Chapter 10
Agriculture and Important Farmland

10.1 Affected Environment

This section describes the affected environment related to existing agricultural land uses, Important Farmland, Williamson Act contract lands, and forest resources in the primary and extended study areas. See Chapter 12, "Botanical Resources and Wetlands," for detailed definitions of forest land habitats and Chapter 13, "Wildlife Resources," for a discussion of the relationship between agricultural land uses and wildlife uses. See Chapter 17, "Land Use and Planning," for a discussion of existing land uses within the primary and extended study areas and the project's consistency with existing land uses.

10.1.1 Agriculture

Shasta Lake and Vicinity

The setting for agricultural resources in the Shasta Lake and vicinity portion of the primary study area consists of areas in Shasta County north of Shasta Dam, including lands surrounding the lake, that would be subject to inundation and areas where infrastructure would be removed, modified, or relocated under the action alternatives.

Shasta Lake is surrounded by mountainous and rugged terrain. There are no known agricultural uses adjacent to the lake or in its immediate vicinity above Shasta Dam.

Upper Sacramento River (Shasta Dam to Red Bluff)

The upper Sacramento River portion of the primary study area consists of the portion of Shasta County south of Shasta Dam and downstream to Red Bluff in Tehama County. The valleys of the Sacramento River and its tributaries (Churn, Cottonwood, Anderson, Stillwater, Cow, Bear, Battle, and Clover creeks) contain some of the most productive agricultural land in Shasta and Tehama counties. In addition to the high quality of their soils, agricultural lands in this area enjoy a long growing season of 172 to 205 days. Water from the Anderson-Cottonwood Irrigation District (ACID), surface diversions of streams, or groundwater is available and good transportation access exists (Shasta County 2004). As of 2007, Shasta County's 1,473 farms encompassed a total of almost 390,812 acres and Tehama County's 1,752 farms were located on 532,206 acres (USDA 2007a, 2007b). About 253,000 acres of Important Farmland are located in the Sacramento River corridor between Shasta Dam and the Red Bluff

Pumping Plant. Please see Section 10.1.2, “Important Farmland,” below for further discussion.

The majority of agricultural activity is located on the Sacramento Valley floor in the south-central portion of Shasta County and across central Tehama County. Small pockets of pastureland exist throughout Shasta County, including mountainous regions. Based on production value, the largest use of agricultural land in Shasta County is field crops, followed by livestock (Shasta County 2011). Nursery stock is the third largest use. Approximately 13 percent of Shasta County land is devoted to some type of agricultural use.

Agricultural uses in the Tehama County portion of the Sacramento Valley consist mostly of orchard and nursery plant operations. The primary crops of Tehama County orchards are walnuts, prunes, almonds, and olives. These crops are largely concentrated in the floodplain alongside the Sacramento River (within and below the upper Sacramento River portion of the primary study area) and are irrigated with groundwater, as well as surface water from local creek diversions and the Sacramento River.

A drastic increase in orchard acreage has occurred since orchard production was initially reported by the National Agricultural Statistics Service in 1930. A combination of factors is responsible for this increase: the availability of irrigation water, advances in irrigation technologies, relatively good commodity prices for orchard crops, and the availability of processing facilities.

The upper Sacramento River portion of the primary study area (areas below Shasta Dam) is largely serviced by ACID. ACID’s service area of approximately 32,000 acres extends south from the city of Redding in Shasta County into northern Tehama County. ACID does not provide water for municipal and industrial uses in these areas. Approximately 90 percent of ACID’s customers irrigate pasture for haying or livestock; however, in most of the river corridor the water is used to irrigate orchard and other food crops. In total, ACID’s service area accounts for about two-thirds of all irrigated pasture in the Redding basin.

ACID uses a rotation schedule to deliver irrigation water to its customers. Very little groundwater is used within the district for agricultural purposes, except occasionally during drought years. Water requirements are typically highest during summer (June, July, and August) because of the area’s hot, dry climate. A groundwater management program is being developed; by 2005, 12 dual-completion groundwater monitoring wells had been installed within ACID boundaries. The small portion of groundwater used is limited primarily to deciduous crops and is pumped by privately owned wells. ACID’s facilities and irrigation are important contributors to groundwater recharge in the Redding basin. Annual seepage associated with the ACID Main Canal is estimated to be approximately 44,000 acre-feet.

Agricultural use within ACID's service area is primarily pasture, in addition to alfalfa and some deciduous orchard crops. Pasture use is typically in the range of 75 percent of the total crop mix served by ACID. Annual cropping patterns have not varied substantially since the mid-1970s. Therefore, associated on-field water requirements and diversions for crops have been more a function of water-year type and climate than changes in cropping.

Agriculture thus accounts for an important segment of the economic base of Shasta and Tehama counties. In 2011, for example, the total market value of farm products in Shasta County was $76,328,000, a slight increase from the $70,760,000 produced in 2010. Minor increases in the annual production value of orchard crops and apiary products accounted for this increase. Field crops accounted for nearly 46 percent of this total, with livestock sales providing nearly one-third (32.2 percent) of the county's total agricultural production value. In 2010, Shasta County ranked only 37th among the 58 California counties in the value of total agricultural production – $110,283,000, as reported by the California Department of Food and Agriculture (Shasta County 2011).

In addition to its economic contribution, the agriculture industry is in large part responsible for the rural character of Shasta and Tehama counties. Farmland can also play an important role in the support of wildlife values through the effects it has on conservation of wildlife habitats. As more farmland is developed for urban and suburban uses, the available habitat for most field and woodland edge species decreases, resulting in a subsequent decline in or potential elimination of their populations. Agricultural lands also provide productive, privately maintained open space that contributes to the open, natural landscape of much of Shasta and Tehama counties.

Lower Sacramento River and Delta

The Sacramento River below the Red Bluff Pumping Plant and the river's tributaries continue to provide water to crops grown in the river's floodplain and the valley floor, which broadens as it expands into the Central Valley. The Sacramento River crosses Tehama, Butte, Glenn, Colusa, Sutter, Yolo, and Sacramento counties and is an important source of water for the irrigation and agricultural districts in those counties.

California's Central Valley is home to more than 4 million people; agriculture is the most important segment of the region's robust economy. The Sacramento and San Joaquin river basins provide drinking water for more than two-thirds of Californians and irrigation water for California's crops. The availability of irrigation water makes the Central Valley a major source of reliable, high-quality crops, such as almonds, walnuts, grapes, tomatoes, rice, and other orchard, vineyard, and field crops, marketed to the nation and the world (Reclamation and DWR 2005; DWR and Reclamation 2006).

As of 2007, California's 81,033 farms included a total of 25.4 million acres (USDA 2007c). Of that acreage, the Sacramento Valley had more than 11,000 farms with about 4.3 million acres. Sacramento Valley portions of the Central Valley's watersheds support a wide variety of agricultural uses, including livestock grazing, irrigated grain and vegetable crops, and orchards (DWR and Reclamation 2006).

Most agricultural water demands in the Sacramento Valley are met in average water years. Farmers have been growing more crops per acre-foot of applied water by improving productivity and efficiency. However, in some areas, water sources once used for agriculture are now used for urban needs, environmental restoration, and groundwater replenishment. During droughts, water supplies are less reliable, heightening competition and at times leading to conflicts among water users. Water quality is degraded, making it difficult and costly to make the water drinkable. Irrigated agriculture and related businesses are adversely affected, in turn affecting California's economy. During droughts, groundwater levels decline, pumping costs increase, and many rural residents who depend on small water systems or wells run short of water (DWR and Reclamation 2006).

Table 10-1 provides examples of water supply distribution among uses in wet, above-normal, and dry years.[1] Delta agricultural lands were "reclaimed" when levees were constructed and marshy areas were drained. In less than 100 years, from 1850 to 1930, hundreds of thousands of acres of land went into agricultural production. Historically, asparagus, corn, alfalfa, and sugar beets were the Delta's dominant crops. However, a wide variety of crops have been grown in the Delta. In 2008, the Delta's main crops were corn, alfalfa, tomatoes, and wine grapes (DWR 2009).

[1] Throughout this document, water year types are defined according to the Sacramento Valley Index Water Year Hydrologic Classification unless specified otherwise.

Table 10-1. California Water Balance Summary for Wet, Above-Normal, and Dry Years

Category	State Summary (MAF)			Sacramento River (TAF)			San Joaquin River (TAF)		
	1998 (171%)[1]	**2000 (97%)[1]**	**2001 (72%)[1]**	**1998 (168%)[1]**	**2000 (105%)[1]**	**2001 (67%)[1]**	**1998 (171%)[1]**	**2000 (97%)[1]**	**2001 (72%)[1]**
Total Supply (Precipitation and Imports)	336.9	194.7	145.5	90,351	58,217	36,564	40,727	28,497	20,010
Total Uses, Outflows, and Evaporation	331.1	200.5	159.8	86,859	59,469	40,124	38,922	28,527	22,707
Net Storage Changes in State	**5.8**	**-5.8**	**-14.3**	**3,492**	**-1,252**	**-3,560**	**1,805**	**-30**	**-2,697**
Distribution of Dedicated Supply (Includes Reuse) to Various Applied Water Uses									
Urban Uses	7.8	8.9	8.6	727.3	859.6	877.2	562.5	594.0	622.8
	(8%)	(11%)	(13%)	(3%)	(4%)	(5%)	(5%)	(5%)	(6%)
Agricultural Uses	27.3	34.2	33.7	6,458.2	8,713.9	8,567.1	5,458.1	7,034.1	7,154.2
	(29%)	(41%)	(52%)	(27%)	(38%)	(45%)	(47%)	(57%)	(67%)
Environmental Water [2]	59.4	39.4	22.5	16,397.8	13.487.6	9,587.7	5,604.5	4,637.1	2.930.1
	(63%)	(48%)	(35%)	(70%)	(58%)	(50%)	(48%)	(38%)	(27%)
Total Dedicated Supply	**94.5**	**82.5**	**64.8**	**23,583.3**	**23,061.1**	**19,032.0**	**11,625.1**	**12,265.2**	**10,707.1**

Source: DWR and Reclamation 2006

Notes:

[1] Percentage of normal precipitation. Water year 1998 was classified as a wet water year; 2000 was an above-normal water year; 2001 was a dry water year.

[2] Environmental water includes instream flows, wild and scenic river flows, required Delta outflow, and managed wetlands water use. Some environmental water is reused by agricultural and urban water users.

Key:

% = percent

DWR = California Department of Water Resources

MAF = million acre-feet

Reclamation = U.S. Department of Interior, Bureau of Reclamation

TAF = thousand acre-feet

CVP/SWP Service Areas

The CVP is the largest water storage and delivery system in California, covering 29 of the State of California's (State) 58 counties. Operated by Reclamation, the CVP consists of 21 reservoirs capable of storing 12 million acre-feet (MAF) of water, 11 powerplants, 500 miles of major canals and aqueducts, and many tunnels, conduits, and power transmission lines. The CVP irrigates about 3.25 million acres of farmland and supplies water to more than 2 million people through more than 250 water districts, individuals, and companies through water service contracts, Sacramento River water rights, and San Joaquin River exchange contracts. Most of the CVP service area is inside the Central Valley. About 90 percent of the south-of-Delta contractual delivery is for agricultural uses (Reclamation 2007).

