# Chapter 12
# Botanical Resources and Wetlands

## 12.1 Affected Environment

This section describes the affected environment related to botanical resources for the dam and reservoir modifications proposed under the SLWRI. For a more in-depth description, see the *Botanical Resources and Wetlands Technical Report*.

The botanical resources and wetlands setting for the Shasta Lake and vicinity portion of the primary study area consists of the impoundment area (five arms and the Main Body of Shasta Lake, as described below) and the relocation areas (Figure 12-1).

Reclamation established project boundaries for focused surveys in the areas that would be subject to inundation under the various enlargement scenarios. The lower boundary corresponds to the current full-pool elevation defined by Reclamation (1,070-foot mean sea level contour line). The upper boundary was established using the 1,090-foot mean sea level contour line around the entire lake. This area is referred to as the "impoundment area" (Figure 12-1).

Areas subject to physical disturbance as an indirect result of the proposed project (i.e., areas proposed as relocation sites for roadways, bridges, utilities, and campgrounds that would be inundated after the enlargement of Shasta Dam as well as proposed dike locations) were incorporated into the Shasta Lake and vicinity portion of the primary study area. These locations are hereafter referred to as "relocation areas" (Figure 12-1).

To examine the biological resources along riverine reaches that would be subject to inundation if Shasta Dam were enlarged, reaches of 11 streams and rivers that are tributary to Shasta Lake were also incorporated into the Shasta Lake and vicinity portion of the primary study area. These streams were selected by Reclamation in conjunction with USFS as an initial sampling of streams representative of riverine and riparian habitats. Subsequently, botany studies have been expanded into select areas of the impoundment area and within all of the relocation areas.

For the purposes of this investigation, approximate acreages for vegetation types and waters of the United States are reported by arm of the lake. For a relocation area that falls between two arms, the area is included with the arm that has the most acreage of the vegetation type or water of the United States.

Vegetation communities and special-status plant species in the extended study area are discussed in less detail. The extended study area includes the Sacramento River basin from Red Bluff Diversion Dam (RBDD) south to the Delta. It also includes the San Francisco Bay/Sacramento–San Joaquin River Delta (Bay-Delta) area and portions of the American River basin, San Joaquin River basin, and the water service areas of the CVP and the SWP.

Descriptions of biological resources were derived primarily from the following sources:

- Shasta Lake Water Resources Investigation Mission Statement Milestone Report (Reclamation 2003)
- Shasta Lake Water Resources Investigation Initial Alternatives Information Report (Reclamation 2004)
- Chapter 3, "Biological Environment," in the Draft Shasta Lake Water Resources Investigation Plan Formulation Report (Reclamation 2007)
- USFWS Endangered Species Lists
- The California Natural Diversity Database (CNDDB)
- The California Native Plant Society (CNPS) online inventory

Several attachments to the *Botanical Resources and Wetlands Technical Report* provide detailed lists and descriptions of special-status species present in the primary and extended study areas:

- Attachment 1, "Lists of All Special-Status Plant Species Known from or Potentially Present in the Primary and Extended Study Areas"
- Attachment 2, "List of Plant Species Observed in the Shasta Lake and Vicinity Portion of the Primary Study Area"
- Attachment 3, "Special-Status Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area"
- Attachment 4, "List of All Sensitive Plant Species in the Extended Study Area Reported to the CNDDB"
- Attachment 5, "Known Weed Source Locations, Potential Mode of Spread, and Risk of Spread"

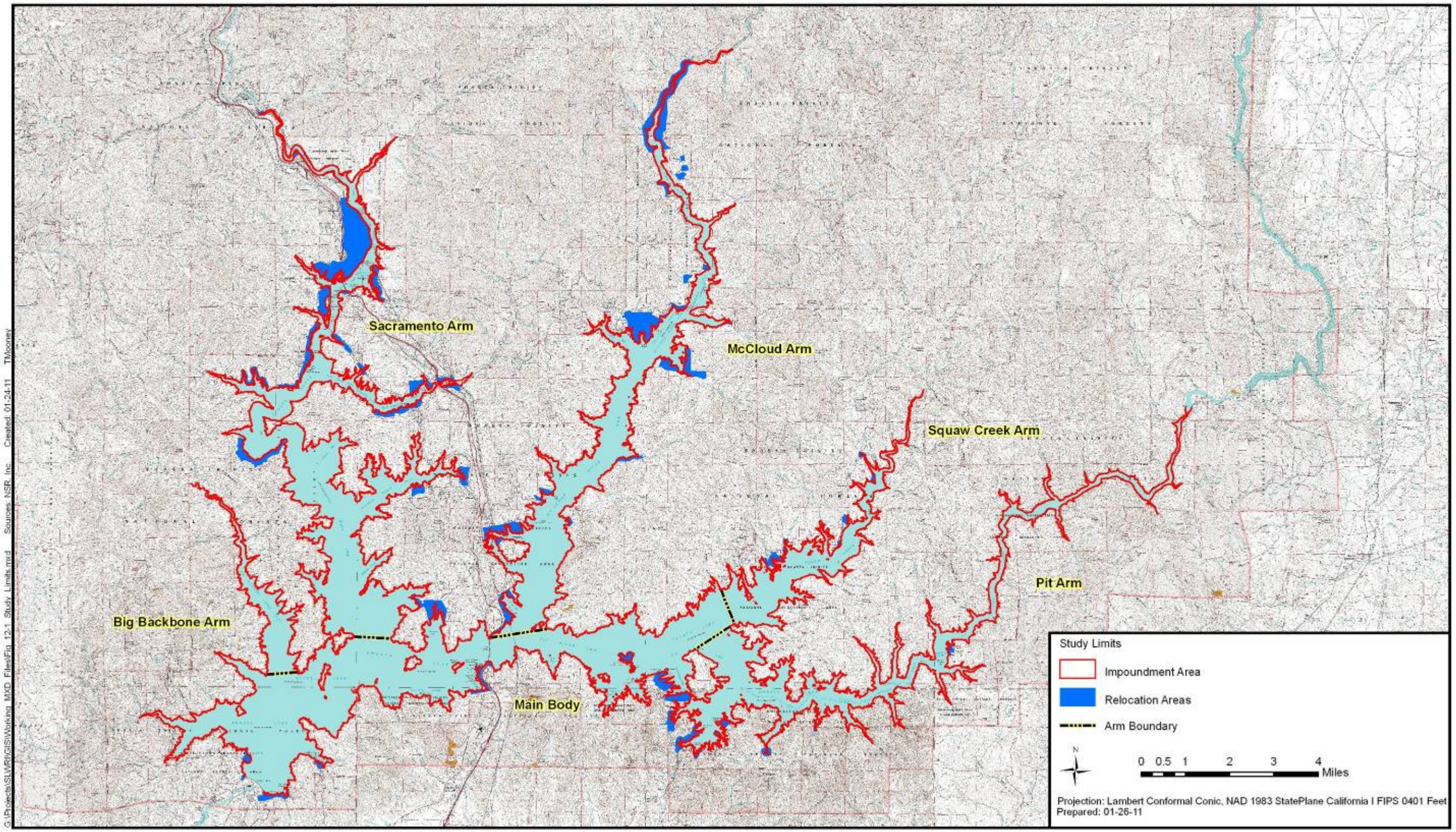



**Figure 12-1. Study Limits**

*This page left blank intentionally.*

### 12.1.1 Vegetation Communities

***Shasta Lake and Vicinity***

North State Resources, Inc. (NSR) conducted extensive mapping to characterize the plant communities in the Shasta Lake and vicinity portion of the primary study area. The study area for botanical resources in the Shasta Lake and vicinity portion of the primary study area corresponds to the area that would be subject to inundation under the five action alternatives and areas where infrastructure would be removed, modified, or relocated (Figure 12-1). The vegetation mapping followed the technical approach described in *A Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995) (MCV), using the vegetation alliance classification system described in *A Manual of California Vegetation, Second Edition* (Sawyer et al. 2009).

MCV represents the most recent effort to provide a common and accepted vegetation classification system for use throughout California. It classifies vegetation into a set of plant alliances, provisional alliances, special stands, or semi-natural stands. In this system, the plant species dominance or importance in the layer (i.e., tree, shrub, and ground) with the greatest amount of cover determines the vegetation alliance classification. The same approach used to describe and classify MCV types was applied when other vegetation types not described in the current MCV were encountered and determined to be significant vegetative components.

The vegetation mapping used recent 1:2,400-scale color aerial photography provided by Reclamation. All vegetation mapping was performed in the field by ground truthing the study area from boat, vehicle, and/or on foot. MCV plant alliances were identified and delineated onto the aerial photographs. The delineated boundaries were digitized and generated in ArcGIS/ArcInfo software for display and data query purposes.

The Shasta Lake and vicinity area is characterized by a variety of vegetation types typical of transitional mixed woodland and low-elevation forest habitats. MCV plant series types in this portion of the primary study area are birch-leaf mountain mahogany chaparral, black willow thicket, blue oak woodland, Brewer's oak scrub, buck brush chaparral, California annual grassland, California black oak forest, California ash chaparral, California buckeye groves, California yerba santa scrub, canyon live oak forest, deer brush chaparral, Fremont cottonwood forest, ghost pine woodland, Himalayan blackberry brambles, interior live oak chaparral, interior live oak woodland, knobcone pine forest, mixed willow, Oregon ash groves, Oregon white oak woodland, pale spike rush marshes, ponderosa pine–Douglas fir forest, ponderosa pine forest, red osier thickets, sandbar willow thickets, spicebush thickets, valley oak woodland, white alder groves, and white leaf manzanita chaparral. Vegetation in each of these series varies, with dramatic changes often occurring in relation to aspect, slope, geologic substrate, or juxtaposition with other habitats.

The acreage of MCV types found in the impoundment area along the Main Body and the five arms of Shasta Lake is shown in Table 12-1, and the acreage of MCV types found in the relocation areas along the Main Body and the five arms of Shasta Lake is shown in Table 12-2. The locations of each type are depicted on Figures 12-2a through 12-2f. General descriptions of each type are provided below.

**Table 12-1. Summary of Plant Communities in the Impoundment Area**

| Plant Series | Area (Acres) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Arm | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| Barren[1] | 1.05 | 0.00 | 0.55 | 0.00 | 0.00 | 0.00 |
| Birch-leaf mountain-mahogany chaparral | 0.00 | 0.00 | 0.00 | 2.23 | 0.00 | 0.00 |
| Black willow thicket | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 |
| Blue oak woodland | 1.27 | 0.00 | 0.00 | 0.70 | 0.00 | 4.07 |
| Brewer oak scrub | 9.78 | 0.17 | 51.64 | 4.99 | 4.50 | 7.78 |
| Buck brush chaparral | 1.46 | 2.42 | 2.11 | 1.59 | 0.67 | 0.19 |
| California annual grassland | 0.58 | 0.33 | 4.17 | 0.94 | 0.00 | 0.33 |
| California black oak forest | 71.45 | 14.14 | 160.32 | 47.44 | 1.72 | 5.05 |
| California buckeye groves | 0.00 | 0.00 | 0.20 | 0.001 | 0.00 | 0.00 |
| California yerba santa scrub | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.89 |
| Canyon live oak forest | 9.80 | 18.41 | 53.80 | 48.40 | 26.79 | 110.51 |
| Deer brush chaparral | 0.18 | 0.00 | 0.00 | 0.08 | 0.00 | 2.34 |
| Fremont cottonwood forest | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.05 |
| Ghost pine woodland | 54.05 | 0.00 | 51.29 | 13.50 | 22.03 | 30.54 |
| Himalayan blackberry brambles | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.44 |
| Interior live oak chaparral | 1.24 | 0.00 | 10.05 | 0.01 | 0.00 | 24.86 |
| Interior live oak woodland | 2.00 | 0.00 | 0.14 | 0.09 | 0.00 | 2.28 |
| Lacustrine** | 10,196.88 | 1,014.12 | 7,225.14 | 5,032.68 | 2,081.60 | 4,372.80 |
| Knobcone pine forest | 32.96 | 0.40 | 16.38 | 20.61 | 47.92 | 85.35 |
| Mixed willow | 1.54 | 1.46 | 14.56 | 0.16 | 0.19 | 0.83 |

**Table 12-1. Summary of Plant Communities in the Impoundment Area (contd.)**

| Plant Series | Area (Acres) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Arm | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| Oregon ash groves | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 |
| Oregon white oak woodland | 0.00 | 0.00 | 0.00 | 1.09 | 0.00 | 0.66 |
| Ponderosa pine – Douglas fir forest | 5.01 | 0.00 | 28.37 | 50.04 | 69.14 | 127.51 |
| Ponderosa pine forest | 226.04 | 36.67 | 212.79 | 208.87 | 59.38 | 101.21 |
| Red osier thickets | 0.00 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 |
| Riverine[1] | 0.00 | 0.88 | 5.24 | 15.42 | 1.41 | 0.00 |
| Sandbar willow thickets | 0.00 | 0.00 | 0.00 | 0.28 | 0.07 | 0.00 |
| Spicebush thickets | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 |
| Urban[1] | 22.04 | 0.00 | 0.00 | 0.00 | 0.00 | 1.92 |
| White alder groves | 1.34 | 4.46 | 9.70 | 12.40 | 1.18 | 2.85 |
| White leaf manzanita chaparral | 16.80 | 12.30 | 98.21 | 6.13 | 7.49 | 2.86 |
| Total | 10,655.47 | 1,105.79 | 7,944.75 | 5,468.00 | 2,324.09 | 4,900.34 |

Notes:

Data to be provided at a later date.

[1] WHR Wildlife Habitat Type (Mayer and Laudenslayer 1988); no corresponding plant series type included in *A Manual of California Vegetation* (Sawyer et al. 2009).

**Lacustrine values are included for the entire surface area of Shasta Lake. The extent of activity occurring within Shasta Lake has yet to be determined.

**Table 12-2. Summary of Plant Communities in the Relocation Areas**

| Plant Series | Area (Acres) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Arm | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| Barren[1] | 23.76 | 0.00 | 88.27 | 36.62 | 12.15 | 22.19 |
| Birch-leaf mountain-mahogany chaparral | 0.00 | 0.00 | 0.07 | 2.57 | 0.00 | 0.00 |
| Black willow thicket | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 |
| Blue oak woodland | 0.00 | 0.00 | 0.00 | 3.89 | 0.00 | 2.29 |
| Brewer oak scrub | 9.24 | 0.00 | 0.00 | 23.83 | 0.00 | 0.91 |
| Buck brush chaparral | 0.00 | 0.00 | 1.30 | 2.11 | 0.00 | 0.22 |
| California annual grassland | 5.02 | 0.00 | 23.24 | 10.65 | 1.29 | 1.25 |
| California ash chaparral | 0.00 | 0.00 | 0.00 | 0.68 | 0.00 | 0.00 |

**Table 12-2. Summary of Plant Communities in the Relocation Areas (contd.)**

| Plant Series | Area (Acres) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Arm | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| California black oak forest | 45.08 | 0.00 | 190.50 | 124.80 | 1.29 | 0.72 |
| California buckeye groves | 0.30 | 0.00 | 0.00 | 1.58 | 0.00 | 0.00 |
| California yerba santa scrub | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 18.5 |
| Canyon live oak forest | 1.18 | 0.00 | 13.92 | 99.86 | 4.98 | 32.58 |
| Deer brush chaparral | 0.18 | 0.00 | 0.00 | 0.65 | 0.00 | 9.67 |
| Fremont cottonwood forest | 0.00 | 0.00 | 0.56 | 0.00 | 0.00 | 0.05 |
| Ghost pine woodland | 124.50 | 0.00 | 84.08 | 49.91 | 13.48 | 20.05 |
| Himalayan blackberry brambles | 0.18 | 0.00 | 0.00 | 0.06 | 0.00 | 0.16 |
| Interior live oak chaparral | 0.00 | 0.00 | 2.42 | 0.00 | 0.00 | 64.85 |
| Interior live oak woodland | 0.72 | 0.00 | 0.00 | 0.00 | 0.00 | 3.41 |
| Knobcone pine forest | 0.11 | 0.00 | 55.68 | 12.50 | 1.94 | 39.25 |
| Lacustrine | 0.00 | 0.00 | 0.00 | 32.49 | 0.00 | 0.00 |
| Mixed willow | 0.079 | 0.00 | 1.26 | | 0.06 | 1.11 |
| Oregon ash groves | 0.00 | 0.00 | 0.00 | 0.50 | 0.00 | 0.00 |
| Oregon white oak woodland | 0.00 | 0.00 | 0.00 | 5.82 | 0.07 | 0.00 |
| Pale spike rush marshes | 0.00 | 0.00 | 6.51 | 0.00 | 0.00 | 0.00 |
| Ponderosa pine–Douglas fir forest | 0.00 | 0.00 | 23.78 | 155.57 | 28.80 | 19.27 |
| Ponderosa pine forest | 185.35 | 0.00 | 557.30 | 501.66 | 43.08 | 62.03 |
| Riverine[1] | 3.75 | 0.00 | 0.39 | 0.00 | 0.00 | 0.00 |
| Sandbar willow thickets | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.00 |
| Spicebush thickets | 0.00 | 0.00 | 0.00 | 0.70 | 0.00 | 0.00 |
| Urban[1] | 21.05 | 0.00 | 229.37 | 0.48 | 0.00 | 2.49 |
| Valley oak woodland | 0.00 | 0.00 | 1.05 | 0.00 | 0.00 | 0.00 |
| White alder groves | 0.00 | 0.00 | 2.51 | 6.33 | 0.17 | 0.00 |
| White leaf manzanita chaparral | 15.97 | 0.00 | 78.43 | 14.98 | 4.38 | 0.40 |
| Total | 433.05 | 0.00 | 1,400.06 | 1,092.36 | 111.67 | 301.40 |

Note:

[1] WHR Wildlife Habitat Type (Mayer and Laudenslayer 1988); no corresponding plant series type included in *A Manual of California Vegetation* (Sawyer et al. 2009).

