the visual quality of the reservoir.

Table 19-4. Changes in Folsom Lake Elevations between Alternative 2 and the No Action Alternative (in feet)

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

Note: Negative numbers indicate that the alternative would decrease reservoir elevations compared to the No Action Alternative; positive numbers indicate that the alternative would increase reservoir elevations.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

As shown in Table 19-5, the resultant changes in San Luis Reservoir water storage between Alternative 2 and the No Action Alternative would be minor and within normal reservoir storage fluctuation. Compared to the No Action Alternative, San Luis Reservoir water storage under Alternative 2 would experience a fluctuation between -25 TAF and 59 TAF per month for all year types. These small reservoir storage changes would not degrade the existing landscape character or scenic attractiveness of visual resources at San Luis Reservoir and would not result in the reservoir reaching low point elevations earlier in the year or more often. Elevation increases as compared to the No Action Alternative would be minor and would not likely substantially benefit the visual quality of the reservoir.

Table 19-5. Changes in San Luis Reservoir Storage between Alternative 2 and the No Action Alternative (in TAF)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
San Luis Reservoir (CVP)												
W	18	21	23	18	14	0	-1	0	0	-1	1	3
AN	3	4	9	3	3	-6	-4	-3	-4	-3	-4	1
BN	3	8	29	28	6	-7	-8	-6	-5	-5	3	7
D	11	20	24	22	20	4	-1	-7	-20	-25	1	15
C	39	46	59	53	46	39	34	28	10	14	26	31
All	15	20	27	23	17	5	2	1	-4	-5	5	10

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

Providing equal shortage allocations to agricultural and M&I water service contractors could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources along surface water bodies. Under Alternative 2, decreased river flows could affect the visual quality of rivers within the area of analysis. Table 19-6 shows changes in river flows on American River and in the Delta for Alternative 2 compared to the No Action Alternative. Changes in river flows under Alternative 2 would be within normal river flow fluctuation and would not result in a notable difference in the landscape character of the rivers. Compared to the No Action Alternative, Alternative 2 would have a minimal effect on the landscape character and scenic attractiveness of existing visual resources along the American River and in the Delta.

Table 19-6. Changes in River Flows between Alternative 2 and the No Action Alternative (in cfs)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River below Nimbus												
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
All	24	18	32	35	32	19	44	20	24	57	74	35
American River at H Street												
W	17	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
All	24	18	31	35	32	19	44	19	23	52	70	34
OMR												
W	-68	-24	-9	3	16	35	3	-5	-2	-1	0	1
AN	23	-11	19	43	-71	-5	0	0	-1	-2	0	-28
BN	-33	-70	-286	0	127	26	0	0	-2	-28	-114	-8
D	-12	-105	15	0	-35	-3	-3	0	5	-158	-600	-179
C	-30	-74	-182	47	13	22	0	9	0	-421	-264	-83
All	-31	-55	-72	14	11	17	0	0	0	-102	-190	-57
Delta Outflow												
W	2	-7	-10	-2	2	2	-1	-1	0	0	0	0
AN	3	0	6	11	0	-3	0	4	0	3	0	-1
BN	1	-2	-17	0	17	4	12	10	-2	12	0	3
D	1	-5	3	2	4	3	6	6	0	1	9	7
C	5	-1	3	8	2	1	10	12	3	-2	-12	1
All	2	-4	-4	3	5	2	5	5	0	2	0	2

Note: Negative numbers indicate that the alternative would decrease river flows compared to the No Action Alternative; positive numbers indicate that the alternative would increase river flows.

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

OMR = Old & Middle River (in the Delta)

Changes to CVP deliveries under Alternative 2 compared to the No Action Alternative could degrade the existing landscape character or scenic attractiveness of Class B community parks. Under Alternative 2, unmet PHS needs would occur in the NOD Shasta and Trinity River Divisions and American River Division in 37 percent and 6 percent of years, respectively. Unmet PHS needs would occur in the SOD Delta Division, Cross Valley Canal Unit, West San Joaquin Division, and San Felipe Division in 49 percent, 5 percent, 89 percent, and 19 percent of years, respectively. Under Alternative 2, unmet PHS needs would occur more often, and to more divisions/units, than under the No Action Alternative; therefore, the potential impacts under Alternative 2 would be greater than under the No Action Alternative.

M&I water service contractors in the divisions experiencing unmet PHS needs may choose to implement reductions in water supplies for non-critical needs, including landscape irrigation of community parks, in order to appropriately balance, for their community, the water supplies available to meet PHS needs. In those cases, there may be impacts to the visual resources of community parks from reduced landscape irrigation causing yellowing or browning of vegetation.

19.2.4 Alternative 3: Full M&I Allocation Preference

Providing 100 percent allocations to M&I water service contractors during ~~shortage conditions~~a Condition of Shortage could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at Folsom Lake and San Luis Reservoir. Under Alternative 3, water supply operations could affect elevations at Folsom Lake and San Luis Reservoir (similar to Alternative 2). In general, decreased reservoir elevations could affect the landscape character and scenic attractiveness of the reservoir. Table 19-7 presents the changes in reservoir elevations at Folsom Lake for Alternative 3 compared to the No Action Alternative. The changes compared to the No Action Alternative would be minor, and the visual effect of the increased bathtub ring would not be noticeable. As shown in Table 19-7, Folsom Lake would experience a fluctuation in elevation of -1 ft in all years. This small reservoir storage change would not degrade the existing landscape character or scenic attractiveness of visual resources at Folsom Lake compared to the No Action Alternative.

Table 19-7. Changes in Folsom Lake Elevations between Alternative 3 and the No Action Alternative (in feet)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Lake												
W	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
BN	0	0	0	-1	0	0	0	0	0	0	0	0
D	0	-1	0	0	0	0	0	0	0	-1	0	0
C	-1	-2	-2	-2	-2	-1	-1	-1	-1	-2	-2	-2
All	0	0	0	0	0	0	0	0	0	-1	0	0

Note: Negative numbers indicate that the alternative would decrease reservoir elevations compared to the No Action Alternative; positive numbers indicate that the alternative would increase reservoir elevations.

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

As shown in Table 19-8, the resultant changes in San Luis Reservoir water storage between Alternative 3 and the No Action Alternative would be minor and within normal reservoir storage fluctuation. Compared to the No Action Alternative, San Luis Reservoir storage under Alternative 3 would experience a fluctuation between -24 TAF and 32 TAF per month in all years. These reservoir storage changes would not degrade the existing landscape character or scenic attractiveness of visual resources at San Luis Reservoir and would not result in the reservoir reaching low point elevations earlier in the year or more often. Elevation increases as compared to the No Action Alternative would be minor and would not likely substantially benefit the visual quality of the reservoir.

Table 19-8. Changes in San Luis Reservoir Storage between Alternative 3 and the No Action Alternative (in TAF)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
San Luis Reservoir (CVP)												
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
All	-4	-4	-10	-6	-2	-1	-1	0	0	4	4	-2

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

Providing 100 percent allocations to M&I water service contractors during a Condition of Shortage ~~shortage conditions~~ could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources along surface water bodies. Under Alternative 3, changes in river flows could affect the visual quality within the area of analysis. Table 19-9 shows changes in river flows on the American River and in the Delta for Alternative 3 compared to the No Action Alternative. Changes in river flows under Alternative 3 would be within normal river flow fluctuation and would not result in a notable difference in the landscape character of the rivers. Alternative 3 would have a minimal effect on the landscape character and scenic attractiveness of existing visual resources along the American River and the Delta.