The CVP plays a key role in California's economy, providing water for 6 of the top 10 agricultural counties in the nation's top farming state. The CVP provides about 5 MAF of water for farms, which is enough to irrigate about 3 million acres, or approximately one-third of the agricultural land in California (Reclamation 2009).

Most of the population of the CVP service area is concentrated in urban areas. The CVP service area includes various municipal and industrial water contractors and water districts that serve portions of the Sacramento and Stockton metropolitan areas and the San Francisco Bay Area (Reclamation 2007).

Outside of the fast-growing population centers, most of the CVP service area is rural, with irrigated agriculture being the predominant land use and driver of the local and regional economies (Reclamation 2007). As California's population continues to grow at a notable pace, water and power supplies have become more scarce and expensive; as a result, existing supplies have become more valuable.

Through contracts with 29 water agencies, the SWP provides water to Butte, Solano, Kings, and Kern counties in the Central Valley; to several Southern California counties; to Alameda and Santa Clara counties in the south San Francisco Bay Area; and to Napa and Solano counties in the north San Francisco Bay Area. In addition, the SWP provides water rights deliveries to water rights holders along the Feather River (Butte and Plumas counties). Of the total water delivered throughout California, the SWP provides water to about 600,000 acres of farmland. The SWP supplies about 10 percent of the total agricultural water used in the extended study area (DWR 2011).

Local surface water supplies (those not delivered by either the CVP or SWP) provide about 40 percent of all agricultural water used in the extended study area. More local surface water supplies are available on the east side of the valley because of the larger amount of precipitation in the Sierra Nevada. Locally owned water projects are especially important on the Yuba, Stanislaus,

Tuolumne, Kings, and Merced rivers; but local sources on the west side, such as the Federal Solano Project, also are important.

As surface water flows through the San Joaquin Valley, numerous turnouts convey the water to farmland within the service areas of the SWP and CVP. The remaining water conveyed by the California Aqueduct is delivered to Southern California, home to about two-thirds of California's population (DWR 2011).

Groundwater provides an important supply of water for agriculture in normal years and often is used to reduce or eliminate shortages of surface water supplies during drought years. On average, groundwater provides about 20 percent of the total agricultural water used in the extended study area. Declining groundwater tables, subsidence, and loss of aquifer storage continue to be costly problems, particularly in the western and southern parts of the San Joaquin River region and the San Francisco Bay region, where less surface water is available.

10.1.2 Important Farmland

Important Farmland is classified by the California Department of Conservation (DOC) as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance (see Section 10.2, "Regulatory Framework," for further discussion). The following discussion of Important Farmland is derived from DOC's *California Farmland Conversion Report 2006–2008*, published in January 2011 (DOC 2011).

In 2008, DOC estimated that California had approximately 31.6 million acres of agricultural land, of which approximately 12.4 million acres were identified as Important Farmland and 19.2 million acres were identified as Grazing Land. During the 12 biennial reporting cycles since DOC's Farmland Mapping and Monitoring Program (FMMP) was established, more than 1.3 million acres of agricultural land in California have been converted to nonagricultural purposes.

Losses of irrigated farmland (Prime Farmland, Farmland of Statewide Importance, and Unique Farmland) have accelerated, as shown in updates to Important Farmland maps. Irrigated farmland decreased by 203,000 acres in 2008, a 30 percent greater decrease than in 2006. Idling of irrigated farmland became a major factor in 2008, exceeding the effect of urbanization for the first time in FMMP history. Losses of irrigated farmland have resulted in part from two factors: (1) drought-related reductions in water supply and (2) reclassification to Grazing Land or Farmland of Local Importance of those lands left idle for three or more update cycles, some of which may have been idled in anticipation of development.

Urban development decreased by 29 percent relative to the 2004–2006 period and the 2008 urbanization rate was the lowest rate recorded since the late 1990s. Nonetheless, between 2006 and 2008, 72,300 acres of agricultural land in the State were lost to urbanization, with irrigated farmland making up 20,400 acres,

or 28 percent of all new urban land. Housing developments were the most frequent and largest category of newly urbanized land. The increase was associated mostly with construction of single-family homes at the periphery of existing cities, and to a lesser degree, with construction of apartment complexes. Retail and commercial developments and community infrastructure supporting new residential development also contributed substantially to urbanization.

The vast majority of the Important Farmland in California is located in the Central Valley, fed by the Sacramento and San Joaquin rivers and their tributaries.

Shasta Lake and Vicinity

According to the Shasta County Important Farmland map, published by DOC's Division of Land Resource Protection, no lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated as Important Farmland (Figure 10-1).

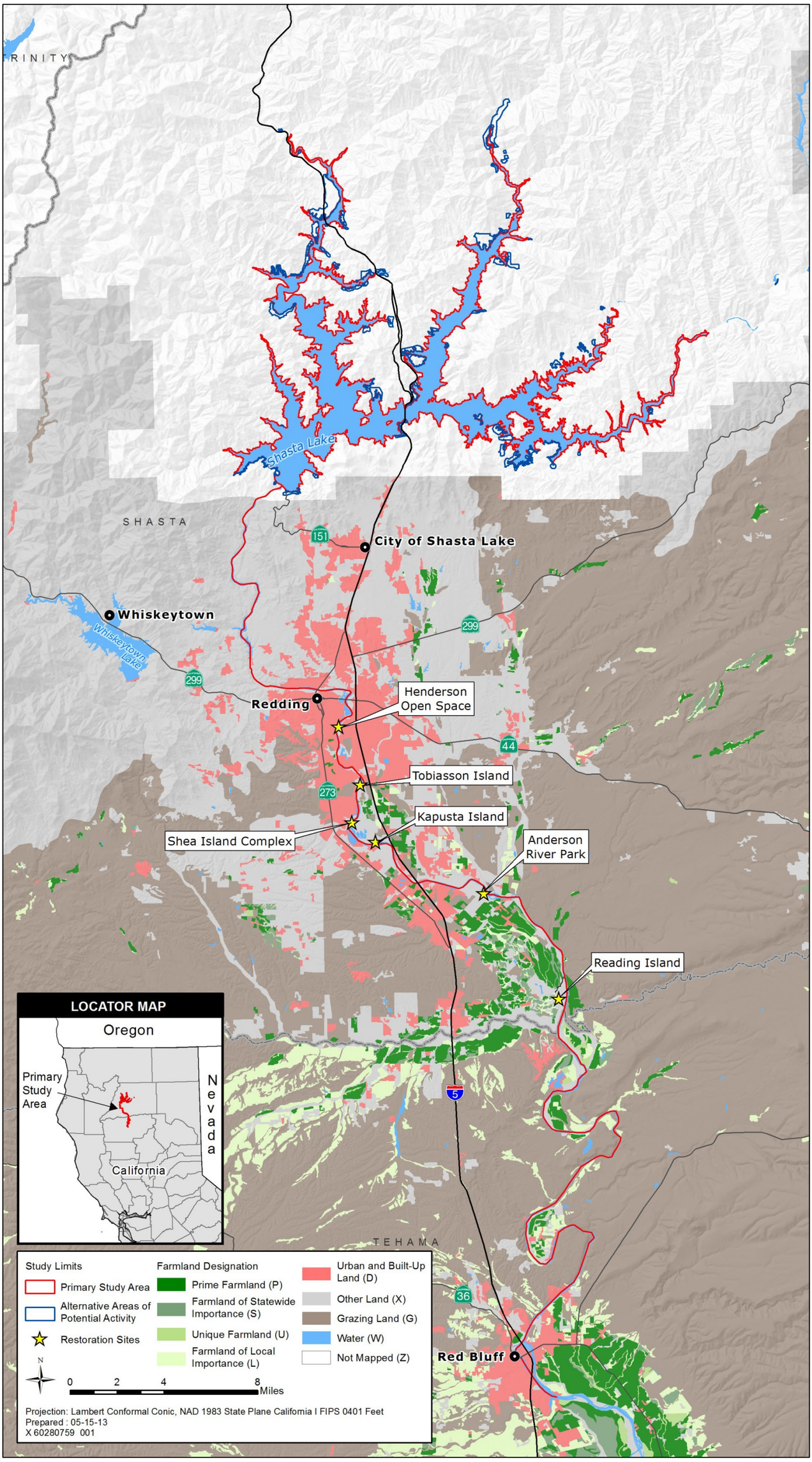

Figure 10-1. Important Farmland in the Primary Study Area

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Upper Sacramento River (Shasta Dam to Red Bluff)

The majority of Important Farmland in the primary study area is clustered in the former floodplain of the Sacramento River. As of 2008, Shasta County had 22,191 acres and Tehama County had 230,932 acres of Important Farmland (Table 10-2). The potential restoration and gravel augmentation sites described as part of CP4, CP4A, and CP5 are not located on Important Farmland.

Table 10-2. Acreage of Important Farmland in Shasta and Tehama Counties

Important Farmland Category	Shasta County	Tehama County	Total
Prime Farmland	12,290	63,037	75,327
Farmland of Statewide Importance	3,288	17,232	20,520
Unique Farmland	510	18,055	18,565
Farmland of Local Importance	6,103	132,608	138,711
Total	**22,191**	**230,932**	**253,123**

Source: DOC 2011

Key:
DOC = California Department of Conservation

According to the Important Farmland maps for Shasta and Tehama counties, the primary study area includes 432 acres of Important Farmland. Of this total, 90 acres are located in Shasta County and 342 acres are located in Tehama County (Table 10-3).

Table 10-3. Acreage of Important Farmland in Portions of Shasta and Tehama Counties Within the Primary Study Area

Important Farmland Category	Shasta County	Tehama County	Total
Prime Farmland	69	30	99
Farmland of Statewide Importance	8	–	8
Unique Farmland	8	38	46
Farmland of Local Importance	5	274	279
Total	**90**	**342**	**432**

Source: DOC 2010a

Key:
DOC = California Department of Conservation

Lower Sacramento River and Delta

Urbanization in the Sacramento Valley between 2006 and 2008 resulted in a decrease of 5,300 acres of irrigated farmland, which accounted for 33 percent of the statewide net decrease. Housing was the largest component of new urban acreage in the lower Sacramento River portion of the extended study area. Most of the increase was associated with single-family homes located at the periphery of existing cities, retail and commercial developments, and community

infrastructure supporting new residential development. It is anticipated that current and future population growth will increase the demand for developable land, particularly near the Bay Area, Stockton, and Sacramento. This demand results in the conversion of open space, primarily agricultural land, to residential and commercial uses.

Overall, the Sacramento Valley saw the largest drop in urbanization between 2006 and 2008—63 percent—with a rate that fell below that of the San Francisco Bay Area for the first time since 2002. Much of this decrease was caused by the slowdown in Sacramento County's growth between the two updates. While urbanization in the Sacramento Valley dropped substantially, ecological restoration remained a factor. Most wetland restoration projects in the region were adjacent to existing wildlife refuges and river channels.

Other factors besides conversion to urban or other land uses (e.g., habitat restoration) also affect the acreage of irrigated farmland. Regionally, complex factors related to availability of surface and groundwater supplies, crop markets, and anticipation of urban development affect the acreage of irrigated farmland. More locally, changes in annual water supplies, drainage, access, and compatibility with adjacent land uses also affect the productivity and value, and thus use, of agricultural land. Potential conflicts of adjacent land uses with agricultural production include traffic, vandalism, dumping, and provision of habitat for pest organisms (EDAW 2006; Sokolow et al. 2010).