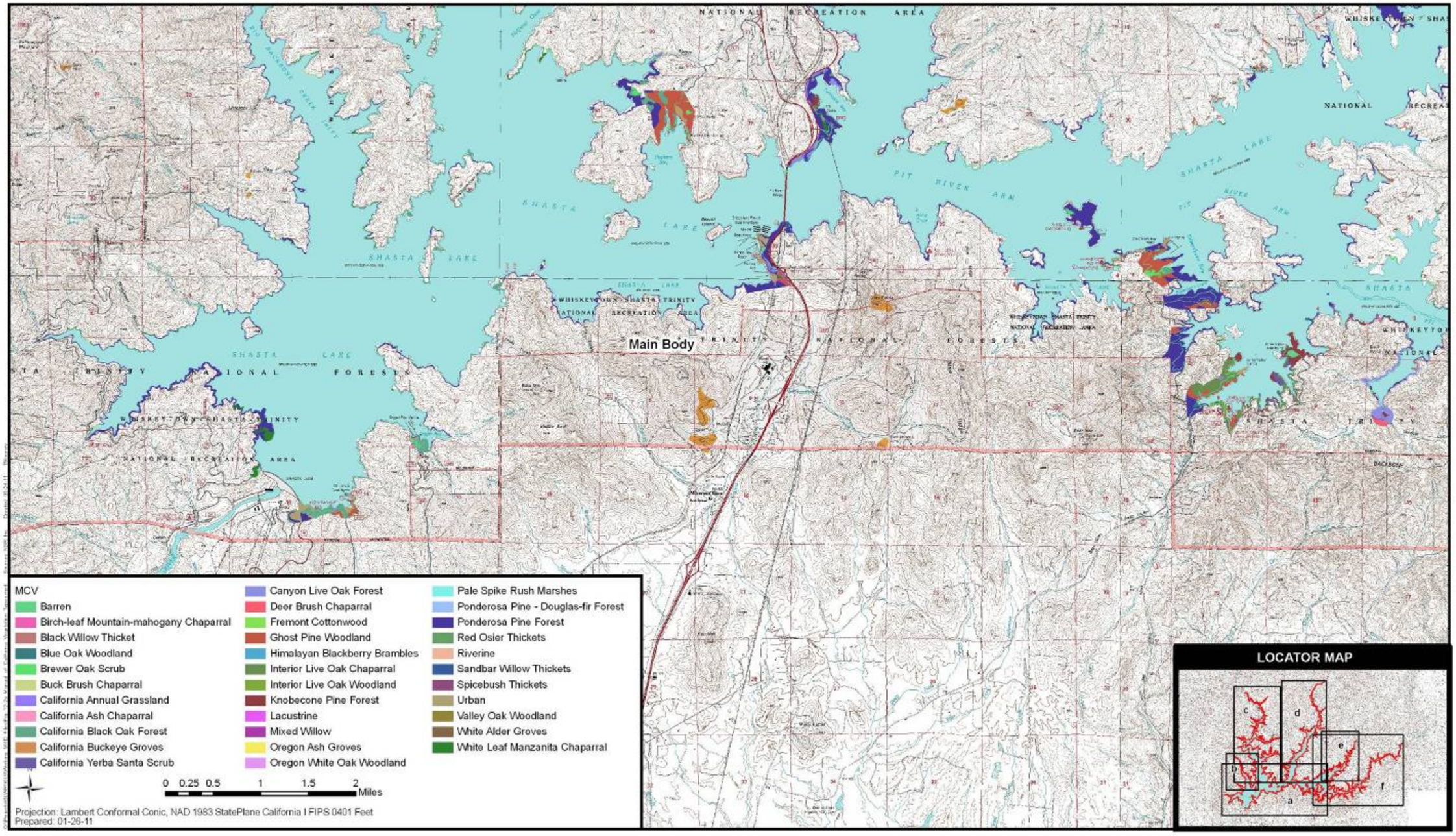



**Figure 12-2a. Manual of California Vegetation Types**

*This page left blank intentionally.*

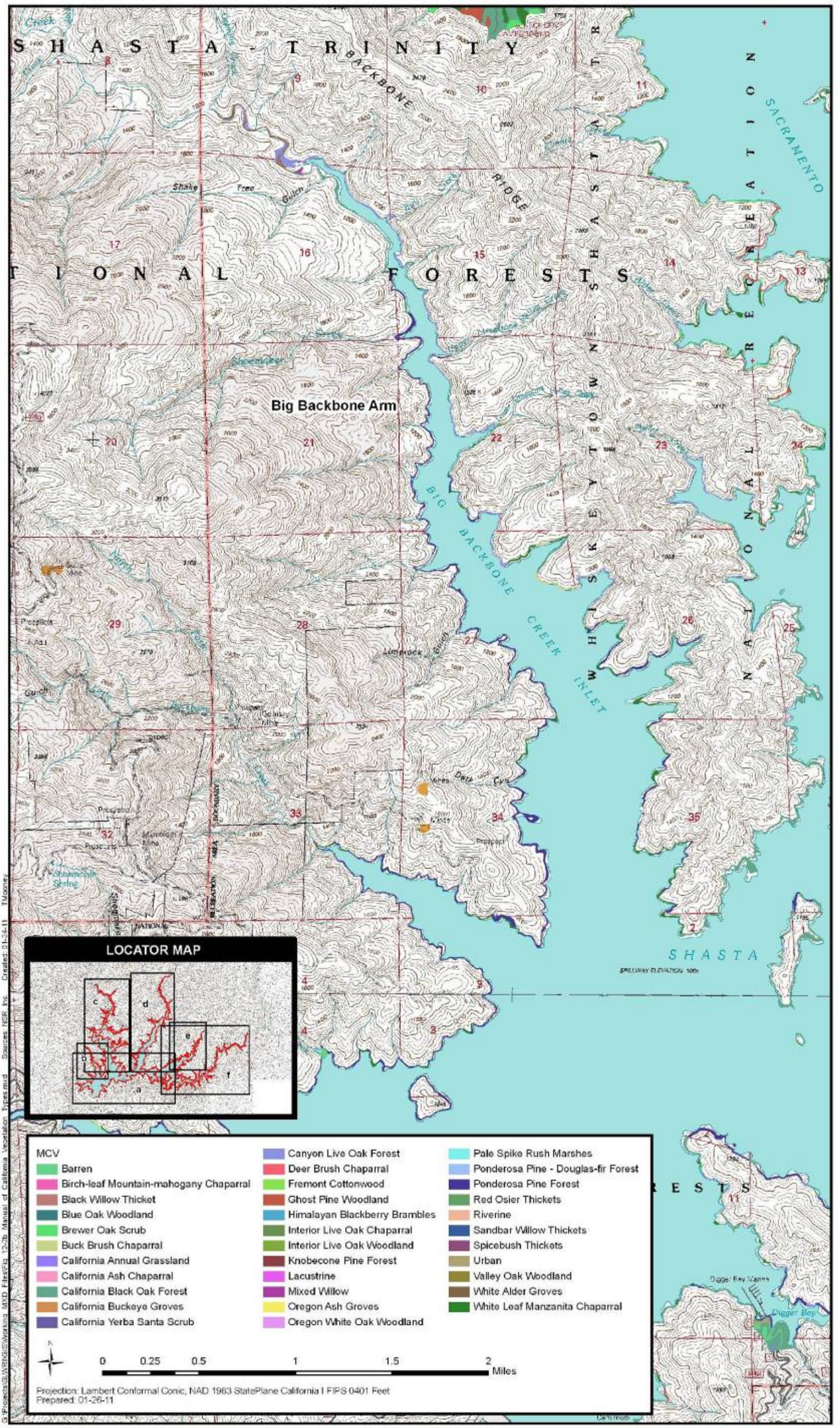



**Figure 12-2b. Manual of California Vegetation Types**

*This page left blank intentionally.*

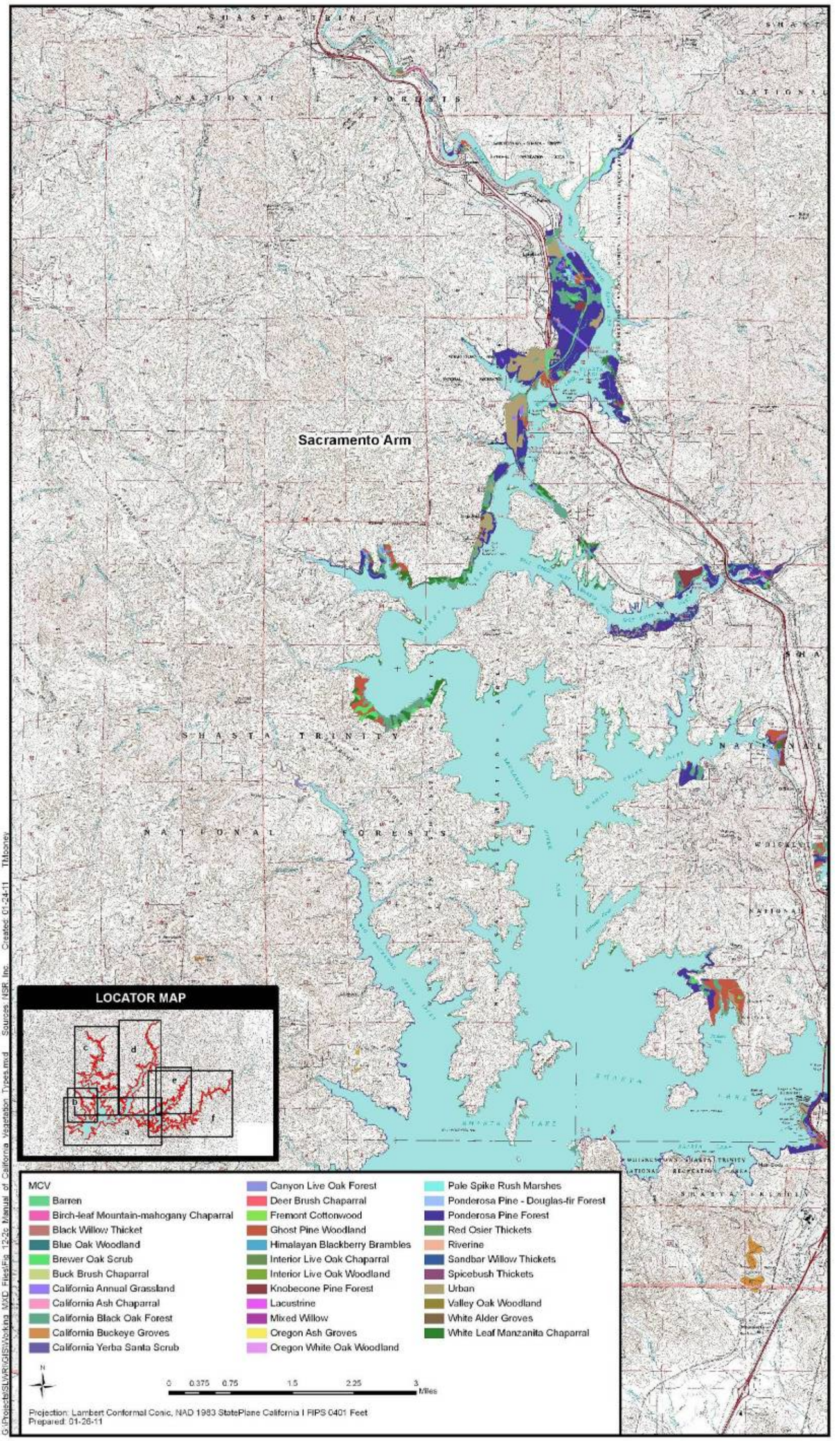



**Figure 12-2c. Manual of California Vegetation Types**

*This page left blank intentionally.*

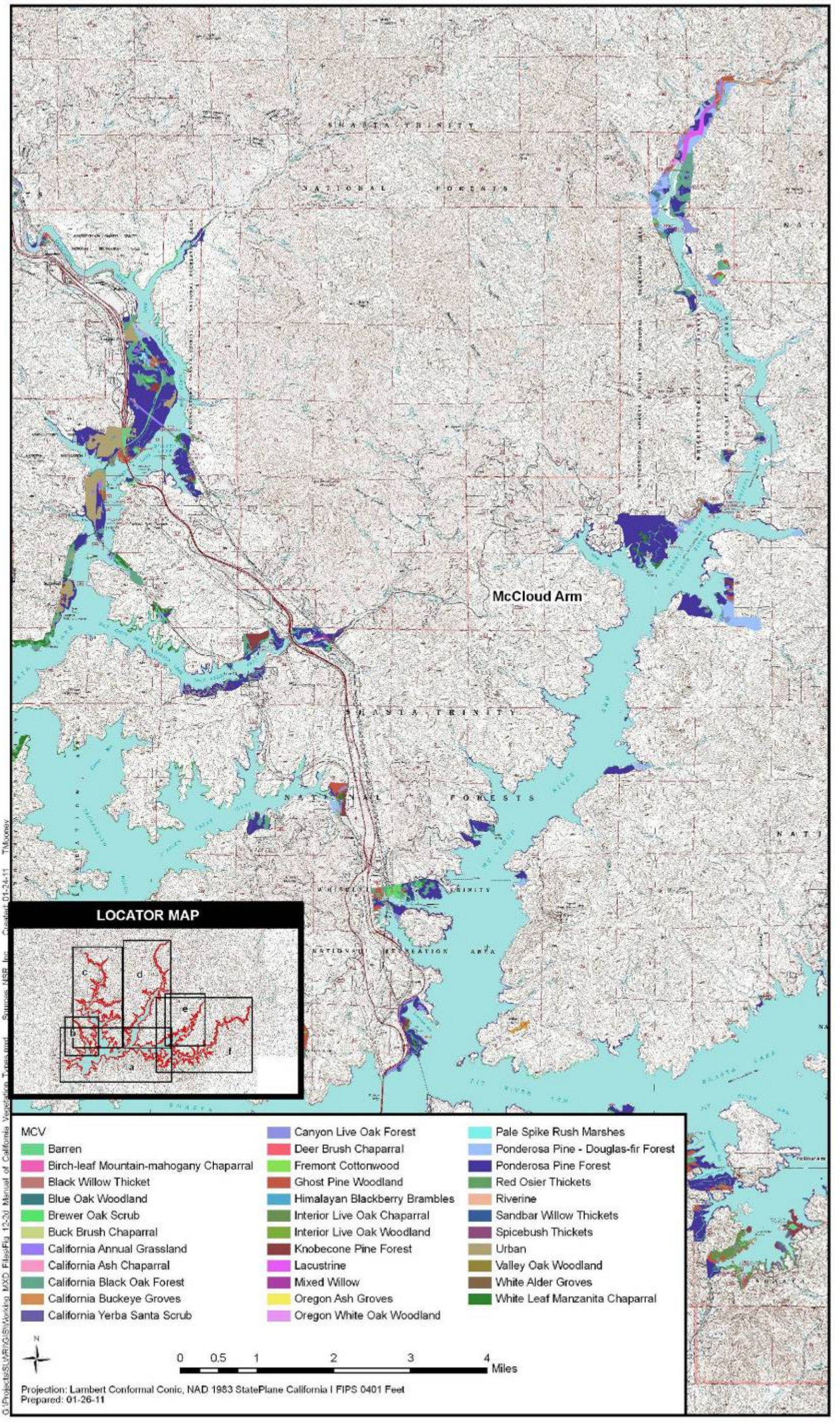



**Figure 12-2d. Manual of California Vegetation Types**

*This page left blank intentionally.*

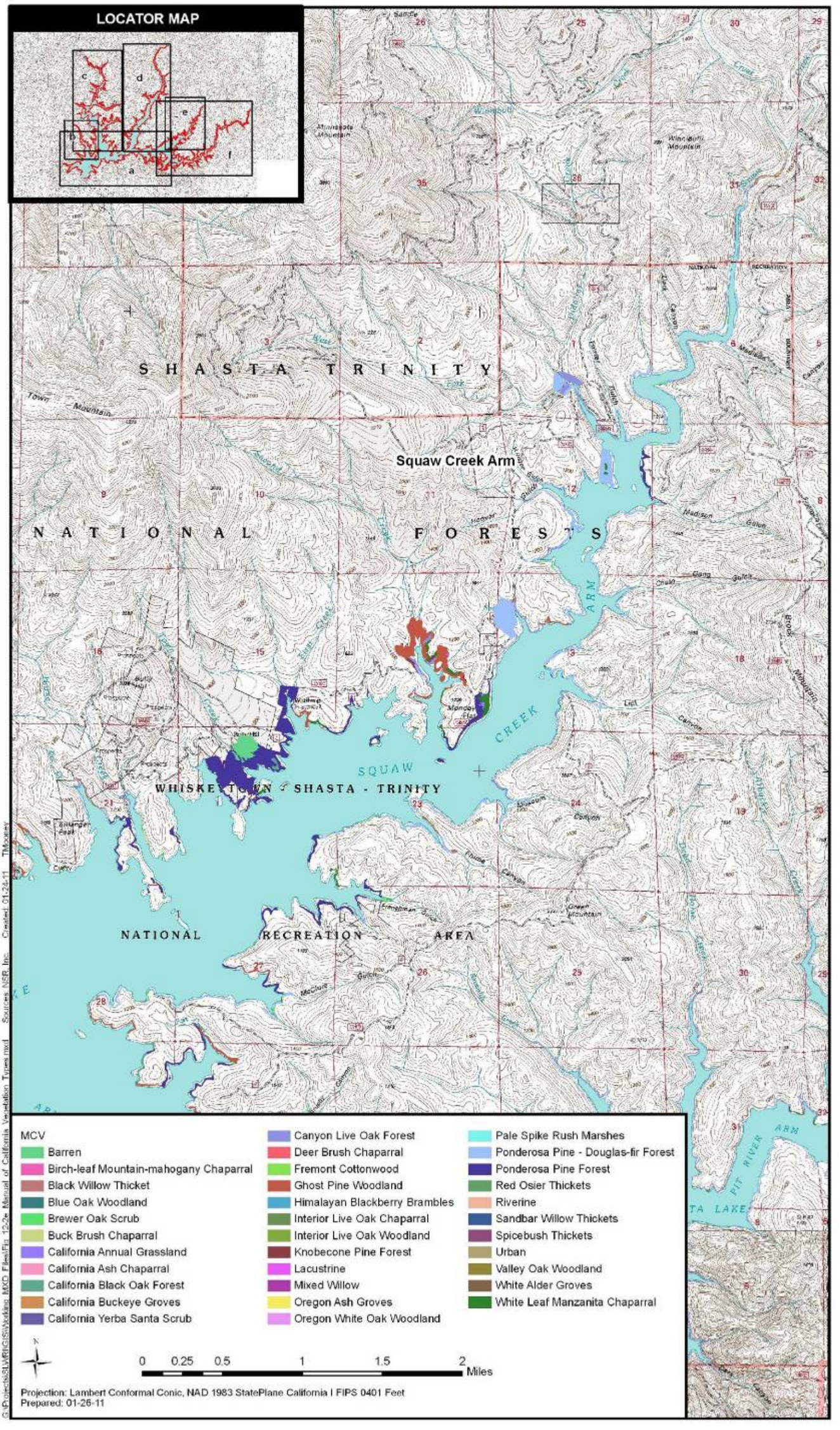



**Figure 12-2e. Manual of California Vegetation Types**

*This page left blank intentionally.*

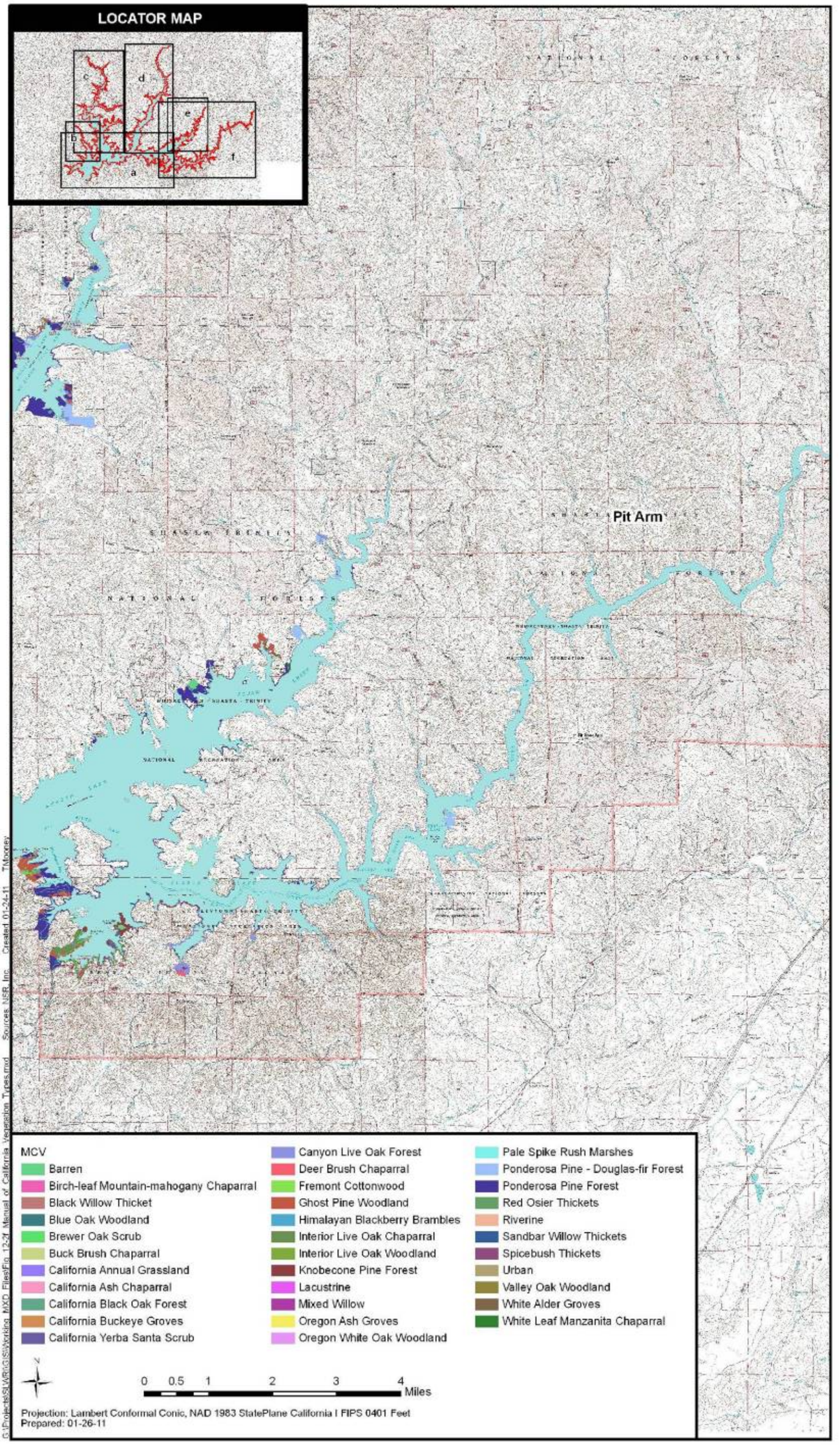



**Figure 12-2f. Manual of California Vegetation Types**

*This page left blank intentionally.*

**Barren** Barren habitat consists mainly of nonvegetated man-made features. Barren habitat is scattered throughout the Shasta Lake and vicinity portion of the primary study area, including boat ramps, parking lots, and roads. Other barren habitats are a large gravel plain feature at the confluence of Butcher Creek and Shasta Lake (Main Body) and a sealed riprap feature adjacent to Interstate 5 near the upper Sacramento Arm and Shasta Lake confluence. Vegetation is usually not present, although sparse opportunistic grasses/forbs or weedy species may occur.

**Birch-Leaf Mountain-Mahogany Chaparral** Birch-leaf mountain-mahogany chaparral is a relatively common associate species in many chaparral and woodland plant series types. As a plant series, birch-leaf mountain-mahogany occurs in the Shasta Lake and vicinity portion of the primary study area along the upper McCloud and Sacramento arms. These sites are located on floodplain terraces and are characterized as moderate to dense chaparral stands dominated by birch-leaf mountain-mahogany (*Cercocarpus betuloides*), with occasional buck brush (*Ceanothus cuneatus*), poison oak (*Toxicodendron diversilobum*), western redbud (*Cercis occidentalis*), yerba santa (*Eriodictyon californicum*), and Brewer oak (*Q. garryana* var. b*reweri*).

**Black Willow Thicket** Although commonly associated with willow and other riparian plant series types, black willow thicket is uncommon in the Shasta Lake and vicinity portion of the primary study area. This plant series is dominated by black willow (*Salix gooddingii*), with spicebush (*Calycanthus occidentalis*), rushes (*Juncus* spp.), and California grape (*Vitis californica*). It occurs at only two locations in the Shasta Lake and vicinity portion of the primary study area, one along the Sacramento Arm and the other in the Jones Valley area (Pit Arm).

**Blue Oak Woodland** The blue oak plant series occurs mainly as small inclusions within other more prevalent plant series types; however, moderate-sized stands also occur. This plant series occurs at scattered locations along the Main Body, McCloud Arm, and Pit Arm and is characterized by open to moderate woodlands dominated by blue oak (*Quercus douglasii*). Associated tree species include occasional interior live oak (*Q. wislizenii* var. *wislizenii*) and gray pine (*Pinus sabiniana*). The shrub layer is open or absent, and a moderate to dense forb layer dominates the understory.

**Brewer Oak Scrub** The Brewer oak plant series consists of moderate to very dense stands of Brewer oak, the shrub form of Oregon white oak (*Q. garryana* var. *garryana*). This plant series type is widespread throughout the Shasta Lake and vicinity portion of the primary study area. Brewer oak stands are often nearly pure; occasionally, however, shrub species such as poison oak, white leaf manzanita, yerba santa, buck brush, bush poppy (*Dendromecon rigida*), Fremont's silktassel (*Garrya fremontii*), deer brush (*Ceanothus integerrimus*), skunkbrush (*Rhus trilobata*), and snowdrop bush (*Styrax officinalis*) occur in association with Brewer oak.