Table 19-9. Changes in River Flows between Alternative 3 and the No Action Alternative (in cfs)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River below Nimbus												
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
All	-11	7	-13	4	-23	-29	-29	-28	-34	3	-52	-31
American River at H Street												
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
All	-10	7	-13	4	-23	-28	-26	-26	-33	4	-52	-29
OMR												
W	-1	-21	-1	1	1	-3	-6	0	1	17	0	-11
AN	-28	-12	5	-137	-21	-3	0	0	0	-1	0	-84
BN	87	-46	35	0	-135	4	0	0	108	-32	79	40
D	26	-176	267	0	6	6	6	11	0	59	162	252
C	95	5	-11	-38	19	55	0	-1	0	176	-62	161
All	30	-54	64	-25	-22	9	-1	2	19	38	40	70
Delta Outflow												
W	1	-4	2	-3	-3	1	-1	-1	-1	1	0	0
AN	1	6	-3	-12	0	-4	1	0	0	0	0	0
BN	0	-2	0	3	-12	-1	-6	-5	9	-3	0	-2
D	3	-3	16	0	-1	-2	-3	-4	1	-3	-11	-4
C	1	0	1	0	-3	2	-3	-2	0	-1	-9	0
All	1	-2	4	-2	-4	-1	-2	-2	1	-1	-4	-1

Note: Negative numbers indicate that the alternative would decrease river flows compared to the No Action Alternative; positive numbers indicate that the alternative would increase river flows.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical
OMR = Old & Middle River (in the Delta)

Changes to CVP deliveries under Alternative 3 compared to the No Action Alternative could degrade the existing landscape character or scenic attractiveness of Class B community parks. Under Alternative 3, unmet PHS needs would occur in the Shasta and Trinity River Divisions, Cross Valley Canal Unit, and West San Joaquin Division in 4 percent, 19 percent, and 28 percent of years, respectively. PHS needs would be fully met in all years in all other NOD and SOD divisions. Under Alternative 3, unmet PHS needs would occur less frequently, except in the Cross Valley Canal Unit, than under the No Action Alternative; therefore, the impacts of Alternative 3 would be less than the No Action Alternative.

M&I water service contractors in the divisions experiencing unmet PHS needs may choose to implement reductions in water supplies for non-critical needs, including landscape irrigation of community parks, in order to appropriately balance, for their community, the water supplies available to meet PHS needs. In those cases, there may be impacts to the visual resources of community parks from reduced landscape irrigation causing yellowing or browning of vegetation.

19.2.5 Alternative 4: Updated M&I WSP

Implementation of the Updated M&I WSP could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at Folsom Lake and San Luis Reservoir. Under Alternative 4, CVP deliveries to agricultural and M&I water service contractors under *a Condition of Shortage* ~~shortage conditions~~ would be the same as those under the No Action Alternative; therefore, there would be no change in reservoir elevation at Folsom Lake or San Luis Reservoir or to the existing landscape character or scenic attractiveness of Class A and B visual resources.

Implementation of the Updated M&I WSP could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources along surface water bodies. Under Alternative 4, CVP deliveries to agricultural and M&I water service contractors under *a Condition of Shortage* ~~shortage conditions~~ would be the same as those under the No Action Alternative; therefore, there would be no change in river flows or the existing landscape character or scenic quality of Class A and B visual resources along the American River and in the Delta.

Changes to CVP deliveries under Alternative 4 compared to the No Action Alternative could degrade the existing landscape character or scenic attractiveness of Class B community parks. Under Alternative 4, unmet PHS needs would occur in the same CVP divisions, at the same frequency, as under the No Action Alternative; therefore, there would be no changes to visual resources of community parks under Alternative 4 compared to the No Action Alternative.

19.2.6 Alternative 5: M&I Contractor Suggested WSP

Implementation of the M&I Contractor Suggested WSP could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at Folsom Lake and San Luis Reservoir. Under Alternative 5, CVP deliveries to agricultural and M&I water service contractors under *a Condition of Shortage* ~~shortage conditions~~ would be similar to those under the No Action Alternative. There would be no changes in reservoir elevation at Folsom Lake or San Luis Reservoir or to the existing landscape character or scenic attractiveness of Class A and B visual resources at the reservoirs as compared to the No Action Alternative.

Implementation of the M&I Contractor Suggested WSP could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources along surface water bodies. Under Alternative 5, decreased river flows could affect the visual quality of these rivers. In general, decreased flows could affect the landscape character and scenic attractiveness of the reservoir and increased flows could improve the landscape character and scenic attractiveness of the reservoir. Table 19-10 shows changes in river flows on the American River and in the Delta for Alternative 5 compared to the No Action Alternative. Changes in river flows under Alternative 5 would be negligible along most rivers in most year types. The anticipated changes would be within normal river flow fluctuation and would not result in a notable difference in the landscape character of the rivers. Alternative 5 would have a minimal effect on the landscape character and scenic attractiveness of existing visual resources along the American River and the Delta.

Table 19-10. Changes in River Flows between Alternative 5 and the No Action Alternative (in cfs)

Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
American River below Nimbus												
W	0	0	0	0	0	0	0	0	0	0	0	0
AN	3	-1	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	-1	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	1	0	0
C	0	0	0	0	0	0	0	0	0	1	-1	0
All	0	0	0	0	0	0	0	0	0	0	0	0
American River at H Street												
W	0	0	0	0	0	0	0	0	0	0	0	0
AN	3	-1	0	0	0	0	0	0	0	0	0	0
BN	0	0	0	0	0	0	-1	0	0	0	0	0
D	0	0	0	0	0	0	0	0	0	1	0	0
C	0	0	0	0	0	0	0	0	0	1	-1	0
All	0	0	0	0	0	0	0	0	0	0	0	0
OMR												
W	0	0	0	0	0	0	0	0	0	0	0	0
AN	1	-1	0	-1	-3	0	0	0	0	0	0	-4
BN	0	0	0	0	-1	0	0	0	0	0	-1	-2
D	0	0	0	0	0	0	0	0	0	-1	-3	-1
C	0	-2	4	-13	2	0	0	0	0	-2	-3	-2
All	0	-1	1	-2	0	0	0	0	0	-1	-1	-1
Delta Outflow												
W	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
BN	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
C	0	0	0	-1	0	0	0	0	0	0	0	0
All	0	0	0	0	0	0	0	0	0	0	0	0

Note: Negative numbers indicate that the action would decrease river flows compared to the No Action Alternative; positive numbers indicate that the action would increase river flows.

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical, OMR = Old & Middle River (in the Delta)

Changes to CVP deliveries under Alternative 5 compared to the No Action Alternative could degrade the existing landscape character or scenic attractiveness of Class B community parks. Under Alternative 5, unmet PHS needs would occur in only the Cross Valley Canal Unit in 15 percent of years. PHS needs would be fully met in all years in all other NOD and SOD divisions. Under Alternative 5, only one division/unit would experience unmet PHS need, compared to three under the No Action Alternative; therefore, the potential impacts under Alternative 5 would be less than under the No Action Alternative.

M&I water service contractors in Cross Valley Canal Unit experiencing unmet PHS needs may choose to implement reductions in water supplies for non-critical needs, including landscape irrigation of community parks, in order to appropriately balance, for their community, the water supplies available to meet PHS needs. In those cases, there may be impacts to the visual resources of community parks from reduced landscape irrigation causing yellowing or browning of vegetation.

19.3 Mitigation Measures

No mitigation measures are identified for the potential impacts anticipated in Alternatives 1 and 2.

19.4 Unavoidable Adverse Impacts

None of the action alternatives would result in unavoidable adverse impacts to visual resources.

19.5 Cumulative Effects

The timeline for the visual resources 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 19-1. The following section analyzes the cumulative effects using both the project and the projection methods, which are further described in Chapter 20, Cumulative Effects Methodology. Chapter 20 describes the projects included in the cumulative condition and growth and development trends in the area of analysis.

The cumulative analysis for visual resources considers projects and conditions that could affect landscape character or scenic attractiveness of existing visual resources within the area of analysis.

19.5.1 Alternative 2: Equal Agricultural and M&I Allocation

Changes in CVP deliveries, in combination with other cumulative projects, could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources. Proposed modifications to CVP water shortage allocations to agricultural and M&I water service contractors in combination with other cumulative projects could affect visual resources by exacerbating the effects on reservoir elevations and river flows. This could substantially degrade the existing landscape character or scenic attractiveness of Class A and B visual resources in the area of analysis.

Existing and foreseeable water acquisition programs with potential to affect reservoir elevation and river flows include the SWP transfers, which are described in Chapter 20. The proposed additional transfers could contribute to the additional fluctuation of reservoir elevations and river flows. Increased elevation and river flows typically improve visual resources by creating a fuller reservoir or river, and improving riparian habitat along shorelines. Reductions in elevation and river flows could result in substantial exposure of a reservoir's bathtub ring or the riverbed of a river, reduction in riparian vegetation along the shore, or change important visual features that are a part of a reservoir or river. All changes to reservoirs and rivers from the cumulative projects would remain within established water flow, water quality, and reservoir level standards; therefore, there would be no adverse cumulative effect to visual resources from increased reservoir elevation and river flow.