The periphery of the Delta is undergoing rapid urbanization associated with substantial population growth. In 2008, declines of irrigated farmland in the Delta occurred primarily in Contra Costa and Solano counties, as each lost more than 4,100 acres of irrigated land during the update. Urbanization accounted for more than half the decrease in Contra Costa County, while Solano County was affected by restoration projects in the south county (Liberty Island area) and land idling near Vacaville. Between 2000 and 2008, about 75,000 acres of agricultural land in the Delta were converted to urban and conservation uses. As of 2008, approximately 550,100 acres of Important Farmland were located in the Delta.

CVP/SWP Service Areas

Declines in Important Farmland in the CVP/SWP service areas have been similar to those discussed above for the lower Sacramento River and Delta. Urbanization was responsible for 77 percent (55,670 acres) of the total losses of Important Farmland in the CVP/SWP service areas between 2006 and 2008. Twenty-one percent of the newly developed land in the CVP/SWP service areas was located in Riverside County alone. Southern California led all regions with 50 percent of the developed acres, while the San Joaquin Valley ranked second at 27 percent of the total. Overall, both regions showed a decline in urbanization relative to the 2004–2006 period. Southern California's decrease was larger—24 percent compared to the 17-percent drop in urbanization in the San Joaquin Valley.

In addition, the San Joaquin Valley lost 66 percent of its irrigated farmland to long-term land idling in Fresno, Kings, and Kern counties. The Fresno County decrease—more than 56,000 acres—was particularly notable and is associated with salinity and drought-related land retirement on the west side of the valley.

10.1.3 Williamson Act

As of January 1, 2008, 16.6 million acres were enrolled under the Williamson Act statewide. (Figure 10-2 shows Williamson Act lands in the primary study area.) This represents approximately half of California's farmland and nearly one-third of its privately owned land. The nonrenewal process is the most common mechanism for terminating Williamson Act contracts. Nonrenewal trends may be seen as an indicator of likely farmland conversion in particular locations. Statewide, nonrenewal initiations have increased each year since 2001 and reached a new high in 2007, with the San Joaquin Valley accounting for the largest increase in nonrenewal initiations. Overall, a total of 520,550 acres of contracted land was at some stage of the nonrenewal process in 2008 (DOC 2009, 2010b).

10.1.4 Forest Land

Forest land is defined as native tree cover greater than 10 percent that allows for management of timber, aesthetics, fish and wildlife, recreation, and other public benefits (California Public Resources Code (PRC) Section 12220(g)). Natural forest and woodland vegetation types in the study area typically have greater than 10 percent cover by native trees. (Figures 12-2a through 12-2f in Chapter 12, "Botanical Resources and Wetlands," display the distribution of natural forest and woodland vegetation.)

Forests serve as high-quality habitat for fish and wildlife species, sequester carbon to mitigate effects of climate change, capture vital runoff for agricultural and domestic water supply, and provide a variety of outdoor recreation and education opportunities. Many rural communities depend on income and employment opportunities that result from working timber industries or on amenity values to attract new residents seeking a better lifestyle. In metropolitan areas, urban forests contribute to improved air quality, cooling of heat islands for energy conservation, and local employment (Cal Fire 2010).

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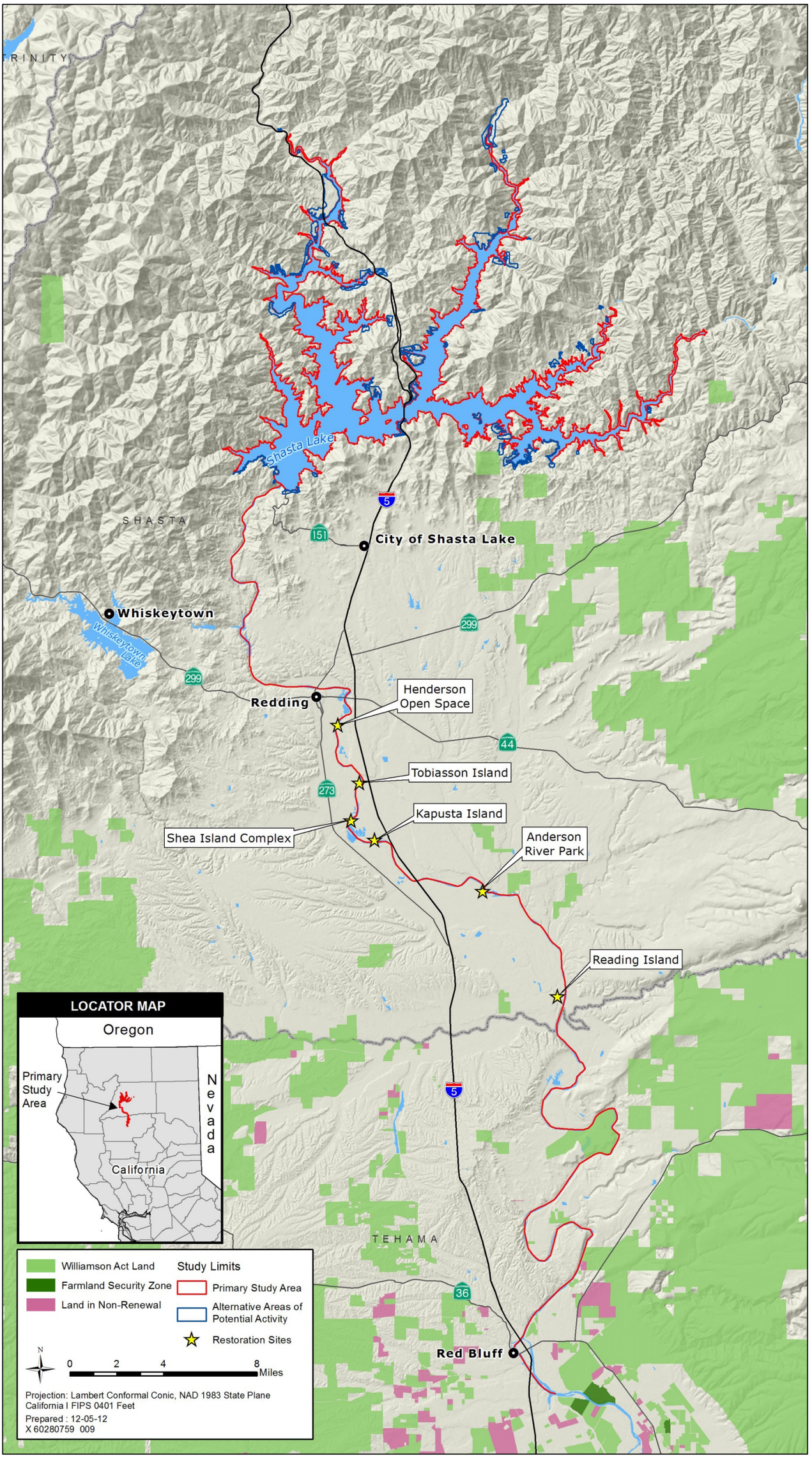

Figure 10-2. Williamson Act Lands in the Primary Study Area

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Shasta Lake and Vicinity

The study area for forest resources in the Shasta Lake and vicinity portion of the primary study area consists of the *impoundment areas* and the *relocation areas*. The impoundment areas are the areas that would be subject to inundation by the five arms and Main Body of Shasta Lake under the proposed dam enlargement scenarios. The relocation areas are those areas proposed as relocation sites for roadways, bridges, utilities, marinas, and campgrounds that could be inundated after the enlargement of Shasta Dam, as well as proposed dike locations.

The impoundment areas and relocation areas are characterized by a variety of forest lands typical of transitional mixed woodland and low-elevation forests: blue oak woodland, Brewer's oak, California black oak forest, canyon live oak forest, Fremont cottonwood forest, ghost pine woodland, interior live oak woodland, knobcone pine forest, Oregon white oak woodland, ponderosa pine-Douglas fir forest, ponderosa pine forest, and valley oak woodland (see Figures 12-2a through 12-2f and Table 12-1 in Chapter 12, "Botanical Resources and Wetlands"). As discussed in Chapter 12, "Botanical Resources and Wetlands," approximately 4,675 acres of forest land in the impoundment areas and relocation areas could potentially be affected by the alternatives (Table 10-4).

The exact combination of vegetation varies, with dramatic changes often occurring in relation to aspect, slope, geologic substrate, or juxtaposition with other habitats.

Table 10-4. Maximum Amount of Forest Land in the Impoundment and Relocation Areas

Forest Land	Area (Acres)
Blue oak woodland	11
Brewer oak scrub	151
California black oak forest	663
Canyon live oak forest	408
Fremont cottonwood forest	<1
Ghost pine woodland	456
Interior live oak woodland	6
Knobcone pine forest	293
Oregon white oak woodland	8
Ponderosa pine-Douglas fir forest	502
Ponderosa pine forest	2,176
Valley oak woodland	1
Total	**4,675**

Key:
< = less than

Upper Sacramento River (Shasta Dam to Red Bluff)

Forest land in the upper Sacramento River portion of the primary study area consists of riparian forest and oak woodland and savanna. Oak woodlands present in the primary study area include blue oak woodland, blue oak savanna,

foothill pine-oak woodland, and valley oak woodland. Much of the Sacramento River from Shasta Dam to Redding is deeply entrenched in bedrock, which precludes development of extensive areas of riparian vegetation. The river corridor between Redding and Red Bluff, however, still maintains extensive areas of riparian forest communities.

Riparian plant communities present in the primary study area are located within the floodplain of the Sacramento River. These communities include Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, and Great Valley valley oak riparian forest. Cottonwood- and willow-dominated riparian forest and woodland are present along active channels and on the lower flood terraces, whereas valley oak-dominated communities occur on higher flood terraces. In general, only narrow remnants of these riparian forests remain, often because levees are located close to river channels and the remaining riparian forest habitat is primarily confined to levee slopes. Riparian vegetation exists at Reading Island and some of the potential gravel augmentation sites.

Lower Sacramento River and Delta

Almost all of the forest land in the lower Sacramento River and Delta consists of riparian forests, including cottonwood-willow woodland and Valley oak riparian woodland. These areas are typically found in the lower Sacramento River and Delta as long, linear patches bordering waterways and agricultural or urban land. Riparian vegetation is most extensive on the water side of levees, but patches of riparian vegetation are also found on the interior of Delta islands along levee toes; along drainage channels; along pond margins; and in abandoned, low-lying fields. Forest land in riparian areas is managed primarily for habitat and water quality values, and to a lesser extent for recreation and other public benefits.

CVP/SWP Service Areas

Forest resources in the CVP/SWP service areas are similar to those discussed above for the upper Sacramento River and the lower Sacramento River and Delta. Agricultural and urban land uses have substantially reduced the area and connectivity of forest land in the CVP/SWP service areas. The region’s natural landscape changed substantially in the late 1800s and early 1900s as land uses were converted to agriculture. In Southern California, however, the land use pattern shifted more dramatically than in the Central Valley, as urban growth in the region that started in the 1900s began to convert large areas of forest land to developed land uses.

10.2 Regulatory Framework

10.2.1 Federal

Farmland Protection Policy Act

The Farmland Protection Policy Act is intended to minimize the effect of Federal programs with respect to the conversion of farmland to nonagricultural uses. It ensures that, to the extent possible, Federal programs are administered to be compatible with State, local, and private programs and policies to protect farmland. The U.S. Natural Resources Conservation Service (NRCS), part of the U.S. Department of Agriculture, is the agency primarily responsible for implementing the Farmland Protection Policy Act.