**Buck Brush Chaparral** Buck brush chaparral occurs at scattered locations throughout the Shasta Lake and vicinity portion of the primary study area. This plant series is dominated by moderate to dense stands of buck brush. Associated species include white leaf manzanita, poison oak, western redbud, yerba santa, Brewer oak, birch-leaf mountain-mahogany, and coffeeberry (*Rhamnus* sp.).

**California Annual Grassland** California annual grassland is uncommon in the Shasta Lake and vicinity portion of the primary study area, occurring only as small inclusions in other more prevalent plant series types or in areas subjected to previous disturbance. Dominant species include wild oat (*Avena fatua*), cheatgrass (*Bromus tectorum*), ripgut (*B. diandrus*), yellow star-thistle (*Centaurea solstitialis*), squirreltail (*Elymus elymoides*), and European hairgrass (*Aira caryophyllea*).

**California Ash Chaparral** California ash is a relatively common associate species in many chaparral and woodland plant series types. As a plant series, California ash chaparral occurs in the Shasta Lake and vicinity portion of the primary study area at several locations along the McCloud Arm. This plant series is characterized as a moderate to dense chaparral stand dominated by birch-leaf mountain-mahogany, with occasional buck brush, poison oak, western redbud, yerba santa, and Brewer oak.

**California Black Oak** The black oak series is characterized by moderate to dense stands of California black oak (*Quercus kelloggii*). This plant series is relatively common throughout the Shasta Lake and vicinity portion of the primary study area. Understory associates include white leaf manzanita (*Arctostaphylos viscida*), poison oak, snowdrop bush (*Styrax officinalis*), and buck brush. The ground layer is open to dense and is dominated by various grasses and forbs.

**California Buckeye Groves** Although a common associate in many plant series types in the Shasta Lake and vicinity portion of the primary study area, California buckeye groves are uncommon as a plant series type. This plant series is dominated by California buckeye (*Aesculus californica*). Associated species include poison oak, Brewer oak, buck brush, and various grasses and forbs. It occurs at only several scattered locations in the Sacramento Arm, McCloud Arm, and Pit Arm.

**California Yerba Santa Scrub** California yerba santa scrub is a relatively common associate species in many chaparral and woodland plant series types. California yerba santa is a pioneer species that readily responds to various disturbances and wildfire. As a plant series, California yerba santa scrub occurs in the Shasta Lake and vicinity portion of the primary study area at two general locations subject to recent wildfire: the Dry Creek area (Main Body) and the Jones Valley area (Pit Arm). This plant series is characterized as moderate to dense chaparral stands dominated by California yerba santa, with occasional

shrub interior live oak, shrub canyon live oak, buck brush, poison oak, western redbud, and Brewer oak.

**Canyon Live Oak Forest** The canyon live oak plant series is characterized by moderate to dense stands of canyon live oak (*Quercus chrysolepis*). This plant series is relatively common throughout the Shasta Lake and vicinity portion of the primary study area. Associated tree species include occasional California black oak. Understory associates include white leaf manzanita and poison oak. The ground layer is open to moderate and is dominated by various grasses and forbs.

**Deer Brush Chaparral** Deer brush chaparral is a relatively common associate in chaparral and forest plant series types in the Shasta Lake and vicinity portion of the primary study area; however, deer brush is uncommon in the study area as a plant series type. This plant series is dominated by deer brush. It occurs at several scattered locations along the Main Body, McCloud Arm, and Pit Arm.

**Fremont Cottonwood Forest** In the Shasta Lake and vicinity portion of the primary study area, Fremont cottonwood forest is an uncommon plant series type that occurs as single stands of trees along small portions of the upper Sacramento Arm and the Pit Arm. The dominant species is Fremont cottonwood (*Populus fremontii*).