19.5.2 Alternative 3: Full M&I Allocation Preference

The visual impacts under Alternative 3 would be very similar to those experienced under Alternative 2. As under Alternative 2, there would be no adverse cumulative effect to visual resources.

19.5.3 Alternative 4: Updated M&I WSP

The visual impacts under Alternative 4 would be very similar to those experienced under Alternative 2. As under Alternative 2, there would be no adverse cumulative effect to visual resources.

19.5.4 Alternative 5: M&I Contractor Suggested WSP

The visual impacts under Alternative 5 would be very similar to those experienced under Alternative 2. As under Alternative 2, there would be no adverse cumulative effect to visual resources.

19.6 References

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Chapter 20
Cumulative Effects Methodology

Cumulative effects are those environmental effects that on their own, may not be considered significant, but when combined with similar effects over time, result in significant adverse effects. Cumulative effects are an important part of the environmental analysis because they allow decision makers to look not only at the impacts of an individual proposed project, but the overall impacts to a specific resource, ecosystem, or human community over time from many different projects. This section presents the cumulative effects analysis for the Central Valley Project (CVP) Municipal and Industrial Water Shortage Plan (M&I WSP). Each resource chapter includes the complete cumulative effects analysis for that resource.

The cumulative effects analysis has been prepared according to the Council on Environmental Quality's (CEQ's) regulations for implementing the National Environmental Policy Act (NEPA), CEQ's Guidance on the Consideration of Past Actions in Cumulative Effects Analysis (June 24, 2005), and the CEQ's Considering Cumulative Effects under the NEPA (1997).

20.1 Definition of Cumulative Effects

The CEQ's regulations for implementing NEPA define a cumulative impact as:

> *"The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 Code of Federal Regulations [CFR] 1508.7)."*

This cumulative effects analysis examines the effects of the M&I WSP and how they may combine with the effects of other past, present, and reasonably foreseeable future actions or projects to create significant cumulative impacts on a resource.

20.2 Regulatory Requirements

NEPA regulations require an analysis of direct, indirect, and cumulative effects and define "effects" as ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative (40 CFR Section 1508.8). Additionally, NEPA regulations state that both connected and cumulative actions must be considered and discussed in the same document as the Proposed Action (40 CFR Section 1508.25(a)(2) and (c)).

20.3 Methodology and Assumptions

The analysis of cumulative effects begins with consideration of the direct and indirect effects on the environment that would likely result from the proposed alternatives, including the geographic scope and timeframe of those effects. This helps to guide the scope of the cumulative effects analysis. The Lead Agency (the Bureau of Reclamation [Reclamation]) then examines any effects of past, present, or future actions that are relevant because they would have similar environmental effects as the proposed alternatives. Next, the Lead Agency assesses the extent that the effects of the proposed alternatives would add to, modify, or mitigate those cumulative effects. The final analysis documents an assessment of the cumulative effects of the alternatives and other cumulative actions considered (including past, present, and reasonably foreseeable future actions) on the affected resource.

The following subsections describe the methodology and assumptions for the cumulative effects analysis, including the geographic scope, timeframe, and past, present, and reasonably foreseeable future cumulative actions considered in the analysis, the method for determining significance, and when mitigation is necessary.

20.3.1 Geographic Scope

Many of the cumulative effects would likely occur within the M&I WSP general study area. However, several impacts of the project have the potential to extend beyond the boundaries of study area. In these cases, the geographic scope has been expanded to account for potential cumulative effects. Table 20-1 presents the geographic scope for each resource analyzed for cumulative effects.

Table 20-1. Cumulative Effects Geographic Scope

Resource	Geographic Scope	
	Study Area	**Other**
Surface Water	X	
Agricultural Water Deliveries	X	
Water Quality	X	
Groundwater Resources	X	
Geology & Soils	X	
Air Quality		Air Basin
Greenhouse Gases and Climate Change		No defined study area
Aquatic Resources	X	
Terrestrial Resources	X	
Agricultural Resources	X	
Socioeconomics	X	
Environmental Justice	X	
Indian Trust Assets	X	
Recreation	X	
Power	X	
Flood Hydrology	X	
Visual Resources	X	

20.3.2 Timeframe

The timeframe for this cumulative effects analysis extends to 2030. Any alternative selected for implementation may be in place until 2030; therefore, any effects of the M&I WSP that would contribute to cumulative impacts would occur within this timeframe. Any cumulative projects or actions that would not occur until after 2030 are not considered in this cumulative effects analysis.

20.3.3 Past, Present, and Reasonably Foreseeable Future Actions and Projects

The CEQ guidance for cumulative effects requires the consideration of past, present, and reasonably foreseeable future actions. Future cumulative impacts should be based upon known or reasonably foreseeable long-range plans, regulations, operating agreements, or other relevant information. This analysis considers actions that are far enough along in the planning process to be considered reasonable foreseeable, which means they have issued Notices of Intent to prepare environmental documents, they have issued draft or final environmental documents, or they have secured funding and have sufficient information available to allow analysis of effects. They must also affect the resources that would be potentially affected by the M&I WSP alternatives. Several cumulative actions are in the preliminary stages of planning and have not completed environmental documents. While it can be argued that these actions are reasonably foreseeable because they have issued notices in the Federal Register and may have completed scoping meetings, some do not have sufficient information available to determine potential effects.

The analysis of every past action that may have affected a resource is not possible or required. Past projects were mainly identified as part of the affected environment of each resource and are considered as part of the cumulative condition for each resource.

The following sections outline the past, present, and reasonably foreseeable future actions and projects that are considered in this cumulative effects analysis. A preliminary list of actions was compiled by reviewing available information regarding planned projects (including agency web sites). Actions were then reviewed for inclusion in the cumulative impacts analysis based on three criteria:

- The action has an identified sponsor actively pursuing project development; the sponsor has completed or issued NEPA and/or California Environmental Quality Act (CEQA) compliance documents such as a Draft Environmental Impact Statement (EIS) or Draft Environmental Impact Report (EIR); and the action appears to be "reasonably foreseeable," given other considerations such as public and stakeholder controversy.

- Available information defines the action in sufficient detail to allow meaningful analysis; and

- The action could affect resources that would be potentially affected by action alternatives.

Some unknown subset of the following projects, though not strictly meeting the criteria above, would likely be implemented, such as the Bay Delta Conservation Plan (BDCP), the North-of-Delta Offstream Storage Facility (Sites Reservoir), Shasta Lake Water Resources Investigation, and the Upper San Joaquin River Basin Investigation (Temperance Flat Reservoir). It would be speculative to consider these projects at any more than a conceptual level because these projects and their effects are not defined in sufficient detail to allow meaningful analysis.

20.3.3.1 Actions, Plans, and Programs Considered in Cumulative Effects Analysis

BDCP The original Draft BDCP EIR/EIS, published in December 2013, included an ambitious and comprehensive plan under Section 10 of the Endangered Species Act (ESA) and California's Natural Community Conservation Planning Act, to include new water conveyance facilities and sought to secure water supplies and contribute to the recovery of listed species under a single regulatory package. After receiving public comment on the Draft EIR/EIS, rather than pursuing the project as a Habitat Conservation Plan, under Section 10 of the ESA, and a Natural Community Conservation Plan, under the state's Natural Community Conservation Planning Act, DWR and Reclamation jointly decided to study additional alternatives to achieve the dual goals through implementation of new water conveyance facilities built in compliance with Section 7 of the ESA and Section 2018(b) of the California ESA. The State now proposes to restore more than 30,000 acres of Delta habitat separately through another venture called California EcoRestore.

In July 2015, DWR and Reclamation released a Notice of Availability for the Partially Recirculated Draft EIR/Supplemental Draft EIS on the BDCP, proposing the California WaterFix as the preferred alternative. California WaterFix is proposed to fix California's aging water delivery system to help protect the state's economy and public safety. This project covers five main areas: water security; climate change adaptation; environmental protection; seismic safety; and affordability. Primary goals of the alternative include the protection of the state's water supplies from climate change through water system upgrades, improvements of river flows for threatened fish species, and ecosystem restoration and protection.