The Farmland Protection Policy Act established the Farmland Protection Program and the Land Evaluation and Site Assessment system. The Farmland Protection Program, a voluntary program administered by NRCS, provides funds to help purchase development rights to keep productive farmland in agricultural uses. The program provides matching funds to State, local, and tribal entities and nongovernmental organizations with existing farmland protection programs to purchase conservation easements. Participating landowners agree not to convert the land to nonagricultural uses and retain all rights to the property for future agriculture. A minimum 30-year term is required for conservation easements, and priority is given to applications with perpetual easements. NRCS provides up to 50 percent of the fair market value of the easement (NRCS 2006).

The Land Evaluation and Site Assessment system is a tool used to rank lands for suitability and inclusion in the Farmland Protection Program. The Land Evaluation and Site Assessment evaluates several factors: soil potential for agriculture, climate, location, market access, and adjacent land use. These factors are used to numerically rank land parcels based on local resource evaluation and site considerations (NRCS 2006).

10.2.2 State

California Important Farmland Inventory System and Farmland Mapping and Monitoring Program

DOC's Office of Land Conservation maintains a statewide inventory of farmlands, which are mapped by the DOC Division of Land Resource Protection as part of the FMMP. The FMMP was established by the State in 1982 to continue the Important Farmland mapping efforts begun in 1975 by the U.S. Soil Conservation Service (now called NRCS). The intent of the U.S. Soil Conservation Service was to produce agricultural-resource maps based on soil quality and land use across the nation. DOC sponsors the FMMP and is also responsible for establishing agricultural easements in accordance with PRC Sections 10250-10255. The maps are updated every 2 years with the use of

aerial photographs, a computer mapping system, public review, and field reconnaissance.

As part of the nationwide effort to map agricultural land uses, the U.S. Soil Conservation Service/NRCS developed a series of definitions known as Land Inventory and Monitoring criteria. These criteria classify the land's suitability for agricultural production. Suitability includes both the physical and chemical characteristics of soils and the actual land use. Important Farmland maps are derived from NRCS soil survey maps using the Land Inventory and Monitoring criteria and are available by county. The maps prepared by NRCS classify land into one of eight categories, defined as follows (DOC 2011):

- **Prime Farmland** – Land that has the best combination of physical and chemical characteristics for crop production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed.

- **Farmland of Statewide Importance** – Land other than Prime Farmland that has a good combination of physical and chemical characteristics for crop production. This land has minor shortcomings, such as greater slopes or less ability to store soil moisture than Prime Farmland.

- **Unique Farmland** – Land that does not meet the criteria for Prime Farmland or Farmland of Statewide Importance, but that has been used for the production of specific crops with high economic value. This land is usually irrigated, but may include nonirrigated orchards or vineyards as found in some climatic zones in California.

- **Farmland of Local Importance** – Land that either is currently producing crops or has the capability of production, but does not meet the criteria of the categories above. Farmland of Local Importance is defined by each county's local advisory committee and adopted by its board of supervisors.

- **Grazing Land** – Land on which the vegetation is suited to the grazing of livestock. The minimum mapping unit for Grazing Land is 40 acres.

- **Urban and Built-up Lands** – Land occupied by structures with a density of at least one dwelling unit per 1.5 acres.

- **Land Committed to Nonagricultural Use** – Vacant areas; existing lands that have a permanent commitment to development but have an existing land use of agricultural or grazing lands.

- **Other Lands** – Land that does not meet the criteria of the remaining categories. This optional designation allows local governments to provide detail on the nature of changes expected to occur in the future.

Important Farmland is classified by DOC as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance. The total acreages of Urban and Built-up Lands and Other Lands are calculated by DOC and are defined by DOC as agricultural land.

The designations for Prime Farmland, Farmland of Statewide Importance, Unique Farmland, and Farmland of Local Importance are defined together under the terms "Agricultural Land" and "Important Farmland" in CEQA (PRC Sections 21060.1 and 21095) and Appendix G of the State CEQA Guidelines. The conversion of these types of farmland could be considered an environmental impact.

Williamson Act Contracts

The California Land Conservation Act of 1965, commonly known as the Williamson Act, is the principal method for encouraging the preservation of agricultural lands in California. The Williamson Act enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open-space use for 10 years. In return, landowners receive property tax assessments that are based on farming and open-space uses as opposed to full market value. Local governments receive an annual subvention (subsidy) of forgone property tax revenues from the State via the Open Space Subvention Act of 1971.

The Williamson Act empowers local governments to establish "agricultural preserves" consisting of lands devoted to agricultural uses and other uses that are compatible with agriculture. Upon establishing such a preserve, the locality may offer to the owner of included agricultural land the opportunity to enter into an annually renewable contract that restricts the land to agricultural use for at least 10 years. (The contract continues to run for 10 years after the first date upon which the contract is not renewed.) In return, the landowner is guaranteed a relatively stable tax base, founded on the value of the land for agricultural/open space use only and unaffected by its development potential.

Canceling a Williamson Act contract involves an extensive review and approval process, in addition to payment of fees of up to 12.5 percent of the property value. The local jurisdiction approving the cancellation must find that the cancellation is consistent with the purpose of the California Land Conservation Act or is in the public interest. Several subfindings must be made to support either finding, as defined in Section 51282 of the California Government Code.

Farmland Security Zones

Farmland Security Zones (FSZ), also known as Super Williamson Act lands, were established by DOC with the same general intent as Williamson Act

contracts. Agricultural landowners in FSZs may enter into contracts with the county for 20-year increments, with an additional 35 percent tax benefit over and above the standard Williamson Act contract. The FSZ program has been adopted by 25 counties, although not all of those counties have executed contracts. FSZ contracts constitute nearly 2 percent of statewide Williamson Act enrollment.

An FSZ must be located in an agricultural preserve (area designated as eligible for a Williamson Act contract) and designated as Prime Farmland, Farmland of Statewide Importance, Unique Farmland, or Farmland of Local Importance. Land protected in an FSZ cannot be annexed by a city or county government or school district.

An FSZ contract can be terminated through a nonrenewal or cancellation. The nonrenewal allows a rollout process to occur over the remainder of the term of the contract, when the tax rates would gradually rise to the full rate by the end of the 20-year term. A cancellation must be applied for and approved by the DOC director and must meet specific criteria. The cancellation must be in the public interest and consistent with Williamson Act criteria. If a cancellation is approved, fees equal to 25 percent of the full market value of the property must be paid.

Agricultural Water Management Plans

By the end of 2004, 62 water districts, 3 environmental interest groups, and more than 53 other interested groups had signed the Agricultural Water Management Memorandum of Understanding as members of the Agricultural Water Management Council. The agricultural signatories represent more than 4.75 million acres of irrigated agricultural land statewide.

In 2004, the council endorsed an additional three agricultural water management plans that had been submitted by agricultural water suppliers to the council. These plans have since become the basis for the districts' water conservation efforts. The districts with endorsed agricultural water management plans are expected to prepare and submit a biannual progress report to the Agricultural Water Management Council, starting from the date their plan was endorsed. DWR staff members provide technical review and evaluation of these plans. DWR also reviewed two biannual progress reports for the council. DWR staff also provided technical assistance to water districts to prepare water management plans and helped implement efficient water management practices, as well as administrative and programmatic assistance to both the Agricultural Water Management Council and water districts.

1992 Delta Protection Act

The 1992 Delta Protection Act identified the Delta as a natural resource of statewide significance, formalized the State's commitment to preserve its diverse values, and established the Delta Protection Commission. The purpose of the Delta Protection Act is to ensure protection, maintenance, and

enhancement of the Delta environment; ensure orderly and balanced use of Delta land resources; and improve flood protection to increase public health and safety. The Delta Protection Commission has planning jurisdiction over portions of five counties: Contra Costa, Sacramento, San Joaquin, Solano, and Yolo.

In Section 29703a of the Delta Protection Act, the Delta Primary Zone is designated as an area for protection from intrusion of nonagricultural uses. In 1995, the Delta Protection Commission adopted its regional plan, *Land Use and Resource Management Plan for the Primary Zone of the Delta* (also known as the Delta Plan). The current Delta Plan was approved by the California Office of Administrative Law on October 7, 2010, and became effective November 6, 2010. Policies in the Delta Plan are developed to project the conversion of agricultural resources. Policy P-2 states that conversion of land to non-agriculturally oriented uses should occur first where productivity and agricultural values are lowest. Policy P-6 encourages acquiring agricultural conservation easements from willing sellers as mitigation for projects within each county. Use of environmental mitigation is to be promoted in agricultural areas only when it is consistent and compatible with ongoing agricultural operations and when developed in appropriate locations designated on a countywide or Deltawide habitat management plan (DPC 2010).

10.2.3 Regional and Local

Shasta and Tehama Counties

The general plans of Shasta and Tehama counties contain goals, policies, and implementation measures to protect agricultural lands, as summarized below.

Shasta County General Plan The *Shasta County General Plan* (Shasta County 2004) identifies goals, policies, and implementation measures aimed at conserving large contiguous areas of productive agricultural land, providing opportunities for the future expansion of such uses, and protecting them from development pressures that would adversely affect or hinder existing or future agricultural operations. This includes the objective to protect water resources and supply systems vital for the continuation of agriculture.

Tehama County General Plan The *Tehama County General Plan* (2009) encourages and supports agriculture and forest resources in Tehama County. The policies are within the Agriculture and Timber Element of the general plan and divided into the Land Use, Open Space and Conservation, and Economic Development elements to aid in implementation of the general plan, but focus on agriculture nonetheless.

Other

Sacramento River Conservation Area The Sacramento River Conservation Area seeks to promote the reestablishment of the 100-year floodplain along the Sacramento River. In 1986, the California Legislature passed Senate Bill 1086, which called for a management plan for the Sacramento River that would help

restore, protect, and enhance the riparian and aquatic habitat. After much debate, the *Upper Sacramento River Fisheries and Riparian Habitat Management Plan* was developed (Resources Agency 1989). This plan called for fish bypass structures on the Sacramento River and its tributaries, as well as the Shasta Dam temperature control structure. After implementation of these projects began, the advisory council reconvened to complete additional work. This effort led to the *Sacramento River Conservation Area Handbook* (Resources Agency 2003), which would guide riparian habitat management along the river. In 1999, a memorandum of agreement was signed by most entities involved in management activities along the river. The U.S. Bureau of Land Management has acquired roughly 15,000 acres of riparian lands along the Sacramento River.

10.3 Environmental Consequences and Mitigation Measures

10.3.1 Methods and Assumptions

Implementation of the project would result in construction-related, maintenance-related, and operational impacts that could substantially affect agricultural and forest resources. This analysis evaluates potential construction-related and operational activities that could directly or indirectly affect existing agricultural and forest resources in the primary study area. Indirect impacts on the extended study area could result from alteration of flow regimes downstream from Shasta Lake and downstream from other reservoirs with altered operations, as well as increased inundation width of the Sacramento River during the growing season. In addition, water supply reliability in the CVP/SWP service areas could increase, which in turn could reduce limitations on growth and increase development that could adversely affect agricultural and forest resources.

Evaluation of the project's potential impacts on agricultural resources was based on a review of the planning documents pertaining to the study area, including goals and policies from the general plans of Shasta and Tehama counties. DOC's Important Farmland and Williamson Act maps were used to determine the agricultural significance of the lands in the primary study area. In addition, the results of CalSim-II simulations were reviewed to assess changes in flow regime in the primary and extended study areas.