**Ghost (Gray) Pine** The ghost pine plant series occurs in all parts of the Shasta Lake and vicinity portion of the primary study area except along the Big Backbone Arm. This plant series type is characterized by open to moderate stands of gray pine. Associated species include blue oak, canyon live oak, interior live oak, and California black oak. Shrub species are moderate to dense and include white leaf manzanita, western redbud, buck brush, Brewer oak, poison oak, and yerba santa.

**Himalayan Blackberry Brambles** Himalayan blackberry (*Rubus discolor*) is a common associate in many riparian plant series and in various other plant series with mesic microhabitats and/or previous disturbance. As a plant series, Himalayan blackberry brambles occur in portions of the Dry Creek (Main Body) and Jones Valley (Pit Arm) areas recently disturbed by wildfire. This plant series occurs in and along drainage and stream features and is characterized as dense thickets of Himalayan blackberry. Associated species include spicebush, willow, and rushes.

**Interior Live Oak Chaparral** In the Shasta Lake and vicinity portion of the primary study area, the interior live oak chaparral plant series is relatively uncommon, occurring mainly along the Sacramento Arm. However, this plant series also occurs at scattered locations along the Main Body, the McCloud Arm, and the Pit Arm. This plant series is dominated by moderate to dense stands of the shrub form of interior live oak. Associated species include Brewer oak, white leaf manzanita, poison oak, and buck brush.

**Interior Live Oak Woodland** The interior live oak woodland plant series is uncommon in the Shasta Lake and vicinity portion of the primary study area. It occurs in several small areas along the Sacramento Arm, the Pit Arm, the McCloud Arm, and the Main Body.

**Knobcone Pine Forest** The knobcone pine forest plant series consists of open to dense knobcone pine (*Pinus contorta*) stands. This plant series is scattered throughout all portions of the Shasta Lake and vicinity portion of the primary study area. Knobcone pine forest often occurs at locations characterized by disturbances, including historic mining activities and past or recent wildfires. Dominant species include knobcone pine, with occasional canyon live oak, California black oak, ponderosa pine (*Pinus ponderosa*), and gray pine. The shrub layer is moderate to dense and is dominated by white leaf manzanita and poison oak. The ground layer varies and is dominated by various grasses and forbs.

**Lacustrine** Lacustrine habitat consists of the area regularly inundated by Shasta Lake (i.e., areas at and below the 1,070-foot elevation). Most of this area is barren of vegetation and is characterized as exposed soil and/or rock. Portions of the lacustrine habitat do support vegetation, including woody riparian species such as black willow, button willow (*Cephalanthus occidentalis*), Fremont cottonwood, and various grasses and forbs, during draw-down periods.

**Mixed Willow** Mixed willow is the most common willow plant series type in the Shasta Lake and vicinity portion of the primary study area and occurs throughout the entire area. Dominant species include red willow (*Salix laevigata*), black willow, shining willow (*S. lasiandra*), arroyo willow (*S. lasiolepis*), and narrowleaf willow (*S. exigua*).

**Oregon Ash Groves** Oregon ash groves are an uncommon plant series type in the Shasta Lake and vicinity portion of the primary study area. This type occurs along the upper McCloud Arm and is dominated by open to moderate stands of Oregon ash (*Fraxinus latifolia*) with willow, California grape, mock orange, brickellbush (*Brickellia* sp.), and poison oak.

**Oregon White Oak Woodland** The Oregon white oak woodland plant series is uncommon in the Shasta Lake and vicinity portion of the primary study area and occurs as small inclusions in other more prevalent plant series types. This plant series is characterized by open to moderate woodlands dominated by Oregon white oak. Associated tree species include occasional canyon live oak, blue oak, and California black oak. The shrub layer is open or absent, and a moderate to dense forb layer dominates the understory.

**Pale Spike Rush Marshes** Pale spike rush is an uncommon plant series in the Shasta Lake and vicinity portion of the primary study area; it is known to occur only in a portion of one relocation area near Lakehead (Sacramento Arm). This plant series is characterized as a seasonal wetland dominated by a complex of

annual and perennial upland and wetland plant species. Dominant species include pale spike rush (*Eleocharis macrostachya*), jointed coyote-thistle (*Eryngium articulatum*), pennyroyal (*Mentha pulegium*), panic grass (*Panicum acuminatum*), iris-leaf rush (*Juncus xiphioides*), sedges (*Carex* spp.), rushes, poison oak, white leaf manzanita, western choke-cherry (*Prunus virginiana*), interior rose (*Rosa woodsii*), and Himalayan blackberry.

**Ponderosa Pine–Douglas-Fir** Ponderosa pine-Douglas-fir is the second-most-common conifer plant series type in the Shasta Lake and vicinity portion of the primary study area, occurring everywhere except along the Big Backbone Arm. This plant series is characterized by open to dense conifer stands dominated by Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine. Associated species include occasional sugar pine (*P. lambertiana*), incense cedar (*Calocedrus decurrens*), canyon live oak, and California black oak. Associated understory species vary and include Pacific dogwood (*Cornus nuttallii*), mock orange (*Philadelphus lewisii*), poison oak, snowdrop bush, and white leaf manzanita. The ground layer is open to moderate and is dominated by various grasses and forbs.

**Ponderosa Pine** Ponderosa pine is the most common conifer plant series type in the Shasta Lake and vicinity portion of the primary study area and is scattered throughout all portions of the area. This plant series is characterized by open to dense conifer stands dominated by ponderosa pine. Associated species include occasional Douglas-fir, sugar pine, incense cedar, canyon live oak, and California black oak. Associated understory species vary and include redbud, buck brush, mock orange, poison oak, snowdrop bush, and white leaf manzanita. The ground layer is open to moderate and is dominated by various grasses and forbs.

**Red Osier Thickets** Red osier is a common associate in many riparian plant series types in the Shasta Lake and vicinity portion of the primary study area. As a plant series, red osier thickets are an uncommon plant series type. In the vicinity of Shasta Lake, red osier thickets are found along the upper McCloud Arm. Dominant species include red osier (*Cornus stolonifera*), brown dogwood (*C. glabrata*), mock orange, spicebush, and California grape.

**Riverine** Riverine habitat includes the free-flowing portions of the larger Shasta Lake tributaries occurring in the Shasta Lake and vicinity portion of the primary study area. The riverine habitat is highly variable and ranges from moderate, low-gradient to steep, well-confined stream reaches.

**Sandbar Willow Thickets** Sandbar willow thicket is an uncommon plant series that occurs at one location each along the McCloud Arm and the Squaw Creek Arm. Dominant species include narrowleaf willow, with occasional red willow, black willow, shining willow, and arroyo willow.

**Spicebush Thickets** Spicebush is a common associate in many riparian plant series types in the Shasta Lake and vicinity portion of the primary study area. As a plant series, spicebush thickets are an uncommon plant series type. This plant series occurs at several locations along the McCloud Arm. Dominant species include spicebush, red osier, mock orange, and California grape.

**Urban** Urban habitat consists of various man-made features scattered throughout the Shasta Lake and vicinity portion of the primary study area, including resorts and a portion of the visitor center complex at Shasta Dam. These features are typically a combination of various buildings, pavement areas with manicured landscaping, and lawns.

**Valley Oak Woodland** Valley oak woodland is an uncommon plant series and occurs at two small locations in the Lakehead area (Sacramento Arm). Dominant species include valley oak (*Quercus lobata*) with white leaf manzanita, redbud, poison oak, and various grasses and forbs.

**White Alder Groves** The white alder plant series occurs in the riparian vegetation found in drainages throughout the Shasta Lake and vicinity portion of the primary study area. This plant series is characterized as narrow bands of vegetation occurring in and along the margins of rivers, streams, or other drainages. Dominant species include white alder (*Alnus rhombifolia*) with occasional Oregon ash, red osier, big-leaf maple (*Acer macrophyllum*), narrowleaf willow, red willow, shining willow, and arroyo willow. Associated shrubs include spicebush, mock orange, California blackberry (*Rubus ursinus*), mugwort (*Artemisia douglasiana*), ninebark (*Physocarpus capitatus*), and western azalea (*Rhododendron occidentale*). Common lianas include California grape, pipevine (*Aristolochia californica*), greenbriar (*Smilax californica*), and virgin's bower (*Clematis ligusticifolia*). The ground layer is open to dense and is dominated by sedges with various grasses and forbs.

**White Leaf Manzanita Chaparral** White leaf manzanita is the most common chaparral plant series type in the Shasta Lake and vicinity portion of the primary study area and is scattered throughout all portions of the area. The dominant species is white leaf manzanita. Associated species include occasional common manzanita (*A. manzanita*), western redbud, buck brush, deer brush, poison oak, birch-leaf mountain-mahogany, interior live oak (shrub form), Fremont's silktassel, bush poppy, yerba santa, and Brewer's oak.

#### *Upper Sacramento River (Shasta Dam to Red Bluff)*

The plant communities present in the primary study area between Shasta Dam and RBDD are grouped into common and sensitive communities as described below, and the relevant aspects of their ecology are discussed in detail in the *Botanical Resources and Wetlands Technical Report*, and summarized below for sensitive communities. These descriptions are generally applicable to the extended study area as well. (Plant community names and descriptions used in

this section are based primarily on the Preliminary Descriptions of the Terrestrial Natural Communities of California (Holland 1986).)

Common plant communities present within the primary study area include annual grassland, chaparral, and agricultural lands. The upper banks along steep-sided, bedrock constrained segments of the Sacramento River and its tributaries are characterized primarily by upland communities including blue oak woodland, foothill pine-oak woodland, and chaparral. These segments occur primarily between Shasta Dam and Redding.

Sensitive plant communities include those that are of special concern to resource agencies or are afforded specific consideration through CEQA, Section 1602 of the California Fish and Game Code, Section 404 of the Federal Clean Water Act (CWA), and the State's Porter-Cologne Water Quality Control Act, as discussed under "Regulatory Framework."

**Oak Woodlands** Oak woodlands present in the study area include blue oak woodland, blue oak savanna, foothill pine-oak woodland, and valley oak woodland. The oaks that dominate the tree layer of oak savannas and woodlands are long-lived trees that are resilient to damage; their stems often survive fire, and when their stems are killed by fire or are cut down, basal sprouts often grow into new stems. (Valley oak also tolerates inundation during winter before it has leafed out.) Nonetheless, there are concerns regarding the status and ongoing trends of tree mortality and recruitment in tree canopies of blue oak- and valley oak-dominated savannas and woodlands (Tyler et al. 2006).

**Riparian Communities** California's riparian communities have experienced the most extensive reductions in their acreage, and in the Sacramento Valley more than 90 percent of riparian vegetation has been converted to agriculture or development, and the remainder substantially altered by dams, diversions, gravel mining, grazing practices, and invasive species (Hunter et al. 1999).

In the primary study area, 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 vegetation.

Riparian communities present within the floodplain of the Sacramento River, within the study area, include blackberry scrub, Great Valley willow scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, and Great Valley valley oak riparian forest. Willow and blackberry scrub and cottonwood- and willow-dominated riparian communities are present along active channels and on the lower flood terraces whereas valley oak–dominated communities occur on higher flood terraces.

More than 15 native species of deciduous trees and shrubs occur in the riparian forests, woodlands, and scrubs of the Central Valley and the Delta (Conard et al.

1977, Vaghti and Greco 2007). Flow regime, disturbance, and species attributes determine the species composition and physical structure of this woody vegetation. Although flow regime influences the dispersal, establishment, growth, and survival of all the woody riparian species, Fremont's cottonwood (*Populus fremontii*) and the willow species (*Salix* sp.) particularly depend on specific hydrologic events for their recruitment. During seed release, flows must be high enough to disperse seed to surfaces where scouring by subsequent flows does not occur, yet not so high that seedlings desiccate after flows recede, and flows must recede gradually to enable germination and seedling establishment while the substrate is still moist (Mahoney and Rood 1998).

Fremont's cottonwood and willow species are rapidly growing, shade intolerant and relatively short-lived (Burns and Honkala 1990, Vaghti and Greco 2007). Within 10 to 20 years, initially shrubby thickets have reached 10-40 feet in height. Other species, such as Oregon ash (*Fraxinus latifolia*) and valley oak (*Quercus lobata*), establish concurrently or subsequent to the willows and cottonwood, grow more slowly but are more tolerant of shade, and are longer-lived (Burns and Honkala 1990; Tu 2000). In the absence of frequent disturbance, these species enter the canopy, particularly after 50 years, as mortality of willows and cottonwood frees space. Conversely, frequent disturbance prevents the transition to mature mixed riparian or valley oak forests.

The operation of Shasta Dam has limited the frequency, magnitude, and duration of intermediate and larger flows during fall and winter, since the dam's construction, and flow volumes have been greater during the growing season. The operation of Shasta Dam also produces increasing flow volumes during the period of cottonwood seed dispersal (rather than flow volume decreasing during this period), largely precluding establishment of cottonwoods (and to a lesser extent willows) throughout much of the riparian zone (Roberts et al. 2002). The combined effect of these changes in flow regime has been a decrease in early- and mid-successional communities along the Sacramento River that is still ongoing (Fremier 2003).

**Wetland Communities** *S*imilar to riparian communities, much of the wetland habitat that once occurred in the Sacramento River Valley has been eliminated as a consequence of land use conversion to agriculture and urbanization. It is estimated that nearly 1.5 million acres of wetlands once occurred in the Central Valley. Today, approximately 123,000 acres remain. Wetland communities that are likely to occur in the primary study area between Shasta Dam and RBDD include freshwater marsh, freshwater seep, northern hardpan vernal pools, northern volcanic mudflow vernal pools, and other seasonal wetlands.

Freshwater marshes are herbaceous wetland plant communities that occur along rivers and lakes and are characterized by dense cover of perennial, emergent plant species. Marshes are typically perennial wetlands, but may dry out for short periods of time. In marsh vegetation, vegetation structure and species

richness are strongly influenced by disturbance, changes in water levels, and the range of elevations present at a site (Keddy 2000). Disturbances, and water level drawdowns that expose previously submerged surfaces, provide opportunities for species to establish, which creates diversity in species composition and vegetation structure. With increasing depth of water, the growth of marsh plants is reduced, and thus this vegetation type is typically restricted to shallow water.

Freshwater seep is a wetland plant community characterized by dense cover of perennial herb species usually dominated by rushes, sedges, and grasses. Freshwater seep communities occur on sites with permanently moist or wet soils resulting from daylighting groundwater.

Vernal pools are seasonal wetlands that fill during winter rains and dry up in spring. They occur in undulating or mima mound (i.e., mound-intermound) topography where the soil or underlying rock has layers that are relatively impermeable to water. Vernal pools may be isolated from one another, but more often they are interconnected by swales or ephemeral drainages in vernal pool complexes that may extend for hundreds of acres. Vernal pool complexes generally include water features. The two predominant types of vernal pool communities in the study area are northern hardpan vernal pools and northern volcanic mudflow vernal pools.

Pool size and the depth, duration, and seasonal timing of ponding are important factors that influence the composition and diversity of plant and animal species in vernal pools (Solomeshch et al. 2007). Consequently, the vegetation of vernal pools can vary substantially from year to year in response to interannual fluctuations in climate.

Management activities such as grazing and burning also influence species composition and diversity. In fact, recent research indicates that the abundance of nonnative grasses, grazing practices, and hydrology are strongly interrelated and can substantially affect the plant communities of vernal pools (Robins and Vollmar 2002; Pyke 2004; Marty 2005).

Seasonal wetlands are ephemeral wetlands that pond or remain flooded for long periods during a portion of the year, generally the rainy winter season, then dry up, typically in spring. They often occur in shallow depressions on flood terraces that are occasionally to infrequently flooded. Seasonal wetlands are herbaceous communities typically characterized by species adapted for growth in both wet and dry conditions, and may contain considerable cover of upland species as well. Seasonal wetlands differ from vernal pools in that they do not have a restrictive hardpan layer and are usually dominated by nonnative plant species, especially nonnative grasses.