- Water delivery proposals include the development of two tunnels up to 150 feet below ground designed to protect California's water supplies, three new intakes, each with 3,000 cubic-feet per second capacity with an average annual yield of 4.9 million acre-feet (AF), and the project against water supply disruption from failure of aging levees due to sea-level rise, earthquakes and flood events.

- River flow improvements include the reinstatement of a more natural direction of river flows in the South Delta by 46 to 160 percent, development of new criteria to protect spring outflow to San Francisco Bay, and criteria to protect Sacramento River flows and fish.

- New environmental mitigations include approximately 2,100 acres of habitat restoration, in addition to that proposed by California EcoRestore, to mitigate for the construction and operation of new water facilities. These mitigation efforts would include the improvement of habitat conditions along five miles of important juvenile salmon mitigation routes, restoration of tidal and non-tidal wetland habitat to sustain habitat functions for native wildlife (i.e., giant garter snake and salmon), restoration of native riparian forest and scrub to support habitat for riverside species and improve linkages for terrestrial and other native species, and improvement of connectivity among existing patches of grassland and other natural habitats (California Natural Resources 2015).

~~**Bay Delta Conservation Plan and Environmental Impact Statement/Environmental Impact Report (EIS/EIR)** The Bay Delta Conservation Plan (BDCP) is a comprehensive conservation strategy for the Sacramento–San Joaquin River Delta (Delta) to protect ecosystem health, water quality, water supply, and California's economy, while permitting the operation of the CVP and State Water Project (SWP).~~

~~The BDCP addresses federal Endangered Species Act (ESA) and California Natural Communities Conservation Planning Act compliance for the operation of the existing SWP facilities in the Delta and for construction and operation of conveyance facilities for water entering the Delta from the Sacramento Valley watershed to the SWP and CVP pumping plants. The BDCP also proposes conservation and management of covered fish and wildlife species through conservation measures, including the construction and operation of north Delta water conveyance facilities that will contribute to the recovery of the species (Reclamation et al. 2013). The draft BDCP and its corresponding draft EIS/EIR were published for public review and comment in December 2013 and the Lead Agencies are currently preparing a revised draft for recirculation in 2015 to the public and propose the following actions:~~

- ~~Construction and operation of a new north Delta water conveyance facility to bring water from the Sacramento River in the north Delta to the existing water export pumping plants in the south Delta;~~
- ~~Improvements and routine maintenance of the Fremont Weir and Yolo Bypass and operation of the North Bay Aqueduct Alternative Intake Project;~~
- ~~Operation and maintenance of SWP facilities in the Delta;~~
- ~~Ongoing operation of the existing non-project diversions located in the Cache Slough Complex;~~
- ~~Habitat restoration, creation, enhancement, and management activities;~~
- ~~Actions to minimize the methylation of inorganic mercury in BDCP habitat restoration areas;~~
- ~~Activities to reduce predation and other sources of direct mortality for covered fish species;~~
- ~~Adaptive management and monitoring programs; and~~
- ~~Other conservation measures, which may include continued operation and maintenance of an existing oxygen aeration facility in the Stockton Deep Water Ship Channel for fish and the development of a delta and longfin smelt conservation hatchery by United States (U.S.) Fish and Wildlife Service (USFWS) (Reclamation et al. 2012).~~

~~The BDCP proposes actions in the Delta, the Suisun Marsh, and the Yolo Bypass; however, it has the potential to affect regions upstream of the Delta and throughout the CVP service area north of the Delta. The BDCP alternatives have the potential to affect Delta conditions and CVP deliveries in the long-term.~~

North-of-the-Delta Offstream Storage Investigation (Sites Reservoir) Reclamation and DWR, in cooperation with other Federal, state, and local agencies, are evaluating plans to increase surface water storage north of the Delta to improve water supply and water supply reliability and increase Sacramento Valley water management flexibility, improve Delta water quality, provide flexible hydropower generation, and increase anadromous fish survival. The alternatives under consideration include a new off-stream Sites Reservoir, approximately 10 miles west of the town of Maxwell, California. The alternatives also include a Sacramento River Intake/Release Facility in Colusa County, a new pipeline to convey water between the Sacramento River and new reservoir, and ecosystem enhancements to improve endemic fish populations (Reclamation and DWR 2011). A final EIS/EIR and Feasibility Report is anticipated in 2016.

Shasta Lake Water Resources Investigation This project evaluates raising Shasta Dam to increase water supply reliability and anadromous fish survival. The alternatives include varying dam raises (6.5 feet to 18.5 feet) that would increase reservoir storage (256,000 AF to 654,000 AF), modifying temperature control devices, modifying hydropower facilities, and anadromous fish habitat restoration. The project has the potential for ecosystem restoration, flood damage reduction, hydropower, recreation, and water quality benefits. Reclamation released a Draft Feasibility Study and EIS/EIR in February 2012 (Reclamation 2012b). The Draft Feasibility Study indicates that, if approved, the project could be operational in mid-2021. This timeline is dependent on congressional authorization occurring 2016 and appropriation in 2017 (Reclamation 2012b). If congressional authorization occurs, detailed project designs and any necessary real estate acquisitions could be initiated, and project construction could begin approximately two years later. The initial phase of construction would include acquiring any necessary real estate interests and/or relocating displaced parties according to Public Law 91-646, acquiring necessary permits, continuing detailed design work, and relocating infrastructure. Construction activities would likely span four or more years (Reclamation 2012b).

Upper San Joaquin Storage Investigation <u>(Temperance Flat Reservoir)</u> Reclamation and California Department of Water Resources (DWR) are investigating new storage options in the upper San Joaquin River watershed to improve water supply reliability and flexibility for agricultural, urban, and environmental uses and enhance San Joaquin River water temperature and flow conditions to support anadromous fish restoration efforts. In 2009, Reclamation and DWR selected the Temperance Flats Reservoir sites at River Mile 274 in the upstream portion of Millerton Lake for detailed investigation and study. This new reservoir could provide up to 1.2 million AF of additional storage capacity. Other potential benefits include agricultural and urban water supply reliability, emergency water supply, ecosystem enhancement, urban water quality, hydropower, recreation opportunities, and flood damage reduction (Reclamation 2009). Reclamation released an Initial Alternatives Information Report in June 2005, a Plan Formulation Report in October 2008, and a Draft Feasibility Report in February 2014. Reclamation also released a Draft EIS for public review and comment in September 2014. The Draft Feasibility Report indicates the potential initiation of construction in 2021 (Reclamation 2014).

Delta-Mendota Canal/California Aqueduct Intertie The Delta-Mendota Canal/California Aqueduct Intertie was constructed in Alameda County just west of the City of Tracy. It connects the Delta-Mendota Canal (DMC), a CVP facility, and the California Aqueduct, an SWP facility, with two underground pipelines of 500 linear feet and also has a pumping plant. The Intertie allows for maintenance and repair activities of CVP export and conveyance facilities and provides flexibility to respond to CVP and SWP emergencies. Construction of the Intertie was completed in April 2012 (Reclamation n.d.).

Los Vaqueros Reservoir Expansion Project In February 2009, Reclamation and Contra Costa Water District (CCWD) released a Draft EIS/EIR for the Los Vaqueros Expansion Project. The EIS/EIR investigated alternatives to increase the capacity of Los Vaqueros Reservoir to:

- Develop water supplies for environmental water management that supports fish protection, habitat management, and other environmental water needs;
- Increase water reliability for water providers within the San Francisco Bay Area; and
- Improve the quality of water deliveries to municipal and industrial customers in the San Francisco Bay Area (Reclamation 2012).

Reclamation and CCWD completed a Final EIS/EIR in March 2010, and on March 31, 2010, the CCWD Board of Directors approved Alternative 4 of the Final EIS/EIR to expand Los Vaqueros Reservoir from 100,000 acre-feet (AF) to 160,000 AF. Construction for the reservoir expansion began in 2011 and was completed in fall 2012. The dam’s height was increased 34 feet to 226 feet (CCWD 2013). The expanded Los Vaqueros Reservoir allows CCWD to store higher-quality Delta water from wet seasons for blending with the Delta supply during dry periods. The main benefits of the project include increased water supply reliability, added emergency storage for Bay Area agencies, increased environmental water supply, and improved water quality delivered to M&I water treatment facilities (Reclamation 2012).