Forest land that could be inundated or otherwise affected by implementation of any of the action alternatives was determined from vegetation mapping as described in Chapter 12, "Botanical Resources and Wetlands." These forest lands consist of blue oak-foothill pine, blue oak, and closed-cone pine-cypress woodlands; and Douglas-fir, montane hardwood, montane hardwood-conifer, montane riparian, Ponderosa pine, and valley-foothill riparian forests. The following analysis summarizes information provided in Chapter 12, "Botanical Resources and Wetlands," as it relates to the potential conversion of forest land to nonforest uses.

10.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. Under NEPA, the significance of an effect is used solely to determine whether an EIS must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A "[s]ignificant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

The following significance criteria were developed based on guidance provided by the State CEQA Guidelines, and consider the context and intensity of the environmental effects as required under NEPA. Impacts of an alternative on agriculture and Important Farmland would be significant if project implementation would do any of the following:

- Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the FMMP of the Resources Agency, to nonagricultural use
- Conflict with existing zoning for agricultural use, or a Williamson Act contract
- Conflict with existing zoning for, or cause rezoning of, forest land (as defined in PRC Section 12220(g)), timberland (as defined in PRC Section 4526), or timberland zoned Timberland Production (as defined in PRC Section 51104(g))
- Result in the loss of forest land or conversion of forest land to nonforest use
- Involve other changes in the existing environment that, because of their location or nature, could result in conversion of farmland, to nonagricultural use or the conversion of forest land to nonforest use

10.3.3 Topics Eliminated from Further Consideration

None of the lands in the primary study area are zoned as forest land, timberland, or timberland zoned Timberland Production by the *Shasta County General Plan* (2004) or *Tehama County General Plan* (2009). Increasing water supply reliability within the lower Sacramento River to the Delta and within the CVP/SWP service areas would not conflict with existing zoning or directly result in the rezoning of forest land, timberland, or timberland zoned Timberland Production. Therefore, no effects related to conflicts with existing

zoning or causing rezoning of forest land are expected to occur in the study area. Potential effects related to this issue area are not discussed further in this EIS.

10.3.4 Direct and Indirect Effects

No-Action Alternative

Under the No-Action Alternative, the existing Shasta Dam would be operated in the same manner as under current operations. Shasta Dam would not be enlarged and no infrastructure would be removed, modified, or relocated. Changes to the reservoir flow regime caused by changes in demand and other factors would be small, with a reduction in Shasta Lake storage of 2–4 percent during the fall of some years. Shasta Lake storage under the No-Action Alternative would be within -2 percent and 1 percent of existing Shasta Lake storage at most times.

Changes to the flow regime of the upper Sacramento River caused by changes in demand and other factors would be small under the No-Action Alternative; mean monthly flows in the Sacramento River would be within 5 percent of existing flows at most times. (Flows could increase by a greater amount during late summer and early fall of below-normal, dry, and critical years.)

In addition, Shasta Lake operations under the No-Action Alternative would not change the flow regime in the lower Sacramento River and Delta. If none of the project alternatives were implemented, CVP and SWP operations would likely continue under existing regulatory requirements. CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. Overall, CalSim-II modeling results suggest that only a very small decrease in flows greater than 15,000 cubic feet per second would occur.

Shasta Lake and Vicinity

Impact Ag-1 (No-Action): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No new facilities would be constructed at Shasta Lake and no operational changes would occur that would directly convert Important Farmland to nonagricultural uses or result in the cancellation of Williamson Act contracts in the vicinity of Shasta Lake. However, California's demand for water for irrigation and other uses is expected to continue to increase while the water supply will likely become less reliable. This trend could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts, resulting in an indirect impact. Therefore, this impact would be potentially significant.

Under the No-Action Alternative, Shasta Dam would not be enlarged; no infrastructure would be removed, modified, or relocated; and Reclamation's

Shasta operations would not change. Changes to the reservoir flow regime and reservoir storage caused by changes in demand and other factors would be small, and generally the same as under existing conditions at most times. Therefore, implementing the No-Action Alternative would not directly convert agricultural land to nonagricultural uses or result in the cancellation of Williamson Act contracts.

The demand for water for irrigation and other uses in California is expected to continue to increase in the future. At the same time, the water supply may become less reliable because of increasing environmental water requirements for special-status species, decreasing water quality, and climate change. Therefore, the No-Action Alternative could have an indirect, adverse impact on agricultural land uses and Important Farmland in the primary study area. Insufficient water supply, especially during drought periods, could indirectly lead to increased pressure on farmers to convert Important Farmland to other nonagricultural uses, or could cause land designated as Important Farmland to be fallowed. Additionally, the conversion of Important Farmland could involve cancellation or expiration of many Williamson Act contracts.

The magnitude and extent of the agricultural land that could be converted from changes in water supply is unknown; however, any loss of Important Farmland would be significant because there are no measures to fully mitigate the loss of Important Farmland. Based on a review of future demand projections used in CalSim-II modeling and estimated deliveries under the No-Action Alternative, this impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Impact Ag-2 (No-Action): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake No new facilities would be constructed at Shasta Lake and no operational changes would occur that would result in the direct or indirect conversion of forest land to nonforest uses. No impact would occur.

Under the No-Action Alternative, Shasta Dam would not be enlarged; no infrastructure would be removed, modified, or relocated; and Reclamation's Shasta operations would not change. Changes to the reservoir flow regime and reservoir storage caused by changes in demand and other factors would be small and generally the same as under existing conditions at most times. Therefore, the No-Action Alternative would not result in the direct or indirect conversion to nonforest uses of blue oak-foothill pine, blue oak, and closed-cone pine-cypress woodlands; Douglas-fir, montane hardwood, montane hardwood-conifer, montane riparian, Ponderosa pine, and valley-foothill riparian forests; or other forest land. No impact would occur. Mitigation is not required for the No-Action Alternative.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (No-Action): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Changes to the flow regime of the upper Sacramento River caused by changes in demand and other factors would be small under the No-Action Alternative; mean monthly flows in the Sacramento River would be within 5 percent of flows under existing conditions at most times. Implementing the No-Action Alternative would not directly convert Important Farmland to nonagricultural uses or result in the cancellation of Williamson Act contracts in the upper Sacramento River portion of the primary study area. However, California's demand for water for irrigation and other uses is expected to continue to increase while the water supply will likely become less reliable. This trend could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts, resulting in an indirect impact. Therefore, this impact would be potentially significant.

Changes to the flow regime of the upper Sacramento River resulting from changes in demand and other factors would be small under the No-Action Alternative; mean monthly flows in the Sacramento River would be within 5 percent of flows under existing conditions at most times. Therefore, implementing the No-Action Alternative would not directly convert agricultural land to nonagricultural uses or result in the cancellation of Williamson Act contacts.

California's demand for water for irrigation and other uses is expected to continue to increase in the future. At the same time, the water supply may become less reliable because of increasing environmental water requirements for special-status species, population growth that places further demands on existing water supply resources, decreasing water quality, and climate change. Therefore, the No-Action Alternative could have an indirect adverse impact on agricultural land uses and Important Farmland in the primary study area. Insufficient water supply, especially during drought periods, could indirectly lead to increased pressure on farmers to convert Important Farmland to other nonagricultural uses or cause land designated as Important Farmland to be fallowed. Additionally, conversion of Important Farmland could involve canceling many Williamson Act contracts or allowing such contracts to expire.

The magnitude and extent of the agricultural land that could be converted from changes in water supply is unknown; however, any loss of Important Farmland would be significant because there are no measures to fully mitigate the loss of Important Farmland. Based on a review of future demand projections used in CalSim-II modeling and estimated deliveries under the No-Action Alternative, this impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Impact Ag-4 (No-Action): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River No operational changes would occur that would directly convert forest land to nonforest uses along the upper Sacramento River. However, water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. The resulting changes in the flow regime would likely result in minimal adverse effects on riparian forest and oak woodland habitats. Furthermore, management and restoration plans and programs would implement actions that would largely offset those adverse effects. Therefore, this impact would be less than significant.

Under the No-Action Alternative, no changes in Reclamation's Shasta operations would occur that would directly convert riparian and oak woodland habitats along the upper Sacramento River to nonforest uses. However, water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. As a consequence of these actions, the flow regime of the upper Sacramento River would change between 2005 and 2030. As described in Chapter 12, "Botanical Resources and Wetlands," this change in flow regime would likely result in minimal adverse effects on forest land, which along the upper Sacramento River consist of riparian forest and oak woodlands, and these effects would not be sufficient to alter the extent of these forest lands.

As also discussed in Chapter 12, several management and restoration plans and programs would be implemented under the No-Action Alternative. These actions would cause beneficial effects likely to be of a magnitude similar to or greater than the anticipated adverse effects of small changes in flow regime; thus, implementation of the plans and programs would largely offset those adverse effects. Therefore, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (No-Action): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Changes to the flow regime of the lower Sacramento River, Delta, and CVP/SWP service areas caused by changes in demand and other factors would be small under the No-Action Alternative; mean monthly flows in the Sacramento River would be within 5 percent of flows under existing conditions at most times. Implementing the No-Action Alternative would not directly convert Important Farmland to nonagricultural uses or result in the cancellation of Williamson Act contracts along the lower Sacramento River, in the Delta, or in the CVP/SWP service areas. However, California's demand for water for irrigation and other uses is expected to continue to increase while the water supply will likely become less reliable. This trend could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts, resulting in an indirect impact. Therefore, this impact could be potentially significant.

This impact would be similar to Impact Ag-3 (No-Action) for the upper Sacramento River (Shasta Dam to Red Bluff). For the same reasons as described above for Impact Ag-3 (No-Action), this impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Impact Ag-6 (No-Action): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area No operational changes would occur under the No-Action Alternative that would directly convert forest land to nonforest uses in the extended study area. However, water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. The resulting changes in the flow regime would likely result in minimal adverse effects on forest land, which consists of riparian forest and oak woodlands along the lower Sacramento River and in the Delta. Management and restoration plans and programs would implement actions that would largely offset those adverse effects. Therefore, this impact would be less than significant.

This impact would be similar to Impact Ag-4 (No-Action) for the upper Sacramento River (Shasta Dam to Red Bluff). For the same reasons as described above for Impact Ag-4 (No-Action), this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

By increasing storage at Shasta Lake, this alternative would change the full pool elevation and seasonal pool elevations at Shasta Lake, and the flow regime downstream in the Sacramento River and potentially several other reservoirs and downstream waterways. By raising Shasta Dam 6.5 feet, CP1 would increase the height of the reservoir's full pool elevation by 8.5 feet, enlarge the total storage capacity in the reservoir by 256,000 acre-feet, and increase the reservoir's surface area at full pool by about 1,110 acres (4 percent). Areas at this elevation could be periodically inundated; existing facilities within the inundation zone would be relocated to higher areas to accommodate the periodic inundation. In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years.

Shasta Dam's operational guidelines would continue essentially unchanged, except during dry and critical years, when 70,000 acre-feet and 35,000 acre-feet, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. Implementing CP1 would help reduce estimated future agricultural water shortages in the CVP/SWP service areas by increasing water supplies for agricultural deliveries by at least 22,500 acre-feet per year in dry and critical years and increasing average annual deliveries by about 20,300 acre-feet per year.