**Lower Sacramento River and Delta** A large number of natural plant communities occur in the extended study area, and some are described in this section and the “CVP/SWP Service Areas” section, or in the *Botanical*

*Resources and Wetlands Technical Report*. The other natural plant communities are described in the following sections, and in Mayer and Laudenslayer 1988, Sawyer and Keeler-Wolf 1995, and CALFED 2000a. In addition to natural plant communities, plant communities of agricultural and urban areas occupy extensive portions of the extended study area.

The lower Sacramento River can be subdivided into distinct reaches that differ in topography, hydrology, and geomorphology; and thus, in vegetation and associated habitat functions.

**Red Bluff Diversion Dam to Colusa** In this reach, the Sacramento River is classified as a meandering river, where relatively stable, straight sections alternate with more sinuous, dynamic sections (Resources Agency 2003). The channel remains active and has the potential to migrate in times of high water. Point bars, islands, high and low terraces, instream woody cover, early-successional riparian plant growth, and other evidence of river meander and erosion are common in this reach. Major physiographic features include floodplains, basins, terraces, active and remnant channels, and oxbow sloughs. These features sustain a diverse array of riparian plant communities.

**Colusa to the Delta** The general character of the Sacramento River changes quite drastically downstream from Colusa from a dynamic and active meandering channel to a confined, narrow channel restricted from migration. Surrounding agricultural lands encroach directly adjacent to the levees, which have cut the river off from most of its riparian corridor, especially on the eastern side of the river. Most of the levees in this reach are lined with riprap, allowing the river no erodible substrate and limiting the extent of riparian vegetation.

**Primary Tributaries to the Lower Sacramento River** The primary tributaries of the lower Sacramento River are the Feather River, American River, and the Sacramento River floodplain bypasses. The aquatic ecosystem in the lower Feather River, down to the confluence with the Sacramento River at Verona, is influenced by DWR's Oroville Facilities. The upper extent is fairly confined by levees as the river flows through the city of Oroville. Downstream from Oroville, the Feather River is fairly active and meanders its way south to Marysville. However, this stretch is bordered by active farmland, which confines the river into an incised channel in certain stretches and limits the width of riparian woodland. Some of this adjacent farmland is in the process of being restored to floodplain habitat with the relocation of levees to become setback levees.

The lower American River (below Folsom and Nimbus Dams) is fairly low gradient. Most of the lower American River is surrounded by the American River Parkway, which preserves the surrounding riparian zone. The river channel does not migrate to a large degree because it has become deeply incised, leaving tall cliffs and bluffs adjacent to the river.

Multiple water diversion structures in the lower Sacramento River move floodwaters into floodplain bypass areas during high-flow events. These floodplain bypass areas – the Butte Basin, Sutter Bypass, and Yolo Bypass – provide broad, inundated floodplain habitat during wet years. Unlike other Sacramento River and Delta habitats, floodplains and floodplain bypasses are seasonally dewatered (as high flows recede). Their predominant communities include grassland, seasonal wetlands, and agricultural vegetation.

**Sacramento–San Joaquin River Delta** The Delta comprises an area of approximately 750,000 acres divided into a number of islands by hundreds of miles of waterways. Before reclamation, the Delta was inundated each year by winter and spring runoff, which changed channel geometry in response to flood conditions and tidal influence. Consequently, there were extensive areas of marsh in the Delta.

Nearly all of the Delta's marshland has since been reclaimed by agriculture, peat production, and urban and industrial uses. More than 1,000 miles of levees protect this reclaimed land (CALFED 2000b). However, some small islands remain in a quasinatural state, as do some other areas with aquatic and wetland communities (e.g., "flooded islands" that were once reclaimed land, but have been abandoned after levee failures). The species composition and ecology of these riparian, marsh, and aquatic plant communities differ from the composition and ecology of communities in the upper and lower Sacramento River portions of the study area and are described below.

Along the lower Sacramento River and in the Delta, riparian vegetation is characterized by narrow linear strips of trees and shrubs, in single- to multiple-story canopies. Tree canopies may be continuous or discontinuous, or absent altogether (as in riparian scrubs). These patches of riparian vegetation may be on or at the toe of levees (particularly in the Delta). Riparian communities in this region include cottonwood-willow woodland, Valley oak riparian woodland, riparian scrub, and willow scrub. These communities are described below.

The dynamics of riparian communities along the lower Sacramento River and in the Delta are similar to those described for riparian communities along the upper Sacramento River. However, along the Sacramento River south of Colusa, in the flood bypasses, and in the Delta, the disturbances that remove riparian vegetation, or create newly exposed surfaces where riparian vegetation can establish, differ somewhat from those along the upper Sacramento River. In these downstream areas, disturbances related to meander migration are more limited, and anthropogenic (human-caused) disturbances, such as levee maintenance and trampling, are greater than those upstream. This is because of the close proximity to levees, extensive placement of bank protection, and greater human population.

In addition to the wetland communities described for the upper Sacramento River, the Delta has tidal freshwater and brackish-water emergent marshes that like nontidal marshes are dominated by clonal perennial plants. This community occurs on instream islands and along mostly unleveed, tidally influenced waterways. In addition to the environmental factors affecting nontidal marshes, the species composition of tidal marshes in the Delta is also affected by regional salinity gradients.

The Delta also supports extensive areas of aquatic vegetation. These communities consists of submerged plants generally rooted in the substrate, whose stems may partially extend above the water surface (e.g., during flowering) and floating plants that are generally not rooted in the substrate. The availability of light (which decreases with depth), turbidity, and shade cast by overtopping vegetation can restrict submerged plants to relatively shallow areas. In the Delta (which has turbid waters), most submerged vegetation appears to be restricted to areas less than 5 to 10 feet deep. The velocity of flows may contribute to this depth restriction.

**CVP/SWP Service Areas** Although agricultural and urban land uses have substantially reduced the area and connectivity of natural vegetation, the service areas still contain a large diversity of both lowland and upland plant communities, including many sensitive plant communities (see the *Botanical Resources and Wetlands Technical Report*). The most dramatic difference between historical and existing conditions is the fragmentation of what were once large contiguous blocks of habitat. Significant changes to the natural landscape in the region occurred in the late 1800s and early 1900s with land conversions to agriculture. However, in southern California, that pattern shifted dramatically compared to the pattern in the Central Valley, as urban growth in the region that started in the 1900s began to convert large areas of agricultural lands and of remaining natural vegetation to developed land uses.

### 12.1.2 Special-Status Species

Special-status species addressed in this section include plants that are legally protected or are otherwise considered sensitive by Federal, State, or local resource conservation agencies and organizations. These include species that are State listed and/or Federally listed as rare, threatened, or endangered; those considered as candidates or proposed for listing as threatened or endangered; species identified by DFG as Species of Special Concern or USFS as sensitive, endemic, or needing additional survey or management actions; and plants considered jointly by DFG and CNPS to be rare, threatened, or endangered; and species afforded protection under local planning documents, including the CALFED Bay-Delta Program's (CALFED) Multi-Species Conservation Strategy (MSCS).

#### *Shasta Lake and Vicinity*

Within the Shasta Lake and vicinity portion of the primary study area are a wide variety of vegetative communities and habitat components that support a large

diversity of plant species. To aid in determining the potential impacts of the project, a list of potential plant species of concern was developed.

For the purposes of this evaluation, botanical species of concern are plants, lichen, and fungi that fall into any of the following categories:

- Designated as rare or listed as threatened or endangered by the State or Federal government
- Proposed for designation as rare or listing as threatened or endangered by the State or Federal government
- Candidate species for State or Federal listing as threatened or endangered
- Ranked as California Rare Plant Rank (CRPR) 1B, 2, 3, or 4 (formerly CNPS List 1A, 1B, 2, 3, or 4)
- Considered sensitive or endemic by USFS
- Considered a survey and manage species by USFS or U.S. Bureau of Land Management (BLM)
- Designated as an MSCS covered species by CALFED

Potentially occurring plant species of concern were determined by performing several database searches, reviewing USFWS and DFG special-status species lists for Shasta County, reviewing other appropriate literature, discussions with resource agency personnel, and professional experience in the region. Additionally, results from the various vegetation habitat mapping efforts, botanical surveys, and wildlife surveys conducted in the area by NSR since 2002 were used in developing the list of species of concern.

Table 12-3 summarizes special-status plant species identified as having a potential to occur in the Shasta Lake and vicinity portion of the primary study area.

**Table 12-3. Plant Species of Concern with Potential to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area**

| Common Name | Scientific Name | Status[1] |
|---|---|---|
| Shasta ageratina | Ageratina shastensis | CRPR 1B.2, USFS E |
| Bent-flowered fiddleneck | Amsinckia lunaris | CRPR 1B.2, BLMS |
| Mallory's manzanita | Arctostaphylos malloryi | CRPR 4.3 |
| Shasta County arnica | Arnica venosa | CRPR 4.2, USFS E |
| Depauperate milk-vetch | Astragalus pauperculus | CRPR 4.3 |
| Moonwort, grape-fern | Botrychium subgenus Botrychium | USFS S, S&M |
| Yellow-twist horsehair | Bryoria tortuosa | BLMS |
| Green bug moss | Buxbaumia viridis | USFS S, BLMS, S&M |
| Callahan's mariposa lily | Calochortus syntrophus | CRPR 1B.1 |
| Butte County morning-glory | Calystegia atriplicifolia ssp. buttensis | CRPR 4.2 |
| Castle Crags harebell | Campanula shetleri | CRPR 1B.3, USFS S, BLMS |
| Buxbaum's sedge | Carex buxbaumii | CRPR 4.2 |
| Bristly sedge | Carex comosa | CRPR 2.1, MSCS r |
| Fox sedge | Carex vulpinoidea | CRPR 2.2 |
| Shasta clarkia | Clarkia borealis ssp. arida | CRPR 1B.1, MSCS m, BLMS |
| Northern clarkia | Clarkia borealis ssp. borealis | CRPR 1B.3, BLMS |
| Silky cryptantha | Cryptantha crinita | CRPR 1B.2, MSCS m, BLMS |
| California lady's-slipper | Cypripedium californicum | CRPR 4.2 |
| Clustered lady's-slipper | Cypripedium fasciculatum | CRPR 4.2, USFS S, BLMS, S&M |
| Mountain lady's-slipper | Cypripedium montanum | CRPR 4.2, USFS S, BLMS, S&M |
| Four-angled spike rush | Eleocharis quadrangulata | CRPR, MSCS m |
| Butte County fritillary | Fritillaria eastwoodiae | CRPR 3.2, USFS S |
| Dubious pea | Lathyrus sulphureus var. argillaceus | CRPR 3 |
| Broad-lobed linanthus | Leptosiphon latisectus | CRPR 4.3 |
| Cantelow's lewisia | Lewisia cantelovii | CRPR 1B.2, USFS S, BLMS |
| Howell's lewisia | Lewisia cotyledon var. howellii | CRPR 3.2 |
| Bellinger's meadowfoam | Limnanthes floccosa ssp. bellingeriana | CRPR 1B.2, MSCS m, BLMS |
| Awl-leaved navarretia | Navarretia subuligera | CRPR 4.3 |
| Shasta snow-wreath | Neviusia cliftonii | CRPR 1B.2, USFS S, MSCS m, BLMS |
| Thread-leaved beardtongue | Penstemon filiformis | CRPR 1B.3, MSCS m, USFS S, BLMS |
| Narrow-petaled rein orchid | Piperia leptopetala | CRPR 4.3 |
| Bidwell's knotweed | Polygonum bidwelliae | CRPR 4.3 |
| Eel-grass pondweed | Potamogeton zosteriformis | CRPR 2.2, MSCS m |
| Pacific fuzzwort | Ptilidium californicum | USFS S, BLMS, S&M |
| Brownish beaked-rush | Rhynchospora capitellata | CRPR 2.2 |
| Sanford's arrowhead | Sagittaria sanfordii | CRPR 1B.2, MSCS m, BLMS |
| Marsh skullcap | Scutellaria galericulata | CRPR 2.2, MSCS m |
| Canyon Creek stonecrop | Sedum obtusatum ssp. paradisum | CRPR 1B.3, USFS S, BLMS |
| English Peak greenbriar | Smilax jamesii | CRPR 1B.3, USFS S, MSCS m, BLMS |
| Obtuse starwort | Stellaria obtusa | CRPR 4.3 |
| Slender false lupine | Thermopsis gracilis var. gracilis | CRPR 4.3 |
| Shasta huckleberry | Vaccinium sp., undescribed | Genetically distinct from coastal and Sierra Nevada populations; may warrant taxonomic consideration. |
| Oval-leaved viburnum | Viburnum ellipticum | CRPR 2.3 |

**Table 12-3. Plant Species of Concern with Potential to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)**

Notes:

[1] Status Codes

CRPR 1B = Plants rare, threatened, or endangered in California and elsewhere

CRPR 2 = Plants rare, threatened, or endangered in California but more common elsewhere

CRPR 3 = Plants for which more information is need—a review list

CRPR 4 = Plants of limited distribution—a watch list

CRPR Threat Ranks

0.1 = Seriously threatened in California

0.2 = Fairly threatened in California

0.3 = Not very threatened in California

Multi Species Conservation Strategy (MSCS) covered species

R = Recovery. Recover species' populations within the MSCS focus area to levels that ensure the species' long-term survival in nature.

r = Contribute to recovery. Implement some of the actions deemed necessary to recover species' populations within the MSCS focus area.

m = Maintain. Ensure that any adverse effects on the species that could be associated with implementation of CALFED actions will be fully offset through implementation of actions beneficial to the species (CALFED 2000c).

Key:

BLMS = BLM sensitive

CRPR = California Rare Plant Rank

USFS = U.S. Forest Service

USFS E = USFS Endemic Species

USFS S = USFS Sensitive Species

S&M = Survey and Manage Species

MSCS = Multi Species Conservation Strategy

The CNDDB was reviewed for records of special-status plant species in or near the Shasta Lake and vicinity portion of the primary study area. The CNDDB is a database consisting of historical observations of special-status plant species, wildlife species, and natural communities. The CNDDB is limited to reported sightings and is not a comprehensive list of special-status species that may occur in a particular area.

A search of the CNPS Electronic Inventory was also conducted. The Electronic Inventory allows users to query the database using a set of variable search criteria. The result of the search is a list of potentially occurring special-status plant species. The criteria used for the query included all CRPR 1A, 1B, 2, 3, and 4 plants (formerly CNPS) occurring in Shasta County in closed-cone coniferous forest, chaparral, cismontane woodland, lower montane coniferous forest, marshes and swamps, pebble plain, valley and foothill grasslands, riparian forest, riparian woodland, and riparian scrub habitats between the elevations of approximately 900 feet and 2,500 feet.

**Botanical Surveys** Because botanical studies are ongoing, detailed technical memoranda describing methods, results, and conclusions will be provided in the Final Environmental Impact Statement (FEIS).

NSR conducted several botanical surveys for special-status plant species in the Shasta Lake and vicinity portion of the primary study area. Botanical surveys were conducted in 2002, 2003, 2004, 2009, and 2010. A list of species observed during the surveys is provided as Attachment 2. Hickman (1993) was used as the standard reference for taxonomic nomenclature and identification. Special-status plant species detected during the surveys are discussed in more detail in Attachment 3.

The first botanical surveys were performed during 2002 along the Big Backbone and Squaw Creek arms. The surveys were conducted in accordance with the technical methods prescribed by Nelson (1994). In 2003, botanical surveys were conducted along 11 selected riverine reaches: Little Backbone Creek, Sugarloaf Creek, upper Sacramento River, middle Salt Creek, Salt Creek, Nosoni Creek, Dekkas Creek, Campbell Creek, Flat Creek, Ripgut Creek, and Potem Creek. The surveys were conducted in accordance with the technical methods prescribed by Nelson (1994). In 2004, botanical surveys were conducted at a series of randomly and nonrandomly selected locations. Nonrandomly selected sites were located throughout the Shasta Lake and vicinity portion of the primary study area (not including relocation areas) based on 2002 and 2003 survey results. Sites were selected based on the presence of unique habitat and ecological attributes, such as recently burned areas, unique geologic substrates, late-seral forests, and relatively rare plant series. Nonrandomly selected sites varied in size and often included several plant series types. Randomly selected sites were selected throughout the area using plant series polygons developed from previously completed vegetation mapping. Using geographic information systems, individual vegetation polygons were assigned a unique number, and 100 numbers (i.e., vegetation polygons) were then randomly selected.