Lower San Joaquin River Feasibility Study The Lower San Joaquin River Feasibility Study is a cooperative effort being carried out by the U.S. Army Corps of Engineers (USACE), the Central Valley Flood Protection Board (CVFPB), and the San Joaquin Area Flood Control Agency to address flood risk management and ecosystem restoration along the lower San Joaquin River. The Energy and Water Development Appropriations Act of 1998 (PL 105-62) authorized the USACE to complete the Sacramento and San Joaquin River Basins Comprehensive Study. The Comprehensive Study was initiated in Fiscal Year

1998 and a system-wide hydrologic/hydraulic model was completed as well as extensive public involvement and planning for flood damage reduction and ecosystem restoration purposes; however, additional investigations are needed along the lower San Joaquin River (USACE et al. 2008). The feasibility study has the following objectives:

- Reduce the risk of flooding to people and property, and economic damages due to flooding within the primary study area.
- Develop a sustainable flood management system for the future, as well as a plan to address and communicate residual flood risks.
- Reduce the risk of adverse consequences of floods when they do occur.
- Restore the quantity, quality, diversity, and connectivity of riparian, wetland, floodplain, and shaded riverine aquatic habitats where appropriate (USACE et al. 2008).

The Feasibility Study is in the preliminary stages. The USACE has completed a draft Project Management Plan for the investigation that lays out the scope, budget, tasks, schedule, cost and management plan. A Notice of Intent to prepare an EIS/EIR for the feasibility study was published in the Federal Register by the USACE in January 2010. Public workshops and scoping meetings were also held in 2010. A draft EIS/EIR is anticipated in late 2014.

North Delta Flood Control and Ecosystem Restoration Project The North Delta Flood Control and Ecosystem Restoration Project is being carried out by DWR. The purpose of the project is to combine flood control and ecosystem restoration goals in the north Delta area using the McCormack-Williamson Tract and Staten Island. Flood control improvements are needed to reduce damage to land use, infrastructure, and the Bay-Delta ecosystem from overflows caused by insufficient channel capacities and levee failures. The project proposes alterations to levees, dredging, and modifications to existing roads and infrastructure. Levee enhancements are proposed to provide vegetative cover for wildlife (DWR 2007). The Final EIR was certified in October 2010. Final designs were completed in fall 2013 and construction is anticipated to be completed by summer 2015. Funding remains an issue for the project.

South Delta Improvements Program The South Delta Improvements Program (SDIP) proposes actions to improve water quality and protect salmon in the South Delta while allowing the SWP to operate more effectively. The proposed plan includes physical/structural improvements as well as operational changes. The physical improvements include replacing four seasonal rock barriers with permanent operable gates on Old River, Grantline Canal, Middle River and Old River where it leaves the San Joaquin River. Improvements would also include limited dredging of Middle River and Old River and modifying up to 24 local agricultural diversions. Changes in operations would involve increasing the maximum diversion limit at existing SWP facilities in the South Delta to provide more water to south of Delta contractors (DWR n.d.).

A final EIS/EIR has been completed for SDIP and DWR is working to obtain the required environmental permits. ESA consultation for the operation of the permanent operable gates proposed by the SDIP was included in the Operations Criteria and Plan (OCAP) that covers operations of the SWP and CVP, and both the USFWS and National Oceanic Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) rendered Jeopardy Biological Opinions (BOs) on OCAP. The NOAA Fisheries BO in 2009 specifically directs DWR to halt implementation of the SDIP and consultation cannot be reinitiated until after three years of fish predation studies at the South Delta temporary barriers are completed. After all permits have been acquired DWR can proceed with construction (DWR 2010a). There is currently no schedule for project completion.

San Luis Reservoir Low Point Improvement Project Reclamation and the Santa Clara Valley Water District (SCVWD) are proposing the San Luis Low Point Improvement Project (SLLPIP) to address water supply reliability and schedule certainty issues for SCVWD associated with low water levels in San Luis Reservoir. The SLLPIP alternatives would help to maintain a high quality, reliable, and cost-effective water supply for SCVWD, and would ensure that they receive their annual CVP contract allocations at the time and at the level of quality needed to meet their existing water supply commitments. The alternatives proposed under the SLLPIP include lowering the San Felipe Intake in San Luis Reservoir to allow SCVWD to withdraw water from the reservoir at lower levels, new groundwater recharge and groundwater wells, operational changes, and upgrades to existing wastewater treatment plants to improve their ability to treat algae-laden water from San Luis Reservoir. Work is currently underway to incorporate the ongoing Sisk Dam Safety of Dams Corrective Action Study into the SLLPIP with an anticipated draft Feasibility Report and EIS/EIR in 2017.

South Bay Aqueduct Improvement and Enlargement Project DWR has been working to enlarge and improve the South Bay Aqueduct, a SWP facility that serves Zone 7 Water Agency (Zone 7), Alameda County Water District, and SCVWD. The project includes upgrades to the South Bay Pumping Plant, raised linings on open channel sections of the aqueduct, the addition of a 450-AF Dyer Reservoir, and a new pipeline connecting it to the South Bay Pumping Plant. The project provides conveyance capacity to meet the water needs of the Zone 7 service area, increases operational reliability, provides adequate freeboard along canals, provides off-peak power efficiency, and provides water quality benefits to Zone 7 by allowing Zone 7 to import and recharge water with lower total dissolved solids during spring months (DWR 2004). Construction was completed in 2012.

In-Delta Storage Program (Delta Wetlands Project) DWR, in coordination with the California Bay-Delta Authority and with technical assistance from

Reclamation, has been analyzing the feasibility of in-Delta storage options. The program would provide capacity for 217,000 AF of water storage in the south Delta for water supply, water quality, and ecosystem purposes. The program would include two storage islands (Webb Tract and Bacon Island), two habitat islands (Bouldin Island and Holland Tract), new embankment designs, consolidated inlet and outlet structures, new operations and revised habitat management plans. The program is intended to enhance water supply reliability and operational flexibility of the CVP/SWP, contribute to ecosystem restoration, and provide water for the Environmental Water Account. The program has been suspended since July 2006 when state funding was cut (DWR 2010b).

Semitropic Water District completed a Wetlands Project Place of Use Final EIR in 2011 that analyzes the diversion and storage of water by the Delta Wetlands Project, the supplying of that water to the place of use, and the supplemental storage of that water in Semitropic and Antelope Valley groundwater banks. The project would increase water supply reliability for Semitropic Water District and other places of use, and would help to reduce groundwater overdraft, reduce pumping lift, and provide dry year water supply reliability (Semitropic Water District 2011).

Long-Term Water Transfers Reclamation and the San Luis & Delta-Mendota Water Authority (SLDMWA) ~~are completing~~ completed a joint EIS/EIR for water transfers from 2015 through 2024. Reclamation ~~would~~ plans to facilitate transfers, including groundwater substitution, reservoir releases, cropland modifications and conservation measures, proposed by buyers and sellers involving CVP supplies or CVP facilities. The SLDMWA, consisting of federal and exchange water service contractors in western San Joaquin Valley, San Benito, and Santa Clara counties, helps negotiate transfers in years when the member agencies could experience shortages. Because water shortages are dependent on hydrologic conditions, climatic variability, and regulatory requirements, transfers are needed in most, if not all years. The upper limit for transfers would be 511,094 AF per year, which includes the maximum amount of both groundwater substitution and cropland modification transfers. However, the actual annual amount of transferred water per year would be less because many agencies are uncertain about their anticipated level of ~~participate~~ participation through either groundwater substitution or cropland modification transfers.

Reclamation and SLDMWA propose to facilitate voluntary water transfers from willing sellers upstream of the Delta to water users south of the Delta and in the San Francisco Bay Area from 2015 through 2024. The objectives of long-term water transfers through 2024 include:

- Develop supplemental water supply for member agencies during times of CVP shortages to meet anticipated demands.

- Meet the need of member agencies for a water supply that is immediately implementable and flexible and can respond to changes in hydrologic conditions and CVP allocations.

The Final EIS/EIR was made available on March 20, 2015. A Notice of Determination for CEQA was signed on April 9, 2015 and a Record of Decision for NEPA was signed on May 1, 2015.