Potential impacts of CP1 on the upper Sacramento River's flow and stages and on deliveries of water supplies to the CVP/SWP service areas would be small. On average, in each month, changes in mean monthly flow relative to existing (2005) and No-Action Alternative (2030) conditions would be reductions or increases of about 5 percent or less. Generally, the relative magnitude of effects on river flows diminishes with distance downstream because of the influence of inflows from tributaries and the effects of diversions and flood bypasses.

Shasta Lake and Vicinity

Impact Ag-1 (CP1): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. Therefore, inundation of land and removal, modification, or relocation of infrastructure under CP1 would not directly or indirectly convert agricultural land to nonagricultural uses or result in the cancellation of Williamson Act contacts. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP1): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP1 would result in the conversion of forest land to nonforest uses. This impact would be significant.

A total of 1,032 acres of forest land would be affected by inundation under CP1 (Table 10-5). Also, up to 844 acres of land in the relocation areas would be affected by removal, modification, relocation, or inundation of roadways, bridges, utilities, and campgrounds under CP1 (Table 10-6); most of this acreage would be converted from forest land to nonforest uses. This impact would be significant. Mitigation for this impact is not proposed in Section 10.3.5 because no feasible mitigation is available to reduce the impact to a less-than-significant level.

Table 10-5. Acreage of Forest Land that Would Be Affected by Inundation Under CP1

Forest Land	Area (Acres)
Blue oak–foothill pine	10
Blue oak woodland	1
Closed-cone pine–cypress	247
Douglas-fir	<1
Montane hardwood	190
Montane hardwood–conifer	239
Ponderosa pine	345
Total	**1,032**

Key:
< = less than
CP = Comprehensive Plan

Table 10-6. Maximum Acreage of Forest Land that Would Be Affected in Relocation Areas Under CP1–CP5

Forest Land	Area (Acres)
Blue oak–foothill pine	22
Blue oak woodland	5
Closed-cone pine–cypress	90
Douglas-fir	3
Montane hardwood	715
Montane hardwood–conifer	9
Ponderosa pine	<1
Total	**844**

Key:
< = less than
CP = Comprehensive Plan

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP1): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Agricultural lands in the upper Sacramento River portion of the primary study area, including Important Farmland and Williamson Act contract lands, could be inundated as a result of increases in mean monthly river flows. The flow increases that would occur in some years would generally be small (5 percent or less) and would affect areas periodically inundated under existing conditions or the No-Action Alternative. The effects of increased flows would diminish with distance downstream as tributary inflows, and the effects of diversions and flood bypasses, affect flows in the Sacramento River. CP1 also would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years.

Therefore, implementing CP1 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

Agricultural lands in the upper Sacramento River portion of the primary study area, including Important Farmland and Williamson Act contract lands, could be inundated or could undergo soil saturation as a result of project-related increases in mean monthly river flows. Based on CalSim-II model simulations, the flow increases that would occur in some years under CP1 would likely be small (5 percent or less) relative to existing (2005) and No-Action Alternative (2030) conditions. These increased flows would affect small areas periodically inundated under existing conditions or the No-Action Alternative. In addition, the effects would diminish with distance downstream because of the influence of inflows from tributaries and the effects of diversions and flood bypasses. As a result, implementing CP1 would not directly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts.

Implementing CP1 would increase the reliability of the water supply by increasing water supplies in the upper Sacramento River portion of the primary study area for irrigation purposes, primarily during dry and critical years. A substantial portion of this water would be used instead of groundwater, would allow for changes in agricultural irrigation practices, or would enable farmers to return idle cropland to production. Therefore, implementing CP1 would not indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts.

For the reasons described above, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP1): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP1 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future. However, changes in the flow regime would not reduce the extent of riparian forest. Therefore, implementing CP1 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

Forest land along the upper Sacramento River consists of riparian forest and oak woodlands. These habitats could be affected by changes in river flow and stage in some years. In most years, changes in mean monthly flow would be reductions or increases of 5 percent or less. The areas affected would be areas

periodically inundated under existing conditions and the No-Action Alternative. Generally, these effects diminish with distance downstream because of the influence of inflows from tributaries, and the effects of diversions and flood bypasses.

The altered flow regime of the upper Sacramento River associated with implementation of CP1 could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture. This effect would occur during years when mean monthly stage during March–October would differ from existing and No-Action Alternative conditions. Implementing CP1 could slightly increase the average elevation of the water surface in this zone (but would not increase the zone's elevation range). Because of the important influence of water availability and soil aeration on plant growth and survival, these changes have the potential to result in the loss of oak woodlands. These effects are unclear, however, and may not all prove to be adverse.

The flow regime of a river or stream strongly influences the structure and species composition of riparian forests. Implementing CP1 would not alter the general annual pattern of flows but would reduce the magnitude, duration, and frequency of intermediate and large flows. Reductions in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River; however, changes in the flow regime would not reduce the extent of riparian forest.

For the reasons described above, implementing CP1 would not result in the conversion of forest land to nonforest uses. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas
Impact Ag-5 (CP1): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Agricultural lands in the extended study area, including Important Farmland and Williamson Act contract lands, could be inundated or undergo soil saturation as a result of increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP1 also would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. Therefore, implementing CP1 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

Agricultural lands in the extended study area, including Important Farmland and Williamson Act contract lands, could experience more extensive inundation or

soil saturation during some months as a result of project-related increases in mean monthly river flows. However, these increased flows would affect areas periodically inundated or saturated under existing conditions and/or the No-Action Alternative. In addition, the effects of inundation would diminish with distance downstream because of the influence of inflows from tributaries and the effects of diversions and flood bypasses. As a result, the direct conversion of agricultural land to nonagricultural uses or cancellation of Williamson Act contacts is unlikely to be substantial.

During dry and critical years, 70,000 acre-feet and 35,000 acre-feet, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. Implementing CP1 would help reduce estimated future agricultural water shortages in the CVP/SWP service areas by increasing water supplies for agricultural deliveries by at least 22,500 acre-feet per year in dry and critical years and increasing average annual deliveries by about 20,300 acre-feet per year. The majority of increased dry and critical year water supplies would be for south-of-Delta agricultural deliveries. A substantial portion of this water would be used instead of groundwater, would allow for changes in agricultural irrigation practices, or would enable farmers to return idle cropland to production. Therefore, implementing CP1 would not indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts.

For the reasons described above, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP1): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP1 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future. However, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP1 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-4 (CP1) for the upper Sacramento River. For the same reasons as described above for Impact Ag-4 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

Like CP1, CP2 would increase storage at Shasta Lake, thus changing the reservoir's full pool elevation and seasonal pool elevations, and the flow regime in the Sacramento River and potentially several other reservoirs and downstream waterways.

By raising Shasta Dam 12.5 feet, CP2 would increase the reservoir's full pool elevation by 14.5 feet and enlarge its total storage capacity by 443,000 acre-feet. Raising the dam 12.5 feet would increase the reservoir's surface area at full pool by about 1,900 acres (6 percent). In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years.

Shasta Dam's operational guidelines would continue essentially unchanged, except during dry and critical years, when 120,000 acre-feet and 60,000 acre-feet, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. Implementing CP2 would help reduce estimated future agricultural water shortages in the CVP/SWP service areas by increasing water supplies for agricultural deliveries by at least 37,600 acre-feet per year in dry and critical years and increasing average annual deliveries by about 31,400 acre-feet per year.

In general, the proposed changes in flow and river stage on the upper Sacramento River associated with CP2 would be similar to but slightly greater than the changes associated with CP1, as outlined above.

Shasta Lake and Vicinity

Impact Ag-1 (CP2): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

This impact would be the same as Impact Ag-1 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP2): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP2 would result in the conversion of forest land to nonforest uses. This impact would be significant.

A total of 1,440 acres of forest land would be affected by inundation under CP2 (Table 10-7). Also, up to 844 acres of land in the relocation areas would be affected by removal, modification, relocation, or inundation of roadways, bridges, utilities, and campgrounds under CP2 (Table 10-6); most of this acreage would be converted from forest land to nonforest uses. This impact

would be significant. Mitigation for this impact is not proposed in Section 10.3.5 because no feasible mitigation is available to reduce the impact to a less-than-significant level.

Table 10-7. Acreage of Forest Land that Would Be Affected by Inundation Under CP2

Forest Land	Area (Acres)
Blue oak–foothill pine	15
Blue oak woodland	2
Closed-cone pine–cypress	343
Douglas-fir	<1
Montane hardwood	263
Montane hardwood–conifer	329
Ponderosa pine	488
Total	**1,440**

Key:
< = less than
CP = Comprehensive Plan

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP2): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Agricultural lands in the upper Sacramento River portion of the primary study area, including Important Farmland and Williamson Act contract lands, could be inundated as a result of increases in mean monthly river flows. The flow increases that would occur in some years would generally be small and would affect areas periodically inundated under existing conditions or the No-Action Alternative. The effects of increased flows would diminish with distance downstream. CP2 also would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. Therefore, implementing CP2 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to but slightly greater than Impact Ag-3 (CP1), because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP2): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP2 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect

oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future. However, changes in the flow regime would not reduce the extent of riparian forest. Therefore, implementing CP2 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to but slightly greater than Impact Ag-4 (CP1), because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas
Impact Ag-5 (CP2): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Agricultural lands in the extended study area, including Important Farmland and Williamson Act contract lands, could be inundated or undergo soil saturation as a result of increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP2 also would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. Therefore, implementing CP2 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to but slightly greater than Impact Ag-5 (CP1), because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. In addition, CP2 would include reserving more storage capacity in Shasta Reservoir to specifically focus on increasing M&I deliveries during dry and critical years and a greater volume of dry and critical year and average annual water supply for agricultural water deliveries for the CVP/SWP service areas. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP2): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP2 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River

in the future. However, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP2 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to but slightly greater than Impact Ag-6 (CP1), because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

Like both of the alternatives discussed above, CP3 would increase storage at Shasta Lake, thus changing the reservoir's full pool elevation and seasonal pool elevations and the flow regime in the Sacramento River and potentially several other reservoirs and downstream waterways.

By raising Shasta Dam 18.5 feet, CP3 would increase the reservoir's full pool elevation by 20.5 feet and enlarge its total storage capacity by 634,000 acre-feet. Raising the dam 18.5 feet would increase the reservoir's surface area at full pool by about 2,570 acres (9 percent). In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years.

Implementing CP3 would increase water supply reliability by increasing dry and critical year water supplies for CVP irrigation deliveries. None of the increased storage capacity in Shasta Reservoir would be reserved for increasing M&I deliveries. However, CP3 would help reduce estimated future water shortages for CVP agricultural water users by increasing the reliability of water supplies for agricultural deliveries by at least 70,600 acre-feet per year in dry and critical years and increasing average annual deliveries by about 62,200 acre-feet per year.

In general, the changes in flow and river stage on the upper Sacramento River associated with CP3 would be more substantial than the changes associated with CP1 and CP2. However, these anticipated changes would still be within a few percentage points of the changes associated with CP1 and CP2, as outlined above.

Shasta Lake and Vicinity

Impact Ag-1 (CP3): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

This impact would be the same as Impact Ag-1 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP3): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP3 would result in the conversion of forest land to nonforest uses. This impact would be significant.