Based on previous surveys resulting in discoveries of Shasta snow-wreath (*Neviusia cliftonii*) and Shasta huckleberry (*Vaccinium* sp. undescribed), specific surveys for these species were conducted in 2009 and 2010. These surveys were designed to identify potential habitat for and locate populations of these species outside of the proposed project area. Pedestrian surveys were conducted to search the focus areas identified. Using methods described in Lindstrand and Nelson (2006), potential survey areas were identified using soil and geologic information at known sites and choosing areas with those same characteristics. In addition, survey sites were identified using intuitive techniques, such as selecting areas with vegetative cover types similar to those of known populations and areas near known populations (regardless of vegetative cover).

To address potential project impacts and evaluate potential mitigation measures, a genetic study of the Shasta snow-wreath was conducted in 2009 and 2010. The goal of the genetic study was to determine (1) whether all Shasta snow-wreath populations are genetically identical and (2) whether there are several homogeneous population clusters or whether some other pattern is present.

Twenty-one of the 23 known Shasta snow-wreath sites were included in the study. The genetic study determined that the species is characterized by low genetic diversity and high levels of genetic differentiation (National Forest Genetics Laboratory 2010). No strong patterns were found between the Shasta snow-wreath populations and several physical and geographic variables, including soil, geology, population size, and geographic location. Although high levels of genetic differentiation and no strong population patterns are present, the genetic study found three general population clusters, providing insight and basic species information for potential mitigation planning.

Concurrently with the Shasta snow-wreath genetic study, a genetic study was conducted in 2009 and 2010 to determine whether the huckleberry is different genetically from red huckleberry and, if so, to determine if it warrants recognition as a new taxon. The genetic study determined that the species is genetically distinct from other huckleberry populations (National Forest Genetics Laboratory 2010). Based on the results of the genetic studies combined with phenotypic characteristics, this species warrants recognition as a new taxon. The Shasta huckleberry appears to be an uncommon and geographically restricted species.

In 2010, botanical surveys were conducted in all relocation areas including the dam footprint. The surveys were conducted in accordance with the technical methods prescribed by Nelson (1994).

Shasta County arnica (*Arnica venosa*), Northern clarkia (*Clarkia borealis* ssp. *borealis*), Butte County fritillary (*Fritillaria eastwoodiae*), Cantelow's lewisia (*Lewisia cantelovii*), Shasta snow-wreath, slender false lupine (*Thermopsis gracilis* var. *gracilis*), Shasta huckleberry, and oval-leaved viburnum (*Viburnum ellipticum*) were special-status plant species found both incidentally and during the surveys efforts.

One population of Shasta County arnica was found in ponderosa pine habitat south of Bridge Bay Resort along the Main Body and one population was found near the privately owned cabins on National Forest System lands in the Salt Creek inlet on the Sacramento Arm. Additionally, the USFS has located a population along the Sacramento Arm north of Slaughterhouse Island during surveys conducted in 2010 (Figures 12-3a and 12-3c).

One population of northern clarkia was found in hardwood-conifer/chaparral habitat near Bailey Cove on the McCloud Arm, and another population was found in hardwood-conifer/chaparral habitat in Sugarloaf Cove west of Beehive Point on the Sacramento Arm. Locations of northern clarkia found incidentally and during the surveys are shown on Figures 12-3c through 12-3d.

Surveys conducted by the USFS in 2010 located five populations of Butte County fritillary; two populations along Flat Creek and three populations along Ripgut Creek on the Pit Arm (Figure 12-3f).

One population of Cantelow's lewisia was discovered on a rock outcrop on the right bank of the upper Sacramento River near the Shasta Lake/upper Sacramento River transition zone. Additionally, the USFS has located three populations along Sacramento Arm near Elmore Mountain during surveys conducted in 2010 (Figures 12-3c).

Shasta snow-wreath is currently known from 23 locations, most of which occur at or near the periphery of Shasta Lake. Ten Shasta snow-wreath populations occur in habitats associated with limestone formations, and 13 occur in other habitat types. Most populations are associated with stream drainages or the lower portions of upland slopes. Of these, 13 Shasta snow-wreath populations were discovered during the botanical surveys along the McCloud Arm (south of Shasta Caverns and Keluche Creek), Pit Arm (Brock Creek, Ripgut Creek, Flat Creek, Stein Creek, and west of Stein Creek), and the Main Body (Blue Ridge east, Blue Ridge west, Blue Ridge middle, Cove Creek, south of Cove Creek, and Jones Valley). Locations of Shasta snow-wreath found incidentally and during the surveys are shown on Figures 12-3a through 12-f.

Slender false lupine populations were discovered in all portions of the primary study area, generally on low-gradient slopes. Locations of slender false lupine found during the surveys and incidentally are shown on Figures 12-3a through 12-3f.

Shasta huckleberry is currently known from 12 locations in the upper Spring Creek, Dry Fork, (little) Squaw Creek, Shoemaker Gulch, and Little Backbone Creek drainages, and from the vicinity of Bully Hill. All locations occur in the area historically known as the Copper Belt of Shasta County in the immediate vicinity of historic copper mining activities. Shasta huckleberry occurs at four locations in the SLWRI project area: (little) Squaw Creek, Shoemaker Gulch, Little Backbone Creek, and Horse Creek near Bully Hill. Locations of Shasta huckleberry found incidentally and during the surveys are shown on Figures 12-3a through 12-3f.

Two oval-leaved viburnum populations were found during the surveys. One population was found in a forested upland slope west of Pine Point Campground along the McCloud Arm and a second population was found in chaparral habitat at Jones Valley along the Pit Arm near the Clikapudi Trail. Locations of oval-leaved viburnum found incidentally and during the surveys are shown on Figures 12-3d and 12-3f.