San Joaquin River Restoration Program (SJRRP) In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC) filed a lawsuit, known as *NRDC, et al., v. Kirk Rodgers, et al.*, challenging the renewal of long-term water service contracts between the U.S. and the CVP Friant Division contractors. On September 13, 2006, after more than 18 years of litigation, the Settling Parties, including NRDC, Friant Water Authority, and the United States Departments of the Interior and Commerce, agreed on the terms and conditions of a Settlement subsequently approved by the United States Eastern District Court of California on October 23, 2006. The San Joaquin River Restoration Settlement Act, included in Public Law 111-11 and signed into law on March 30, 2009, authorizes and directs the Secretary of the Interior to implement the Settlement. The Settlement establishes two primary goals:

- Restoration Goal – To restore and maintain fish populations in "good condition" in the main stem San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.

- Water Management Goal – To reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim and Restoration flows provided for in the Settlement.

To achieve the Restoration Goal, the Settlement calls for a combination of channel and structural modifications along the San Joaquin River below Friant Dam, releases of water from Friant Dam to the confluence of the Merced River (referred to as Interim and Restoration flows), and reintroduction of Chinook salmon. To achieve the Water Management Goal, the Settlement calls for downstream recapture of Interim and Restoration flows from the San Joaquin River and the Delta and recirculation of that water to replace reductions in water supplies to Friant Division long-term contractors resulting from the release of Interim and Restoration flows. In addition, the Settlement establishes a Recovered Water Account and allows the delivery of surplus water supplies to Friant Division long-term contractors during wet hydrologic conditions.

The SJRRP will implement the Settlement consistent with the San Joaquin River Restoration Settlement Act. Implementing Agencies responsible for managing and implementing the SJRRP are the Reclamation, NOAA Fisheries, DWR, and California Department of Fish and Wildlife. The Settlement includes a detailed timeline for developing and implementing SJRRP actions.

The Arroyo Canal Fish Screen and Sack Dam Fish Passage Project implements two of the highest priority projects identified in the Settlement. It includes a fish screen on the Arroyo Canal to prevent entrainment of juvenile Chinook salmon in the canal and modifications to Sack Dam to allow for fish passage around the structure. Environmental documentation for this project was completed in 2012 and construction is currently pending.

Environmental documents for several Restoration Goal projects are currently underway, including the Reach 4B, Eastside Bypass, and Mariposa Bypass Channel and Structural Improvements Project EIS/EIR, and the Mendota Pool Bypass and Reach 2B Channel Improvements Project EIS/EIR. These projects involve restoring portions of the San Joaquin River by improving channel and structural features to allow for fish passage and flows.

Franks Tract Project DWR and Reclamation are evaluating methods to improve water quality and fisheries conditions in the Delta by installing gates to control the flow of water at Threemile Slough and/or West False River to reduce sea water intrusion, and to help move fish to better habitat. The proposed gates would be operated seasonally and daily, depending on fisheries conditions. By protecting fish resources, this project also would improve operational reliability of the SWP and CVP because curtailments in water exports (pumping restrictions) would likely occur less frequently. DWR and Reclamation have identified the following objectives for the project:

- Modify hydrodynamic conditions for fish species of concern to positively influence their movement to areas that provide favorable habitat conditions.
- Modify hydrodynamic conditions to improve water quality by reducing higher salinity sea water intrusion into the central and south Delta (DWR 2013).

Freeport Regional Water Project This project by the Sacramento County Water Agency and East Bay Municipal Utility District (EBMUD) involves supplying 85 million gallons per day (mgd) of water from the Sacramento River to customers in Sacramento County, and up to 100 mgd of water to EBMUD during dry years only. The project involves a new intake facility, new pipelines, new pumping plants, and a new water treatment plant. Construction for this project was completed in 2010.

Folsom Dam Safety and Flood Damage Reduction Project (Joint Federal Project) and Folsom Water Control Manual Update Reclamation and USACE, together with the CVFPB and Sacramento Flood Control Agency (SAFCA) are working on upgrades to Folsom Lake for dam safety and flood damage reduction. Improvements that have been completed include seismic and static upgrades to Dikes 4, 5, and 6, Mormon Island Auxiliary Dam, and Left and Right Wing Dams. The project also includes construction of a new auxiliary spillway that would allow more water to be released from Folsom Lake earlier during an extreme storm. This would reduce the chances for flooding the Sacramento area and would achieve the USACE objective of 1 in 200 year flood protection. Phase 3 of the auxiliary spillway is currently under construction and is anticipated to be complete in 2017. The USACE is also considering up to a 3.5 foot dam raise, however no schedule for this action is currently available.

The new auxiliary spillway will allow for operational changes to Folsom Lake because it will allow more water to be released. However, the new auxiliary spillway must be operated within the rules outlined in the current Water Control Manual (WCM) until an updated WCM is approved. The USACE and the CVFPB are currently working on updating the WCM for Folsom. The updated WCM will identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Lake to reduce flood risk to the Sacramento area by utilizing the auxiliary spillway currently under construction and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam. USACE issued a Notice of Intent to prepare a joint EIS/EIR for the WCM update in 2012.

~~Remanded~~ Biological Opinions on the Coordinated Long-Term Operations of the CVP and SWP The CVP and SWP operate under the Coordinated Operation Agreement between the Federal government and the State of California (Public Law 99–546). Operation of the CVP and SWP are described in Reclamation's 2008 Biological Assessment. In December 2008, USFWS issued a BO analyzing the coordinated long-term operation of the CVP and SWP. The USFWS BO concluded that the coordinated operation was likely to jeopardize delta smelt and adversely modify delta smelt critical habitat. It included a Reasonable and Prudent Alternative (RPA) designed to allow the CVP and SWP to continue operating without causing jeopardy or adverse modification. On December 15, 2008, Reclamation provisionally accepted, and began implementing, the USFWS RPA.

In June 2009, the NOAA Fisheries issued a BO for listed species and concluded that coordinated operation was likely to jeopardize Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, southern distinct population segment of North American green sturgeon, and southern resident killer whales and would destroy or adversely modify critical habitat. The BO also included a RPA and on June 4, 2009, Reclamation provisionally accepted and began implementing the NOAA Fisheries RPA.

Lawsuits were filed challenging various aspects of the USFWS and NOAA Fisheries BOs and Reclamation's acceptance and implementation of the RPAs. The District Court ruled that Reclamation violated NEPA by failing to conduct a NEPA review before provisionally accepting and implementing the USFWS and NOAA Fisheries BOs and RPAs. Reclamation was ordered to review the USFWS and NOAA Fisheries BOs and RPAs in accordance with NEPA. ~~The District Court also found certain portions of the USFWS and NOAA Fisheries BOs to be arbitrary and capricious, and remanded those portions of the BOs to USFWS and NOAA Fisheries.~~

To comply with the rulings, Reclamation has initiated a combined NEPA process to address both the USFWS and NOAA Fisheries RPAs. Reclamation published a Notice of Intent in the Federal Register on March 28, 2012 to prepare a combined EIS to address the USFWS and NOAA Fisheries RPAs. The EIS will analyze the effects of modifications to the coordinated long-term operation of the CVP and SWP through 2030 to avoid jeopardy to listed species and destruction or adverse modification of designated critical habitat. Scoping meetings were held in April and May 2012 for the EIS. The court requires a final EIS for the USFWS BO by December 2014 and a final EIS for the NOAA Fisheries BO by February 2017 (Reclamation 2013).

20.3.3.2 Projections Considered in Cumulative Effects Analysis

The population projections used in the cumulative effects analysis are included in Chapter 13, Socioeconomics.

20.3.4 Determining Magnitude

The cumulative effects analysis focuses on meaningful cumulative issues to help guide in the decision-making. The magnitude of a cumulative effect is determined for each resource by considering the severity, geographic extent, duration, and frequency of the effect, as well as the current condition of the affected resource.

20.3.5 Mitigation

According to NEPA, an EIS must include a discussion on the means to mitigate for adverse environmental effects (40 CFR 1502.16(h), 40 CFR Section 1502.14(f)). The final mitigation measures selected for implementation are adopted in a Record of Decision (ROD). The Lead Agency must state in the ROD whether all practicable measures to avoid or minimize environmental harm have been adopted, and if not, why they were not (40 CFR Section 1505.2(c)).