A total of 2,069 acres of forest land would be affected by inundation under CP3 (Table 10-8). Also, up to 844 acres of land in the relocation areas would be affected by removal, modification, or relocation of infrastructure under CP3 (Table 10-6); most of this acreage would be converted from forest land to nonforest uses. This impact would be significant. Mitigation for this impact is not proposed in Section 10.3.5 because no feasible mitigation is available to reduce the impact to a less-than-significant level.

Table 10-8. Acreage of Forest Land that Would Be Affected by Inundation Under CP3

Forest Land	Area (Acres)
Blue oak–foothill pine	17
Blue oak woodland	7
Closed-cone pine–cypress	485
Douglas-fir	<1
Montane hardwood	376
Montane hardwood–conifer	481
Ponderosa pine	703
Total	**2,069**

Key:
< = less than
CP = Comprehensive Plan

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP3): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Agricultural lands in the upper Sacramento River portion of the primary study area, including Important Farmland and Williamson Act contract lands, could be inundated as a result of increases in mean monthly river flows. The flow increases that would occur in some years would generally be small (5 percent or less) and would affect areas periodically inundated under existing conditions or the No-Action Alternative. The effects of increased flows would diminish with distance downstream. CP3 also would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. Therefore, implementing CP3 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-3 (CP1); however, the extent of the impact would be greater under CP3 than under CP1 and CP2 because alteration of the flow regime of the Sacramento River would be greater. This impact

would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP3): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP3 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future. However, changes in the flow regime would not reduce the extent of riparian forest. Therefore, implementing CP3 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-4 (CP1); however, the extent of the impact would be greater under CP3 than under CP1 and CP2 because alteration of the flow regime of the Sacramento River would be greater. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (CP3): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Agricultural lands in the extended study area, including Important Farmland and Williamson Act contract lands, could be inundated or undergo soil saturation as a result of increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP3 also would increase the reliability of the water supply by increasing water supplies for irrigation purposes primarily during dry and critical years. Therefore, implementing CP3 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-5 (CP1); however, the extent of the impact would be greater under CP3 than under CP1 and CP2 because alteration of the flow regime of the Sacramento River would be greater. In addition, CP3 would not include reserving storage capacity in Shasta Reservoir for increasing M&I deliveries during dry and critical years. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP3): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP3 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future. However, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP3 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-6 (CP1); however, the extent of the impact would be greater under CP3 than under CP1 and CP2 because alteration of the flow regime of the Sacramento River would be greater. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP4 and CP4A – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

Like each of the alternatives discussed above, CP4 or CP4A would increase storage at Shasta Lake, thus changing the reservoir's full pool elevation and seasonal pool elevations, and the flow regime in the Sacramento River and potentially several other reservoirs and downstream waterways.

As under CP3, raising Shasta Dam 18.5 feet under CP4 or CP4A would increase the reservoir's full pool elevation by 20.5 feet and enlarge the reservoir's total storage capacity by 634,000 acre-feet. Raising the dam 18.5 feet would increase the reservoir's surface area at full pool by about 2,570 acres (9 percent). In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years. CP4A is identical to CP4 with the exception of Shasta Dam and reservoir operations. CP4 and CP4A have similar reservoir operations in that they each dedicate a portion of the new storage in Shasta Lake for fisheries purposes; however, the portion of this dedicated storage varies.

Approximately 378,000 acre-feet of the increased reservoir storage space of CP4 would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. For CP4, operations for the remaining portion of increased storage (approximately 256,000 acre-feet) would be the same as in CP1, with 70,000 acre-feet reserved in dry years and 35,000 acre-feet reserved in critical years to specifically focus on increasing M&I deliveries. Water supply reliability under CP4 would be the same as under CP1. Implementing CP4 would help reduce estimated future agricultural water shortages in the CVP/SWP service areas by increasing water supplies for agricultural deliveries by at least 22,500 acre-feet per year in dry and critical years and increasing average annual deliveries by about 20,300 acre-feet per year.

Similarly, approximately 191,000 acre-feet of the increased reservoir storage space of CP4A would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. For CP4A, operations for the remaining portion of increased storage (approximately 443,000 acre-feet) would be the same as in CP2, with 120,000 acre-feet reserved in dry years and 60,000 acre-feet reserved in critical years to specifically focus on increasing M&I deliveries. Water supply reliability under CP4A would be the same as under CP2. Implementing CP4A would help reduce estimated future agricultural water shortages in the CVP/SWP service areas by increasing water supplies for agricultural deliveries by at least 37,600 acre-feet per year in dry and critical years and increasing average annual deliveries by about 31,400 acre-feet per year.

The changes in flow and river stage on the upper Sacramento River associated with CP4 would be the same as the changes associated with CP1. The changes in flow and river stage on the upper Sacramento River associated with CP4A would be the same as the changes associated with CP2. CP4 and CP4A also would involve augmenting spawning gravel and restoring riparian, floodplain, and side-channel habitat at up to six potential locations in the upper Sacramento River.

Shasta Lake and Vicinity

Impact Ag-1 (CP4 and CP4A): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

This impact would be the same as Impact Ag-1 (CP1) for CP4. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

This impact would be the same as Impact Ag-1 (CP2) for CP4A. No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP4 and CP4A): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP4 or CP4A would result in the conversion of forest land to nonforest uses. This impact would be significant for CP4 or CP4A.

This impact would be the same as Impact Ag-2 (CP3) and would be significant for CP4. Mitigation for this impact is not proposed in Section 10.3.5 because no feasible mitigation is available to reduce the impact to a less-than-significant level.

This impact would be the same as Impact Ag-2 (CP3) and would be significant for CP4A. Mitigation for this impact is not proposed in Section 10.3.5 because

no feasible mitigation is available to reduce the impact to a less-than-significant level.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP4 and CP4A): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Agricultural lands in the upper Sacramento River portion of the primary study area, including Important Farmland and Williamson Act contract lands, could be inundated as a result of increases in mean monthly river flows. The flow increases that would occur in some years would generally be small (5 percent or less) and would affect areas periodically inundated under existing conditions or the No-Action Alternative. The effects of increased flows would diminish with distance downstream. Both CP4 and CP4A would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. In addition, there is no Important Farmland or Williamson Act contract land in the area proposed for gravel augmentation or within any of the potential restoration areas. Therefore, implementing CP4 or CP4A would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant for CP4 or CP4A.

This impact would be similar to Impact Ag-3 (CP1) for CP4. This impact would be less than significant for CP4. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to but slightly greater than Impact Ag-3 (CP1), because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP4 and CP4A): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP4 or CP4A could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future. However, changes in the flow regime would not reduce the extent of riparian forest. Therefore, the implementation of CP4 or CP4A would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-4 (CP1) for CP4 and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to but slightly greater than Impact Ag-4 (CP1) for CP4, because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas

Impact Ag-5 (CP4 and CP4A): Direct and Indirect Conversion of Important Farmland and Cancellation of Williamson Act Contracts to Nonagricultural Uses in the Extended Study Area Agricultural lands in the extended study area, including Important Farmland and Williamson Act contract lands, could be inundated or undergo soil saturation as a result of increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP4 and CP4A would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. Therefore, the implementation of CP4 or CP4A would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant for CP4 or CP4A.

This impact would be similar to Impact Ag-5 (CP1) for CP4 and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to but slightly greater than Impact Ag-5 (CP1) for CP4A, because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. In addition, CP2 would include reserving more storage capacity in Shasta Reservoir to specifically focus on increasing M&I deliveries during dry and critical years and a greater volume of dry and critical year and average annual water supply for agricultural water deliveries for the CVP/SWP service areas. Therefore, this impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP4 and CP4A): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP4 or CP4A could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future. However, changes in flow regime would not reduce the extent of riparian forest. Therefore, the implementation of CP4 or CP4A would not result in the conversion of forest land to nonforest uses. This impact would be less than significant for CP4 or CP4A.

This impact would be similar to Impact Ag-6 (CP1) and would be less than significant for CP4. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to but slightly greater than Impact Ag-6 (CP1) for CP4A, because alteration of the flow regime of the Sacramento River would be slightly greater under CP2 than under CP1. This impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

CP5 – 18.5-Foot Dam Raise, Combination Plan

Like each of the alternatives discussed above, CP5 would increase storage at Shasta Lake, thus increasing the reservoir's full pool elevation and seasonal pool elevations and changing the flow regime in the Sacramento River and potentially several other reservoirs and downstream waterways.

As under CP3, raising Shasta Dam 18.5 feet under CP5 would increase the reservoir's full pool elevation by 20.5 feet and enlarge its total storage capacity by 634,000 acre-feet. Raising the dam 18.5 feet would increase the reservoir's surface area at full pool by about 2,570 acres (9 percent). In general, the effect of this increase would be slight, given that the reservoir would exceed the current full pool elevation only during wetter-than-normal years.

Shasta Dam's operational guidelines would continue essentially unchanged, except during dry and critical years, when 150,000 acre-feet and 75,000 acre-feet, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. Implementing CP5 would help reduce estimated future agricultural water shortages in the CVP/SWP service areas by increasing water supplies for agricultural deliveries by at least 66,100 acre-feet per year in dry and critical years and increasing average annual deliveries by about 50,900 acre-feet per year. Of all the alternatives, CP5 would provide the greatest water supply reliability for the CVP/SWP service areas and the largest amount of storage capacity reserved for increasing M&I deliveries. CP5 also would involve augmenting spawning gravel and restoring riparian, floodplain, and side-channel habitat at up to six potential locations in the upper Sacramento River. CP5 would also involve constructing additional fish habitat in and along the shoreline of Shasta Lake and along the lower reaches of its tributaries and increasing recreation opportunities at Shasta Lake.

Shasta Lake and Vicinity

Impact Ag-1 (CP5): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake No lands adjacent to Shasta Lake or in the immediate vicinity above Shasta Dam are designated by DOC as Important Farmland or under Williamson Act contracts. No impact would occur.

This impact would be the same as Impact Ag-1 (CP1). No impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-2 (CP5): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake Inundation of land and removal, modification, or relocation of infrastructure under CP5 would result in the conversion of forest land to nonforest uses. This impact would be significant.

This impact would be similar to Impact Ag-2 (CP3) and would be significant. Mitigation for this impact is not proposed in Section 10.3.5 because no feasible mitigation is available to reduce the impact to a less-than-significant level.

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Ag-3 (CP5): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River Agricultural lands in the upper Sacramento River portion of the primary study area, including Important Farmland and Williamson Act contract lands, could be inundated as a result of increases in mean monthly river flows. The flow increases that would occur in some years would generally be small (5 percent or less) and would affect areas periodically inundated under existing conditions or the No-Action Alternative. The effects of increased flows would diminish with distance downstream. CP5 also would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. There is no Important Farmland or land under Williamson Act contract within the areas proposed for gravel augmentation, restoration, and improvements to recreational facilities. Therefore, implementing CP5 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-3 (CP1). In addition, none of the land in the areas proposed for gravel augmentation, restoration areas, and recreational facility improvements are Important Farmland or Williamson Act contract lands. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-4 (CP5): Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River Altered flow regimes associated with project implementation under CP5 could adversely affect forest land along the upper Sacramento River. The altered flow regime could affect oak woodland communities by prolonging inundation and changing the availability of soil moisture; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of forests in the riparian corridor along the upper Sacramento River in the future. However, changes in the flow regime would not reduce the extent of riparian forest.