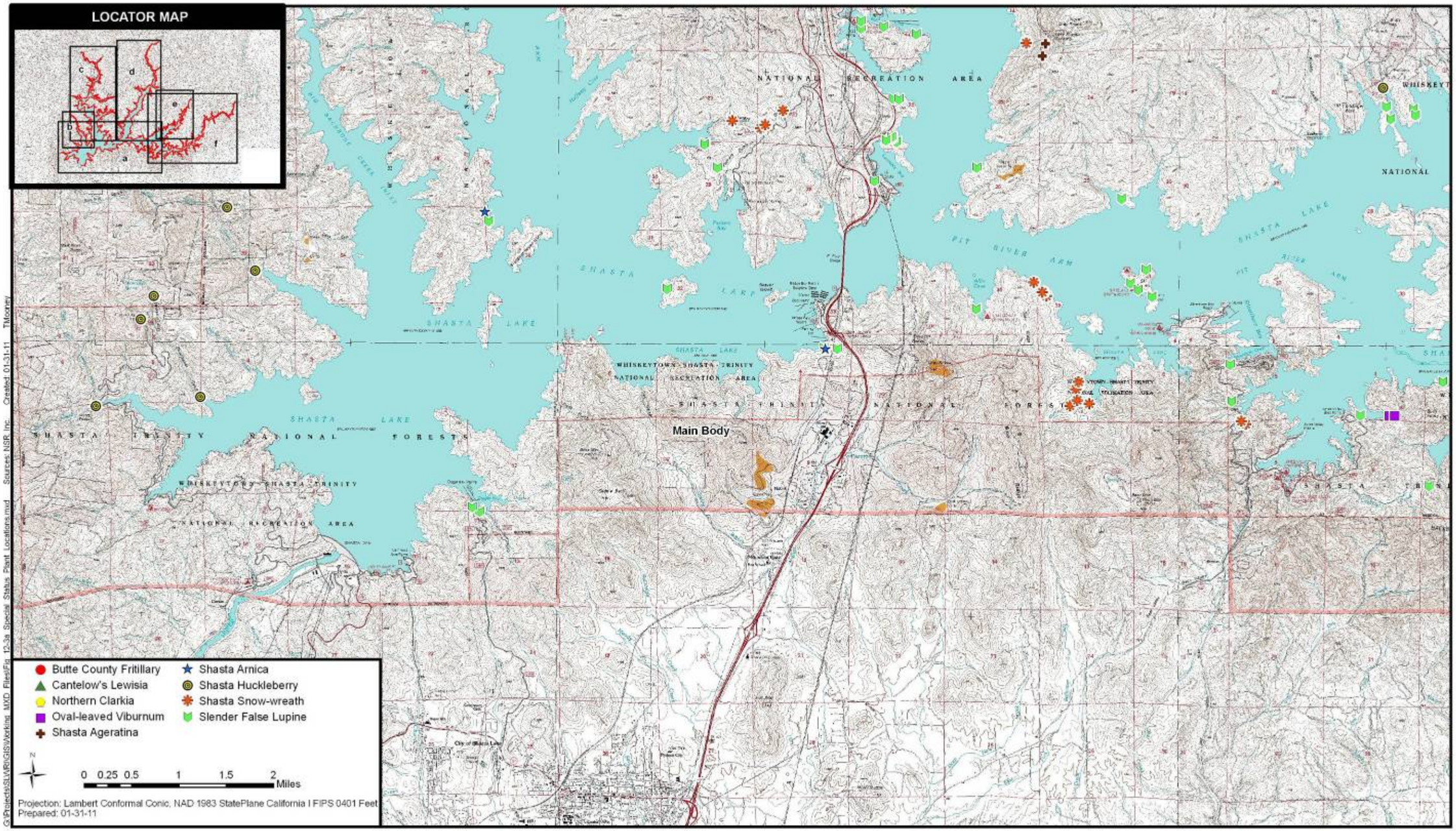



**Figure 12-3a. Special-Status Plant Species Occurring in Shasta Lake and Vicinity**

*This page left blank intentionally.*

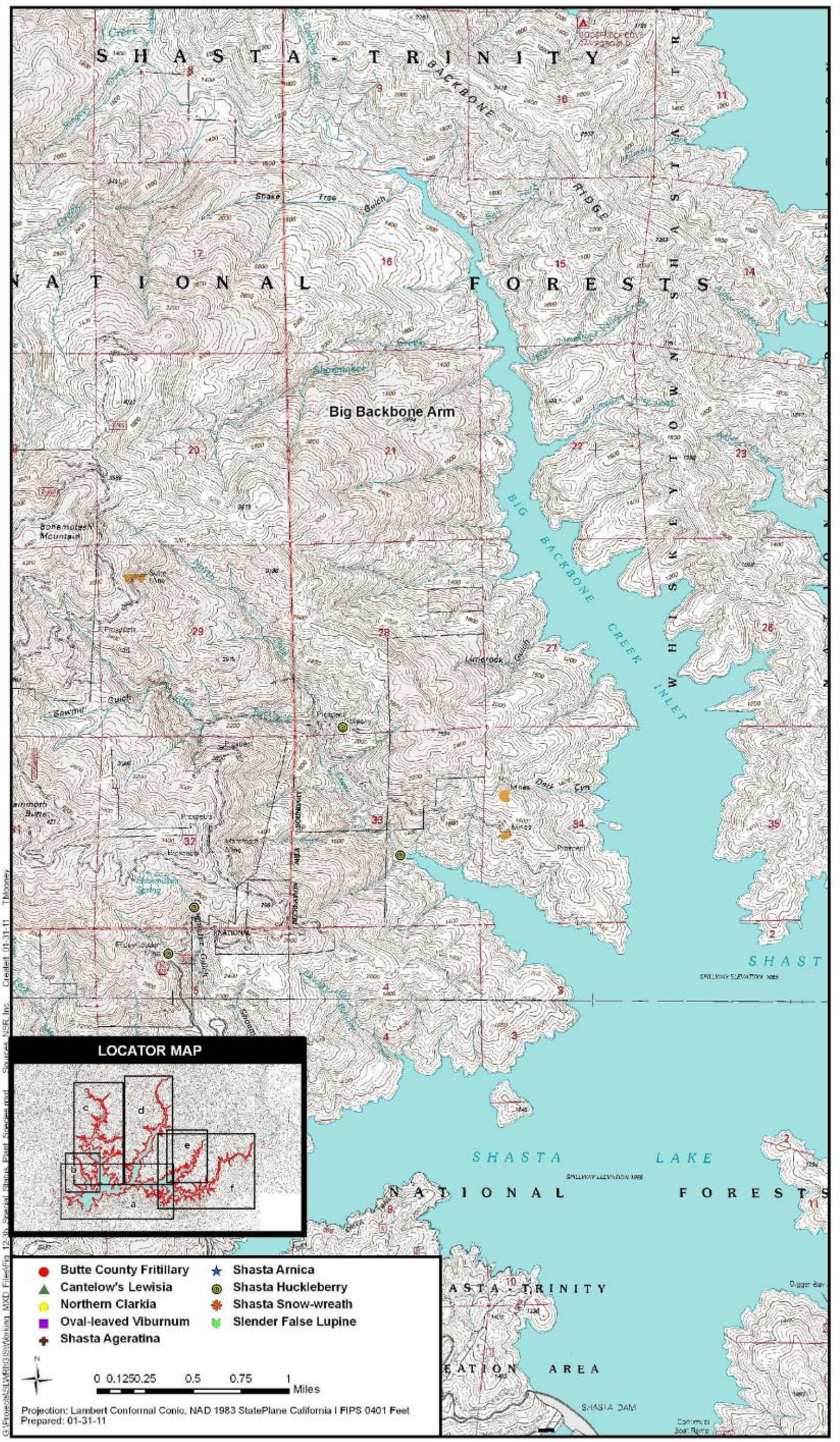



**Figure 12-3b. Special-Status Plant Species Occurring in Shasta Lake and Vicinity**

*This page left blank intentionally.*

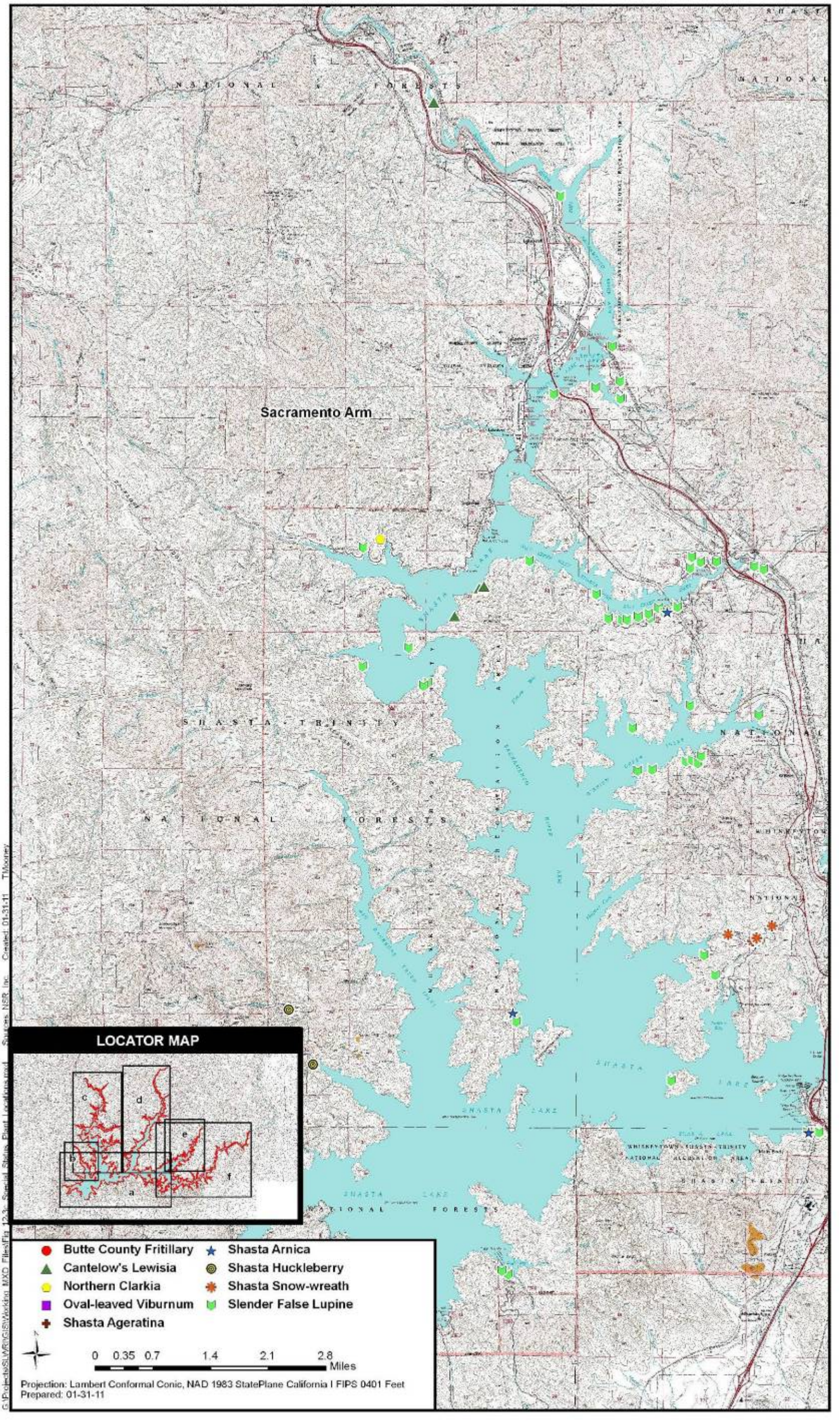



**Figure 12-3c. Special-Status Plant Species Occurring in Shasta Lake and Vicinity**

*This page left blank intentionally.*

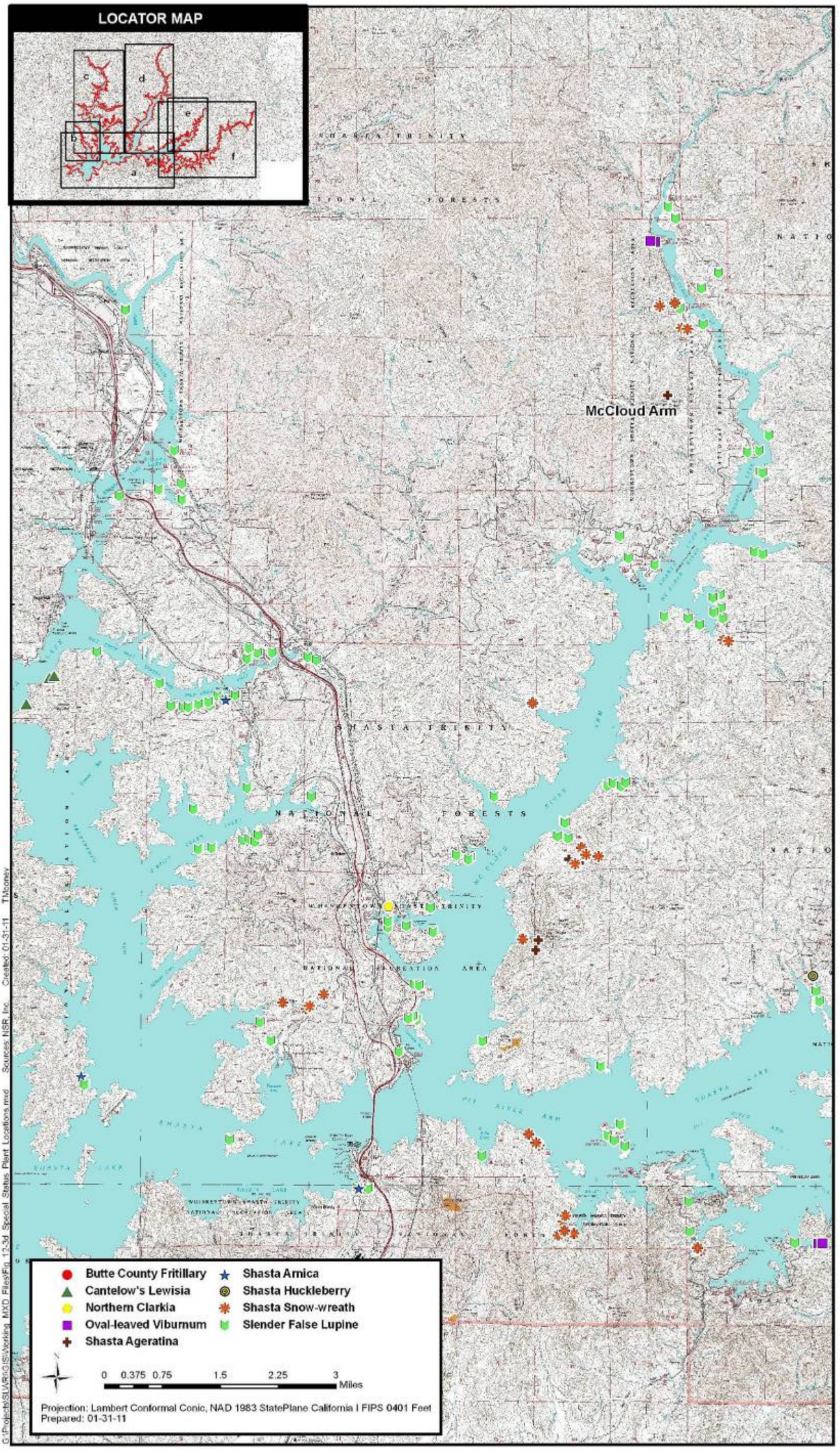



**Figure 12-3d. Special-Status Plant Species Occurring in Shasta Lake and Vicinity**

*This page left blank intentionally.*

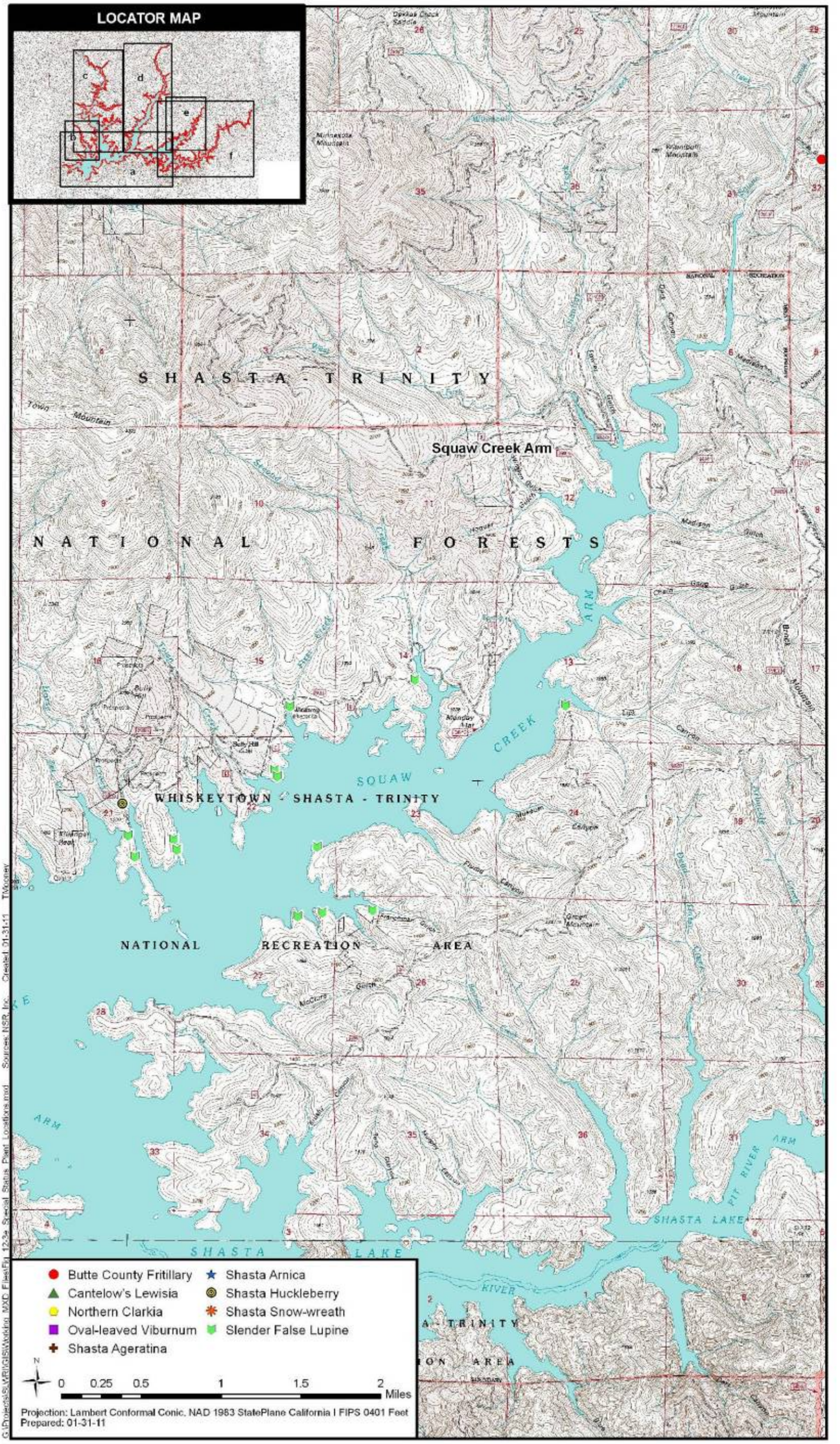



**Figure 12-3e. Special-Status Plant Species Occurring in Shasta Lake and Vicinity**

*This page left blank intentionally.*

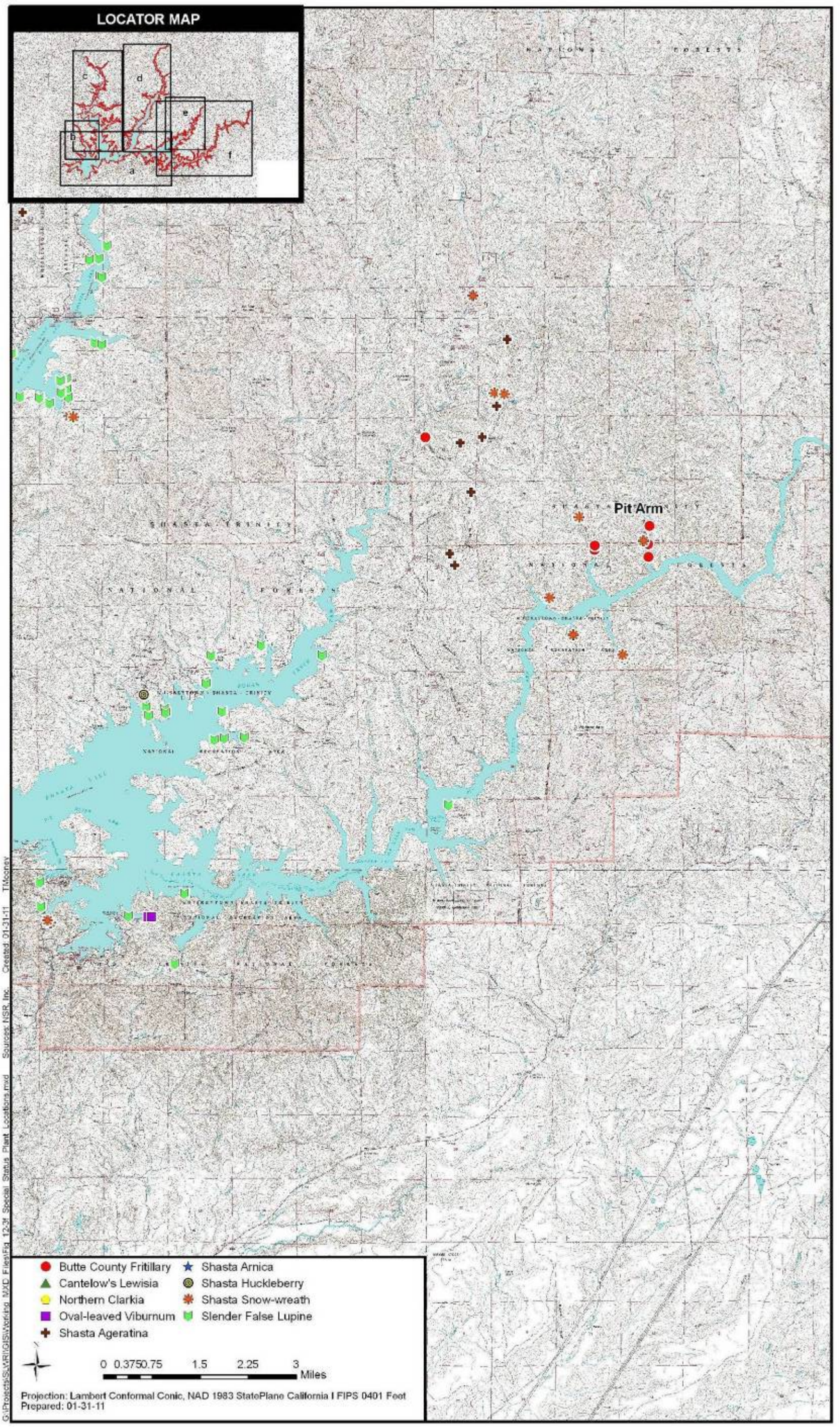



**Figure 12-3f. Special-Status Plant Species Occurring in Shasta Lake and Vicinity**

*This page left blank intentionally.*

### *Upper Sacramento River (Shasta Dam to Red Bluff)*

Based on review of CNDDB and CNPS database searches, a USFWS list of species that could be potentially affected in this portion of the primary study area, and previously prepared biological reports for the area, 25 special-status plant species were identified as possibly occurring in the primary study area between Shasta Dam and RBDD, and thus their potential to occur in this portion of the study area was evaluated further. These special-status plant species, along with the legal status, habitat, and potential for occurrence of each species, are provided in Table 12-4.

Sixteen of the special-status plant species listed in Table 12-4 have the potential to occur within habitat present along the Sacramento River between Shasta Dam and RBDD. Many of these species, such as Bogg's Lake hedge hyssop (*Gratiola heterosepala*; State endangered, MSCS m, CNPS 1B), Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii*; MSCS m, CNPS 1B), Ahart's paronychia (*Paronychia ahartii*; MSCS m, CNPS 1B), dwarf downingia (*Downingia pusilla*; CNPS 2), Greene's legenere (*Legenere limosa*; MSCS m, CNPS 1B), Henderson's bent grass (*Agrostis hendersonii*; MSCS m, CNPS 3), Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*; CNPS 1B), and slender Orcutt grass (*Orcuttia tenuis*; Federal endangered, state endangered, MSCS m, CNPS 1B), typically occur in vernal pools, which are generally not present within the active floodplain of regulated rivers in the extended study area. Other special-status plants, however, could occur in the extended study area in the freshwater marshes, swamps, and riparian woodlands that are found along the river corridor. These species include fox sedge (*Carex vulpinoidea*; CNPS 2), rose mallow (*Hibiscus lasiocarpus*; MSCS m, CNPS 2), and silky cryptantha (*Cryptantha crinita*; USFS SM, CNPS 1B). The remaining five species may occur in annual grassland, chaparral, cismontane woodland, and lower montane coniferous forest vegetation communities along the river corridor, including adobe-lily (*Fritillaria pluriflora*; MSCS m, CNPS 1B), Butte County fritillary (*Fritillaria eastwoodiae*; USFS S, CNPS 3), dubious pea (*Lathyrus sulphureus* var. *agillaceous*; CNPS 3), mountain lady's slipper (*Cypripedium fasciculatum*; USFS SM, CNPS 4), and oval-leaved viburnum (*Viburnum ellipticum*; CNPS 2).

Of the special-status species that could occur along the upper Sacramento River, four are known to occur along the edge of the Sacramento River channel, or along a Sacramento River tributary within 0.2 mile of the river proper, and their establishment and reproduction could potentially be affected by changes in flow regime: fox sedge, silky cryptantha, rose mallow, and Ahart's paronychia (CNDDB 2007, University of California 2011).