This cumulative effects analysis will identify potential mitigation for cumulative effects. The ROD will present the final mitigation measures adopted as part of the project.

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Chapter 21
Other NEPA Considerations

Other required disclosures of environmental documents include irreversible and irretrievable commitment of resources, the relationship between short-term uses and long-term productivity, growth inducing impacts, and unavoidable adverse impacts.

21.1 Irreversible and Irretrievable Commitment of Resources

According to the National Environmental Policy Act (NEPA), an environmental impact statement (EIS) must contain a discussion of irreversible and irretrievable commitment of resources that would result from the proposed action if it was implemented (40 Code of Federal Regulations [CFR] Section 1502.16). The irreversible commitment of resources generally refers to the use or destruction of a resource that cannot be replaced or restored over a long period of time. The irretrievable commitment of resources refers to the loss of production or use of natural resources and represents lost opportunities for the period when the resource cannot be used.

Changes to Central Valley Project (CVP) deliveries to water service contractors would involve the consumption of nonrenewable natural resources. These nonrenewable natural resources would consist of petroleum for fuels necessary to operate equipment used during groundwater pumping activities. Groundwater pumping throughout the project area would be increased under Alternatives 3 and 5 compared to the No Action Alternative.

21.2 Relationship Between Short-Term Uses and Long-Term Productivity

As required by NEPA (40 CFR Section 1502.16), this section describes the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

All action alternatives analyzed in this EIS would involve changes to the amount of water made available to CVP municipal and industrial (M&I) and agricultural water service contractors. These changes in CVP allocations would affect the amount of groundwater and other water supplies used by the contractors during ~~water shortage conditions~~ a Condition of Shortage. Additional use of groundwater or implementation of water transfers (both identified as potential indirect effects for some action alternatives) would require short-term uses of energy for increased groundwater pumping and increased pumping for transfers south of the Sacramento-San Joaquin River Delta (Delta). Long-term productivity would benefit from increased agricultural production when CVP allocations to agricultural water service contractors are increased.

The M&I Water Shortage Policy (WSP) would be applied on a year-to-year basis depending upon CVP water supply conditions. The purpose of the M&I WSP is to provide information to water service contractors for their use in water supply planning and development of drought contingency plans.

21.3 Growth Inducing Impacts

NEPA (40 CFR Sections 1502.16(b) and 1508.8(b)) describes the required analysis of direct and indirect impacts of growth-inducing impacts from projects. Section 1502.16(b) requires the analysis of indirect effects. Under NEPA, indirect effects as stated in Section 1508.8(b) include reasonably foreseeable growth inducing effects from changes caused by a project.

Direct growth inducing impacts are usually associated with the construction of new infrastructure, housing, or commercial development. A project which promotes growth, such as new employment opportunities or infrastructure expansion (i.e., water supply or wastewater treatment capabilities) could have indirect growth inducing effects. Generally, growth inducing impacts would be considered significant if the ability to provide needed public services by agencies is hindered or the potential growth adversely affects the environment.

The M&I WSP addresses drought conditions when CVP supplies are not sufficient to meet demands. The M&I WSP would not directly or indirectly affect growth beyond what is already planned and accounted for in CVP water service contracts. Therefore, the M&I WSP would have no growth inducing impacts.

21.4 Unavoidable Adverse Impacts

Unavoidable adverse effects refer to the environmental consequences of an action that cannot be avoided by redesigning the project, changing the nature of the project, or implementing mitigation measures. NEPA requires a discussion of any adverse impacts that cannot be avoided (40 CFR Section 1502.15).

21.4.1 Surface Water

Under all action alternatives, public health and safety ~~demands~~ needs are not fully met in some of the modeled water years.

21.4.2 Water Quality

Under Alternative 2, water quality in the Delta would be slightly degraded. Salinity and bromide concentrations would increase slightly, especially during dry and critical water years. Additionally, storage in San Luis Reservoir during summer months of dry water years 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 water years due to decreases in storage of up to four percent.

21.4.3 Groundwater Resources

Under Alternative 3, there will be a substantial increase in groundwater pumping in the Sacramento River, San Joaquin River, and Tulare Lake regions. This increase in pumping is expected to decrease groundwater levels and could cause land subsidence within these regions.

21.4.4 Greenhouse Gases and Climate Change

Alternative 3 could increase greenhouse gases emissions by 2,715 metric tons of carbon dioxide equivalent per year ($MTCO_{2e}$/yr) to 5,753 $MTCO_{2e}$/yr due to additional groundwater pumping. Impacts from climate change under Alternative 3 could potentially be adverse because if CVP exports decrease, then more pumping than currently predicted could be necessary.

Alternative 5 could increase greenhouse gases emissions by 15 $MTCO_{2e}$/yr to 136 $MTCO_{2e}$/yr due to additional groundwater pumping.

21.4.5 Agricultural Resources

Alternative 3 would decrease irrigated acreage in the Tulare Lake Region by up to 1.1 percent.

21.4.6 Socioeconomics

Alternative 2 would have adverse impacts to regional economies due to decreased CVP deliveries to M&I contractors, including decreases in output, employment, labor income, and value added. In the Bay Area Region, adverse effects may be more than estimated due to model limitations and need for further conservation. Additional conservation over the No Action Alternative may be needed. M&I conservation measures would reduce volume of water sold and revenues to water supply contractors, which could cause customer rates to further increase.

Alternative 3 would have adverse impacts to regional economies in the Sacramento Valley and Tulare Lake regions due to decreased CVP deliveries to agricultural contractors, including decreases in output, employment, labor income, and value added.

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Chapter 22
Consultation and Coordination

This chapter documents the consultation and coordination efforts that have occurred during development of the Central Valley Project (CVP) Municipal and Industrial Water Shortage Policy (M&I WSP) Environmental Impact Statement (EIS).

22.1 Public Involvement

The National Environmental Policy Act encourages public involvement during preparation of EISs. The following sections describe the public involvement opportunities that have occurred or will occur during the EIS process.

22.1.1 Public Scoping

A public process was initiated in 1993 by the Bureau of Reclamation (Reclamation) to develop an M&I WSP. Reclamation continued the process as part of the Administrative Proposal efforts to implement the Central Valley Project Improvement Act. Reclamation issued draft policies in 1994, 1996, 1997, 2000, and 2001, and prepared an Environmental Assessment in 2005.

In 2009, Reclamation decided to update the 2001 Draft M&I WSP and began a new public scoping process. Reclamation published a Notice of Intent in the Federal Register (Vol. 76, No. 45) on Tuesday March 8, 2011. Public scoping meetings were held between March 21, 2011 and March 24, 2011 in the cities of Sacramento, Willows, Fresno, and Oakland, California. Reclamation prepared the "Central Valley Project Municipal and Industrial Water Shortage Policy Scoping Report" (dated July 2011), which summarized the comments and concerns raised during the meetings, as well as public comments obtained during the public comment period.

22.1.2 Public Meetings

Reclamation ~~will hold public meetings after release of the Draft EIS to solicit public comments.~~ published a Notice of Availability of the Draft EIS in the Federal Register (Vol. 79, No. 223) on November 19, 2014. Public meetings were held between December 8, 2014 and December 17, 2014 in the cities of Sacramento, Willows, Fresno, and Oakland, California. The original public comment period was to conclude on January 12, 2015; however, due to public request Reclamation twice extended the public comment period through to the ultimate date of March 13, 2015. Reclamation published a Notice of Public Review and Comment Period Extension in the Federal Register (Vol. 80, No. 6) on January 9, 2015. Public meeting minutes and copies of all public comments received during the comment period are included in Appendix H, Comment Letters. All commenters on the Draft EIS will be notified once the Final EIS is available for review.

22.1.3 Stakeholder Workshops

Reclamation has been in communication with CVP stakeholders since August 2009 about its effort to update the 2001 Draft M&I WSP. Between May 2010 and June 2012, Reclamation conducted seven M&I WSP Stakeholder Workshops to provide Reclamation's interpretation of the existing policy, receive input from stakeholders on suggested changes, review developing changes to the M&I WSP, and discuss alternatives under consideration and proposed modeling efforts for the EIS. All workshop presentations, workshop materials, and contractor comments can be accessed at Reclamation's website http://www.usbr.gov/mp/cvp/mandi/. The stakeholder group will be notified through the stakeholder email distribution list when the Final EIS is available for review.