Therefore, implementing CP5 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-4 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta and CVP/SWP Service Areas
Impact Ag-5 (CP5): Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area Agricultural lands in the extended study area, including Important Farmland and Williamson Act contract lands, could be inundated for undergo soil saturation as a result of increased mean monthly river flows. Increases in Sacramento River stage (elevation) would be small. These increased flows would affect areas periodically inundated or saturated under existing conditions or the No-Action Alternative. The effects of this inundation would diminish with distance downstream. CP5 also would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. Therefore, implementing CP5 would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant.

This impact would be similar to Impact Ag-5 (CP1); however, CP5 would provide the greatest water supply reliability for the CVP/SWP service areas and the largest amount of storage capacity in Shasta Reservoir reserved to focus on increasing M&I deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Ag-6 (CP5): Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area Altered flow regimes associated with project implementation under CP5 could adversely affect riparian forest and oak woodlands. The altered flow regime could affect oak woodlands by prolonging inundation and changing soil moisture in some years; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forests along the upper Sacramento River in the future. However, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing CP5 would not result in the conversion of forest land to nonforest uses. This impact would be less than significant.

This impact would be similar to Impact Ag-6 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

10.3.5 Mitigation Measures

Table 10-9 presents a summary of mitigation measures for agricultural and forest resources.

No-Action Alternative

Under the No-Action Alternative, no action would be taken, including implementation of mitigation measures; rather, existing conditions would continue to change into the future. No mitigation measures are required for the No-Action Alternative. Thus, Impacts Ag-1 (No-Action), Ag-3 (No-Action), and Ag-5 (No-Action) would be significant and unavoidable.

Table 10-9. Summary of Mitigation Measures for Agriculture and Important Farmland

Impact		No-Action Alternative	CP1	CP2	CP3	CP4/CP4A	CP5
Impact Ag-1: Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Vicinity of Shasta Lake	LOS before Mitigation	PS	NI	NI	NI	NI	NI
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	SU	NI	NI	NI	NI	NI
Impact Ag-2: Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Vicinity of Shasta Lake	LOS before Mitigation	NI	S	S	S	S	S
	Mitigation Measure	None required.	No feasible mitigation is available to reduce impact.				
	LOS after Mitigation	NI	SU	SU	SU	SU	SU
Impact Ag-3: Direct and Indirect Conversions of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts Along the Upper Sacramento River	LOS before Mitigation	PS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	SU	LTS	LTS	LTS	LTS	LTS

Table 10-9. Summary of Mitigation Measures for Agriculture and Important Farmland (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4/CP4A	CP5
Impact Ag-4: Direct and Indirect Conversion of Forest Land to Nonforest Uses Along the Upper Sacramento River	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Ag-5: Direct and Indirect Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts in the Extended Study Area	LOS before Mitigation	PS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	SU	LTS	LTS	LTS	LTS	LTS
Impact Ag-6: Direct and Indirect Conversion of Forest Land to Nonforest Uses in the Extended Study Area	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Key:
CP = Comprehensive Plan
LOS = level of significance
LTS = less than significant
NI = no impact
PS = potentially significant
S = significant
SU = significant and unavoidable

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is required for Impact Ag-1 (CP1) or for Impacts Ag-3 (CP1) through Ag-6 (CP1). No feasible mitigation measures are available at the time of preparation of this EIS to reduce Impact Ag-2 (CP1) to a less-than-significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP1) would be significant and unavoidable.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is required for Impact Ag-1 (CP2) or for Impacts Ag-3 (CP2) through Ag-6 (CP2). As discussed above for CP1, no feasible mitigation measures are available at the time of preparation of this EIS to reduce Impact Ag-2 (CP2) to a less-than-significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP2) would be significant and unavoidable.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

No mitigation is required for Impact Ag-1 (CP3) or for Impacts Ag-3 (CP3) through Ag-6 (CP3). As discussed above for CP1, no feasible mitigation measures are available at the time of preparation of this EIS to reduce Impact Ag-2 (CP3) to a less-than-significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP3) would be significant and unavoidable.

CP4 and CP4A – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

No mitigation is required for Impact Ag-1 (CP4 and CP4A) or for Impacts Ag-3 (CP4 and CP4A) through Ag-6 (CP4 and CP4A). As discussed above for CP1, no feasible mitigation measures are available at the time of preparation of this EIS to reduce Impact Ag-2 (CP4 and CP4A) to a less-than-significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP4 and CP4A) would be significant and unavoidable.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation is required for Impact Ag-1 (CP5) or for Impacts Ag-3 (CP5) through Ag-6 (CP5). As discussed above for CP1, no feasible mitigation measures are available at the time of preparation of this EIS to reduce Impact Ag-2 (CP5) to a less-than-significant level (i.e., to mitigate conversion of forest land to nonforest uses in the vicinity of Shasta Lake). Therefore, Impact Ag-2 (CP5) would be significant and unavoidable.

10.3.6 Cumulative Effects

Chapter 3, "Considerations for Describing the Affected Environment and Environmental Consequences," discusses overall cumulative impacts methodology related to the action alternatives, including the relationship to the CALFED Bay-Delta Program Programmatic EIS/EIR cumulative impacts analysis, qualitative and quantitative assessment, past and future actions in the study area, and significance criteria.. Table 3-1, "Present and Reasonably Foreseeable Future Actions Included in the Analysis of Cumulative Impacts, by Resource Area," in Chapter 3, lists the present and reasonably foreseeable future projects considered quantitatively and qualitatively within the cumulative impacts analysis. This cumulative impacts analysis accounts for potential project impacts combined with the impacts of existing facilities, conditions, land uses, and reasonably foreseeable actions expected to occur in the study area on a qualitative and quantitative level.

Past and present impacts on agriculture and forest lands are from changes in land use, oversubscription of surface and groundwater supplies, economic drivers, pests and disease, and wildland fires. All of the projects listed in Table 3-1 under Quantitative Analysis, would affect agriculture in the future, some beneficially, some adversely, and some both beneficially and adversely. These projects affect agriculture by altering water supplies available for agricultural uses, either directly or indirectly. However, because the SLWRI would improve agricultural water supplies, none of the action alternatives would contribute to a cumulative impact on agricultural resources in the primary or extended study area. Also, none of the projects listed in Table 3-1 under Quantitative Analysis, would have an adverse effect on forest resources, therefore there would be no quantitative cumulative impact on these resources from any of the action alternatives.

The projects listed in Table 3-1 for Qualitative Analysis also both benefit and adversely affect agricultural and forest land resources through alteration of waters supplies and converting agricultural land to other land uses. Example projects include, but are not limited to North Delta Flood Control and Ecosystem Restoration Project, Bay-Delta Conservation Plan, Dutch Slough Tidal Marsh Restoration Project, In-Delta Storage Program, and San Luis Drainage Reevaluation Program. California's demand for water for irrigation and other uses is expected to continue to increase, while the water supply will likely become less reliable. Future implementation of the related projects considered in this analysis of cumulative impacts would convert agricultural land, including Important Farmland, to nonagricultural uses. With or without implementation of the proposed action, the significant cumulative losses of agricultural resources, including Important Farmland, that have occurred in the primary and extended study areas from past projects—and that would continue as a result of planned future projects—are considerable.

Agricultural lands in the upper Sacramento River portion of the primary study area and in the extended study area, including Important Farmland and

Williamson Act contract lands, could be inundated as a result of increases in mean monthly river flows under any of the project alternatives. The flow increases that would occur in some years would generally be expected to be small (5 percent or less) and would affect areas periodically inundated under existing conditions or the No-Action Alternative. The effects of increased flows would diminish with distance downstream. Any of the project alternatives also would increase the reliability of the water supply by increasing water supplies for irrigation purposes, primarily during dry and critical years. Therefore, implementing any of the project alternatives would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts. This impact would be less than significant. Implementation of any of the project alternatives would not result in a considerable incremental contribution to a cumulatively significant impact associated with the conversion of Important Farmland to nonagricultural uses or the cancellation of Williamson Act contracts.

No operational changes would occur that would directly convert forest land to nonforest uses along the upper Sacramento River. However, CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlargement of Shasta Dam. The resulting changes in flow regime would likely result in minimal adverse effects on riparian forest and oak woodlands. Several management and restoration plans and programs would implement actions that would largely offset those adverse effects. Although there would be reasonably foreseeable projects that would restore forest land or put land into agricultural production, there would be an overall significant cumulative effect on Important Farmlands and forest lands. The effects of climate change on operations at Shasta Lake could potentially cause changes in conditions for agricultural land and forest land in downstream areas. As described in the Climate Change Modeling Appendix, climate change could affect future demand for agricultural water by leading to increased rates of evapotranspiration and increasing the length of the growing season. On the other hand, increased precipitation could decrease overall water demand, depending on which adaptation strategies are used by agriculture and municipalities and how much more efficiently plants use water when carbon dioxide concentrations are higher. Crop types, planting cycles, time of planting, and crop productivity may change as a result of climate change, although a consensus has not been reached on how changes will occur. As stated previously in this section, increases in California's demand for water and forecast reductions in water supply could lead to increased pressure to convert Important Farmland to other nonagricultural uses and cancel Williamson Act contracts.

In addition, changes to forest land and land cover could affect climate change. As stated in the Climate Change Modeling Appendix, deforestation and land cover conversion have also been identified as contributing to global warming by reducing the Earth's capacity to remove carbon dioxide from the air and altering

the Earth's albedo or surface reflectance, allowing more solar radiation to be absorbed.

In the primary study area, forest land would be affected by inundation of land and removal, modification, or relocation of infrastructure in the vicinity of Shasta Dam. Implementing any of the project alternatives (CP1–CP5) would result in the conversion of forest land to nonforest uses in the vicinity of Shasta Dam. No feasible mitigation exists to create a similar area of forest land to replace the area of forest land that would be inundated or converted to nonforest uses by relocation of facilities. Although reforestation could occur at a small scale over hundreds of years, the acreage of forest land converted to nonforest uses, including by reservoir inundation, is too large of a scale for successful and feasible reforestation. Therefore, implementing any of the project alternatives would result in a cumulatively considerable incremental contribution to a cumulative impact related to conversion of forest land to nonforest uses. However, most of this area remains substantially in forest land and has not been converted to nonforest uses. Therefore, the overall impact would not be cumulatively significant.

In the extended study area, altered flow regimes associated with implementation of any of the project alternatives could affect forest land. The altered flow regime could affect oak woodlands by prolonging inundation and changing the availability of soil moisture in some years; however, these effects are unclear and may not all prove to be adverse. Changes in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian forest along the upper Sacramento River in the future. However, changes in flow regime would not reduce the extent of riparian forest. Therefore, implementing any of the project alternatives would not result in the conversion of forest land to nonforest uses. Therefore, the project alternatives would not result in a cumulatively considerable incremental contribution to a significant cumulative impact related to conversion of forest land to nonforest uses.

As stated previously, climate change could result in changes to conditions for agricultural land and forest land in downstream areas. However, implementing any of the project alternatives would promote improvements in the reliability of CVP water supply deliveries. Thus, the project alternatives would not result in a cumulatively considerable incremental contribution to a significant cumulative impact related to future demands for, and availability of, agricultural water.

Implementing any of the project alternatives would result in a cumulatively considerable incremental contribution to a cumulative impact related to conversion of forest land to nonforest uses. However, most of this area remains substantially in forest land and has not been converted to nonforest uses. Thus, when added to the anticipated effects of climate change, raising Shasta Dam would not have a significant cumulative effect on climate change resulting from changes to forest land and land cover.

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