22.2 Agency Coordination

Reclamation coordinated with the United States Fish and Wildlife Service (USFWS) during development of the Draft EIS regarding the impact analysis on special status species and environmental commitments. Reclamation ~~will~~ provided USFWS and the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) with a copy of the Draft EIS for review and comment.

Reclamation has further coordinated with NOAA Fisheries in preparing this Final EIS. Reclamation will provide both the United States Environmental Protection Agency and NOAA Fisheries with a copy of the Final EIS.

Chapter 23
List of Preparers and Contributors

The following is a list of preparers who contributed to the development of the Central Valley Project Municipal and Industrial Water Shortage Policy Environmental Impact Statement.

Table 23-1. United States Department of the Interior, Bureau of Reclamation

Preparers	Title	Role In Preparation
Amy Aufdemberg	Assistant Regional Solicitor	Executive Summary, Introduction, Description of Alternatives
Lucille Billingsely	Supervisory Repayment Specialist	Surface Water, Cumulative Effects Methodology
Dan Cordova	Wildlife Biologist/Natural Resources Specialist	Terrestrial Resources
Tom FitzHugh	Hydrologist/Water Resources Modeler	Surface Water
Georgiana Gregory	Repayment Specialist	Surface Water
Shelly Hatleberg	Natural Resources Specialist	Flood Hydrology
Brad Hubbard	Natural Resources Specialist	Visual Resources
Claire Hsu	Water Rights Specialist	Surface Water
Michael Inthavong	Natural Resources Specialist	Project Manager, Coordination and Review
Cathy James	Repayment Specialist	Surface Water
John Jordan	Economist	Socioeconomics
Doug Kleinsmith	Natural Resources Specialist	Environmental Justice
Erma Leal	Repayment Specialist	Surface Water
Myrnie Mayville	Natural Resources Specialist	Terrestrial Resources
Dean McLeod	Economist	Agricultural Resources
Andrea Meier	Natural Resources Specialist	Air Quality
Mike Mosley	Regional Water Quality Coordinator	Water Quality
Kirk Nelson	Modeler/Hydraulic Engineer	Greenhouse Gases and Climate Change
Stanley Parrott	Geologist	Groundwater Resources
Laurie Perry	Regional Archaeologist	Resources Introduction
Patricia Rivera	Native American Affairs Program Coordinator	Indian Trust Assets
Tim Rust	Fish and Wildlife Program Manager	Program Manager
Scott Springer	Recreation Coordinator	Recreation
Mike Tansey, Ph.D.	Climate Change Coordinator	Greenhouse Gases and Climate Change
Erwin Van Nieuwenhuyse, Ph.D.	Supervisory Fish Biologist	Aquatic Resources

Preparers	Title	Role In Preparation
Liz Vasquez	Natural Resources Specialist	Resources Introduction, Aquatic Resources, Power, Cumulative Effects Methodology
Kristin White	Civil Engineer (Hydrologic)	Resources Introduction, Surface Water
Natalie Wolder	Repayment Specialist	Executive Summary, Introduction, Description of Alternatives, Resources Introduction, Surface Water, Groundwater Resources, Agricultural Resources

Key:
Ph.D. = Doctorate

Table 23-2. CDM Smith

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Ahnna Brossy, P.G.	M.S. Geology 10 years experience	Geologist	Geology and Soils
Carrie Buckman, P.E.	M.S. Environmental Engineering 16 years experience	Water Resources Engineer	NEPA Expertise
Selena Evans	M. Urban and Regional Planning 6 years experience	Environmental Planner	Project Coordinator, Environmental Justice, Indian Trust Assets, Flood Control, Visual Resources, Other NEPA Considerations, Consultation and Coordination, List of Preparers
Donielle Grimsley	B.S. Biology 8 years experience	Environmental Scientist	Water Quality
Brian Heywood, P.E.	M.S. Civil Engineering 17 years experience	Senior Water Resource Engineer	Groundwater
Robin Ijams	B.A. Environmental Studies 28 years experience	Environmental Analysis and Regulation	NEPA Expertise
Anusha Kashyap	M.S. Environmental Engineering 5 years experience	Environmental Engineer	Groundwater, Socioeconomics
Alexandra Kleyman, AICP	M.A. Environmental Policy and Urban Planning 6 years experience	Environmental Planner	Geology and Soils
Andria Loutsch, AICP	B.S. Economics 18 years experience	Water Resources Planner	Project Manager, Introduction, Project Description, Resources Introduction, Consultation and Coordination
Kristina Masterson, P.E.	M.S. Mechanical Engineering 25 years experience	Water Resources Engineer	Groundwater Expertise

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Sami Nall, P.E.	M.S. Environmental Policy and Urban Planning 8 years experience	Environmental Engineer	Agricultural Resources, Power
Christopher Park, AICP	M.S. City and Regional Planning 9 years experience	Water Resources Planner	Surface Water, Cumulative Effects Methodology
Gwen Pelletier	M.S. Environmental Studies 14 years experience	Environmental Scientist	Air Quality, Greenhouse Gases and Climate Change
John Pehrson, P.E.	B.S. Chemical Engineering 32 years experience	Associate Chemical Engineer	Air Quality Expertise
Gina Veronese	M.S. Agricultural and Resource Economics 13 years experience	Resource Economist	Socioeconomics
Suzanne Wilkins, AICP	B.S. Business Administration 26 years experience	Water Resources Planner	Recreation
Ruben Zubia, P.E.	M.B.A.; B.S. Civil Engineering 28 years experience	Water Resources Engineer	Program Manager

Key:
AICP = American Institute of Certified Planners, B.A. = Bachelor of Art, B.S. = Bachelor of Science, P.E. = Professional Engineer, P.G. = Professional Geologist, M. = Masters, M.A. Master of Art, M.B.A. = Master of Business Administration, M.S. = Master of Science

Table 23-3. ERA Economics

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Duncan MacEwan	Ph.D. Economic Geography 7 years experience	Agricultural Economics Analysis	Agricultural Economics Model

Key:
Ph.D. = Doctorate

Table 23-4. ESA

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Rachel Brownsey	M.S. Horticulture and Agronomy 5 years experience	Botany and Vegetation Ecology	Terrestrial Resources
Chris Fitzer	M. Environmental Planning 18 years experience	Delta, Aquatic Ecology, Fisheries	Aquatic Resources
Andrew Hatch	M.S. Biological Sciences 14 years experience	Fisheries and Wildlife	Aquatic Resources

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Tom Taylor	M.S. Aquatic Ecology 30 years experience	Delta, Fisheries, Salmonids	Aquatic Resources
Lindsay Tisch	B.S. Fisheries and Wildlife Management 14 years experience	Wildlife, Wetlands and Plant Communities	Terrestrial Resources
Matthew Russell	PhD. Anthropology 22 years experience	Archaeology and Cultural Resource Management	Cultural Resources

Key:
B.S. = Bachelor of Science, M. = Masters, M.S. = Master of Science, PhD. = Doctorate

Table 23-5. MBK Engineers

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Lee Bergfeld	M.S. Civil Engineering, 19 years experience	Hydrologic Modeling	Hydrologic Model
Walter Bourez	M.S. Civil Engineering, 25 years experience	Hydrologic Modeling	Hydrologic Model

Key:
M.S. = Master of Science

Table 23-6. Resource Management Associates

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Marianne Guerin	Ph.D. Mathematics 21 years experience	Water Resource Specialist	Water Quality Model

Key:
Ph.D. = Doctorate

Table 23-7. RMann Economics

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Roger Mann	Ph.D. Agricultural Economics and Economics 37 years experience	Natural Resources Economist	Regional Economics Model

Key:
Ph.D. = Doctorate

Chapter 24
Index

The index is a listing of names, places, and topics in alphabetical order, with chapters or page numbers indicating where they are discussed in this Final Environmental Impact Statement. Page numbers are hyphenated to include the relevant chapter number. For example, Chapter 3, page 5 is presented as page 3-5. Occasionally, an index term is the subject of an entire chapter; in these cases, the chapter itself is referenced, rather than individual page numbers.

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