**Table 12-4. Special-Status Plant Species Known or with Potential to Occur in the Primary Study Area, Along the Sacramento River from Shasta Dam to Red Bluff Diversion Dam**

| Species | Legal Status[1] | | | | | Habitat and Blooming Period | Potential for Occurrence |
|---|---|---|---|---|---|---|---|
| | USFWS | DFG | MSCS | USFS | CNPS | | |
| Shasta ageratina *Ageratina shastensis* | | – | | E | 4 | Rocky carbonate outcrops in chaparral and lower montane coniferous forest; 1,300 – 5,900 feet elevation. Blooms June – October. | Could occur near Shasta Dam if suitable outcrops are present. Potential is low because most of the study area is below species' known elevation range. |
| Henderson's bent grass *Agrostis hendersonii* | – | – | m | – | 3 | Mesic sites in valley and foothill grassland, vernal pools; 230 – 1,000 feet elevation. Blooms April – May. | Could occur along the Sacramento River if suitable vernally mesic habitat is present. |
| Shasta County arnica *Arnica venosa* | – | – | – | E | 4 | Cismontane woodlands and lower montane coniferous forests, often in disturbed areas and roadcuts; 1,300 – 4,900 feet elevation. Blooms May – July. | Could occur along the Sacramento River and tributaries within the study area. Potential is low because most of the study area is below species' known elevation range. |
| Fox sedge *Carex vulpinoidea* | – | – | – | – | 2 | Freshwater marshes and swamps and riparian woodland; 100 – 4,000 feet elevation. Blooms May – June. | Could occur in suitable habitat along the Sacramento River. |
| Silky cryptantha *Cryptantha crinita* | – | – | m | – | 1B | Gravelly streambeds within cismontane woodland, lower montane coniferous forest, riparian forest, riparian woodland, valley and foothill grassland; 275 – 4,000 feet elevation. Blooms April – May. | Could occur along the Sacramento River and tributaries within the study area. |
| Clustered lady's slipper *Cypripedium fasciculatum* | – | – | – | SM | 4 | Lower montane coniferous forest, North Coast coniferous forest; often in serpentinite seeps or on streambanks; 300 – 8,000 feet elevation. Blooms March – July. | Unlikely; no coniferous forest known in the study area. |
| Mountain lady's slipper *Cypripedium montanum* | – | – | – | SM | 4 | Broadleaved upland forest, cismontane woodland, lower montane coniferous forest, North Coast coniferous forest; 500 – 7,000 feet elevation. Blooms March – July. | Could occur at Shasta Dam or along the Sacramento River and tributaries. |
| Dwarf downingia *Downingia pusilla* | – | – | – | – | 2 | Mesic sites in valley and foothill grassland, vernal pools. Blooms March – May. | Could occur along the Sacramento River if suitable vernally mesic habitat is present. |

**Table 12-4. Special-Status Plant Species Known or with Potential to Occur in the Primary Study Area, Along the Sacramento River from Shasta Dam to Red Bluff Diversion Dam (contd.)**

| Species | Legal Status[1] | | | | | Habitat and Blooming Period | Potential for Occurrence |
|---|---|---|---|---|---|---|---|
| | USFWS | DFG | MSCS | USFS | CNPS | | |
| Butte County fritillary *Fritillaria eastwoodiae* | – | – | – | S | 3 | Openings and sometime serpentine areas in chaparral, cismontane woodland, and lower montane coniferous forest; 160 – 4,900 feet elevation. Blooms March – June. | Could occur along the Sacramento River and tributaries within the study area. |
| Adobe-lily *Fritillaria pluriflora* | – | – | m | – | 1B | Chaparral, cismontane woodland, valley and foothill grassland; often in adobe soils; 200 – 2,300 feet elevation. Blooms February – April. | Could occur at Shasta Dam and along the Sacramento River. |
| Bogg's Lake hedge hyssop *Gratiola heterosepala* | – | E | m | – | 1B | Marshes and swamps, vernal pools; 30 – 8,000 feet elevation. Blooms April – August. | Could occur along the Sacramento River and tributaries. |
| Rose mallow *Hibiscus lasiocarpus* | – | – | m | – | 2 | Freshwater marshes and swamps. | Could occur along the Sacramento River and tributaries. |
| Ahart's dwarf rush *Juncus leiospermus* var. *ahartii* | – | – | m | – | 1B | Mesic sites in valley and foothill grassland; 100 – 300 feet elevation. Blooms March – May. | Could occur along the Sacramento River if suitable vernally mesic habitat is present. Shasta Dam is higher than species' known elevation range. |
| Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus* | – | – | – | – | 1B | Vernally mesic sites in chaparral, cismontane woodland, meadows and seeps, valley and foothill grassland, vernal pools; 100 –3,350 feet elevation. Blooms March – May. | Could occur at Shasta Dam or along the Sacramento River if suitable vernally mesic habitat is present. |
| Dubious pea *Lathyrus sulphureus* var. *argillaceous* | – | – | – | – | 3 | Cismontane woodland, lower montane coniferous forest, upper montane coniferous forest; 500 – 1,000 feet elevation. Blooms in April. | Could occur at Shasta Dam and along the Sacramento River. |
| Greene's legenere *Legenere limosa* | – | – | m | – | 1B | Vernal pools; 1 – 3,000 feet elevation. Blooms April – June. | Could occur along Sacramento River if suitable vernal pool habitat is present. |

**Table 12-4. Special-Status Plant Species Known or with Potential to Occur in the Primary Study Area, Along the Sacramento River from Shasta Dam to Red Bluff Diversion Dam (contd.)**

| Species | Legal Status[1] | | | | | Habitat and Blooming Period | Potential for Occurrence |
|---|---|---|---|---|---|---|---|
| | USFWS | DFG | MSCS | USFS | CNPS | | |
| Cantelow's lewisia *Lewisia cantelovii* | – | – | – | S | 1B | Mesic granitic sites within broadleaved upland forest, chaparral, cismontane woodland, and lower montane coniferous forest; 1,250 – 4,500 feet. Sometimes in serpentinite seeps. Blooms May – October. | Could occur in the Shasta Dam area. The remainder of the study area is below species' known elevation range. |
| Bellinger's meadowfoam *Limnanthes floccosa* ssp. *bellingeriana* | – | – | m | – | 1B | Mesic sites in cismontane woodland, meadows and seeps; 950 – 3,600 feet elevation. Blooms April – June. | Could occur at Shasta Dam. Potential along Sacramento River is low because majority of study area is below species known elevation range. |
| Shasta snow wreath *Neviusia cliftonii* | – | – | m | S | 1B | Carbonate substrates in lower montane coniferous forest and riparian woodland; 1,000 – 1,600 feet elevation. Blooms May – June. | Could occur in Shasta Dam area. Unlikely to occur along Sacramento River because study area is lower than species known elevation range. |
| Slender orcutt grass *Orcuttia tenuis* | E | E | m | – | 1B | Vernal pools; 100 – 6,000 feet elevation. Blooms May – October. | Could occur along the Sacramento River if suitable vernal pool habitat is present. Federally designated critical habitat for this species occurs east of the Sacramento River, east of Cottonwood (Units 3A and 3B) and northeast of Anderson (Units 2C and 2D). |
| Ahart's paronychia *Paronychia ahartii* | – | – | m | – | 1B | Cismontane woodland, valley and foothill grassland, vernal pools; 100 – 1,700 feet elevation. Blooms March – June. | Could occur at Shasta Dam and along the Sacramento River. |
| Pacific fuzzwort *Ptilidium californicum* | – | – | – | SM | – | An epiphytic on bark at the base of standing mature to old-growth trees or recently fallen logs; rarely on other organic substrates such as decaying logs and stumps, or humus covering boulders; 1,275 – 5,725 feet elevation. | Could occur along the Sacramento River and tributaries within the study area. Potential is low because most of the study area is below species' known elevation range. |

**Table 12-4. Special-Status Plant Species Known or with Potential to Occur in the Primary Study Area, Along the Sacramento River from Shasta Dam to Red Bluff Diversion Dam (contd.)**

| Species | Legal Status[1] | | | | | Habitat and Blooming Period | Potential for Occurrence |
|---|---|---|---|---|---|---|---|
| | USFWS | DFG | MSCS | USFS | CNPS | | |
| Canyon Creek stonecrop *Sedum paradisum* | – | – | – | S | 1B | Granitic, rocky areas in broadleafed upland forest, chaparral, lower montane coniferous forest, subalpine coniferous forest; 980 – 6,100 feet elevation. Blooms May – June. | Could occur along the Sacramento River and tributaries within the study area. Potential is low because most of the study area is below species' known elevation range. |
| English Peak greenbriar *Smilax jamesii* | – | – | m | S | 1B | Found along streambanks and lake margins in broadleafed upland forest, lower montane, upper montane, and north coast coniferous forests, and marshes and swamps; 1,600 – 8,200 feet elevation. Blooms May – July, rarely through August. | Could occur along the Sacramento River and tributaries within the study area. Potential is low because most of the study area is below species' known elevation range. |
| Oval-leaved viburnum *Viburnum ellipticum* | – | – | – | – | 2 | Chaparral, cismontane woodland, lower montane coniferous forest; 800 – 4,600 feet elevation. Blooms May – June. | Could occur at Shasta Dam and along the Sacramento River. |

*Sources: CNDDB 2007, CNPS 2011, USFS 2007, USFWS 2007*

Notes:

[1] Legal Status

U.S. Fish and Wildlife Service Federal Listing Categories:

| | |
|---|---|
| T | Threatened |
| E | Endangered |

U.S. Forest Service Listing Categories:

| | |
|---|---|
| E | Endemic to specific region or National Forest |
| S | Sensitive |
| SM | Species considered rare or threatened and recommended for survey and management per Northwest Forest Plan 2002 |

MSCS (Multi-Species Conservation Strategy) Listing Categories:

| | |
|---|---|
| R | recovery |
| r | contribute to recovery |
| m | maintain |

California Department of Fish and Game State Listing Categories:

| | |
|---|---|
| R | California Rare |
| T | California Threatened |
| E | California Endangered |

California Native Plant Society Listing Categories:

| | |
|---|---|
| 1B | Plants rare, threatened, or endangered in California and elsewhere |
| 2 | Plants rare, threatened, or endangered in California but more common elsewhere |
| 3 | Plants for which more information is needed—a review list |
| 4 | Plants of limited distribution—a watch list |

### *Lower Sacramento River and Delta*

Most of the special-status plant species listed in Table 12-4 have the potential to occur within the extended study area (lower Sacramento River and Delta and CVP/SWP service areas). Numerous additional special-status plant species could occur in the extended study area. Attachment 4 of the *Botanical Resources and Wetlands Technical Report* contains comprehensive lists of all sensitive plant species in the extended study area that have been reported to the

CNDDB, or that otherwise have the potential to occur in the extended study area.

A number of special-status plant species could be affected in the lower Sacramento River and Delta by changes in hydrology (CALFED 2000c). These include species associated with vernal pool, riparian, marsh, and aquatic plant communities; and several other species with restricted distributions on or near channel banks, active floodplains, flood bypasses, and Delta waterways. These assemblages of special-status species are described below.

**Species of Vernal Pool Communities** In addition to species that are potentially present in the primary study area (Table 12-4), special-status plant species that may be associated with vernal pools along the lower Sacramento River and in the Delta region include alkali milk-vetch (*Astragalus tener* var. *tener*; MSCS r, CNPS 1B), brittlescale (*Atriplex depressa*; MSCS m, CNPS 1B), Hoover's spurge (*Chamaesyce hooveri*; Federal threatened, MSCS m, CNPS 1B), Contra Costa goldfields (*Lasthenia conjugens*; Federal endangered, MSCS m, CNPS 1B), hairy orcutt grass (*Orcuttia pilosa*; Federal endangered, MSCS m, CNPS 1B), slender Orcutt grass (*Orcuttia tenuis*; Federal threatened, MSCS m, CNPS 1B), bearded popcornflower (*Plagoibothrys hystriculus*; CNPS 1B), Delta woolly-marbles (*Psilocarphus brevissimus* var. *multiflorus*; CNPS 4), Crampton's tuctoria (*Tuctoria mucronata*; Federal and State endangered, MSCS r, CNPS 1B), and Greene's tuctoria (*Tuctoria greenei*; Federal endangered, MSCS m, CNPS 1B). The primary threats affecting most of these species at multiple locations are habitat loss because of development, nonnative species, and incompatible grazing practices. Additional threats affecting some of these species at one or more location include game management practices (e.g., inundation of land for waterfowl during the growing season), off-road vehicle use and trampling, incompatible agricultural practices, and hydrological alterations.

**Species of Riparian and Marsh Communities** In addition to species considered potentially present in the primary study area (Table 12-4 of the *Botanical Resources and Wetlands Technical Report*), special-status plant species associated with riparian and marsh communities along the lower Sacramento River or in the Delta region include bristly sedge (*Carex comosa*; MSCS r, CNPS 2), Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*; Federal endangered, MSCS R, CNPS 1B), Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*; Federal endangered, State rare, MSCS R, CNPS 1B), Delta button-celery (*Eryngium racemosum*; MSCS r, CNPS 1B), Northern California black walnut (*Juglans hindsii*; MSCS r, CNPS 1B), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*; MSCS r, CNPS 1B), Mason's lilaeopsis (*Lilaeopsis masonii*; MSCS R, CNPS 1B), Delta mudwort (*Limosella subulata*; MSCS r, CNPS 2), Sanford's arrowhead (*Sagittaria sanfordii*; MSCS m, CNPS 1B), Marsh skullcap (*Scutellaria galericulata*; MSCS m, CNPS 2), blue skullcap (*Scutellaria lateriflora*; MSCS m, CNPS 2), and Suisun Marsh aster (*Symphytotrichum lentum*; CNPS 1B) (CNDDB 2007, CNPS 2011). The

primary threats affecting these species are habitat loss, competition from nonnative species, and alterations to hydrology (including trenching and diking). Additional threats include grazing and trampling, installation of riprap, and anthropogenic disturbances (e.g., off-road vehicles; road, utility, and levee maintenance).

**Species of Aquatic Communities** Eel-grass pondweed (P*otamogeton zosteriformis*; MSCS m, CNPS 2), a submerged aquatic plant of assorted freshwater habitats is rare in California but more common elsewhere (CNPS 2011). Overall, the distribution, abundance, and threats affecting this species in California are not well known.

#### *CVP/SWP Service Areas*

Special-status plants are not likely to occur in a substantial portion of the CVP and SWP service areas because the agricultural and urban land uses tend to preclude suitable habitat for most native species. Although agricultural and developed land uses account for most of the CVP and SWP service areas, a portion of these areas still remains in natural vegetation, Because of the large size of the CVP and SWP service areas, this natural vegetation is distributed over a wide range of climate and soils, and is varied in structure and species composition. Consequently, a large number of special-status plant species has the potential to occur in the natural vegetation that remains within the CVP and SWP service areas. (See the *Botanical Resources and Wetlands Technical Report*.)

### 12.1.3 Invasive Species

#### *Shasta Lake and Vicinity*

Nonnative plant species introduced to the region by early settlers are of concern in the Shasta Lake and vicinity portion of the study area. When plants that evolved in one region of the globe are moved by humans to another region, a few flourish, crowding out native vegetation and wildlife that feed on the native species. Some invasive plants can even change ecosystem processes such as hydrology, fire regimes, and soil chemistry. These invasive plants have a competitive advantage because they are no longer controlled by their natural predators and can quickly spread. In California, approximately 3 percent of the plant species growing in the wild are considered invasive, but they inhabit a much greater proportion of the landscape (Cal-IPC 2007).

Plant pests are defined by law, regulation, and technical organizations, and are regulated by many different bodies, including the California Department of Food and Agriculture (CDFA), U.S. Department of Agriculture, and the California Invasive Plant Council (Cal-IPC). CDFA uses an action-oriented pest-rating system. The low rating assigned to a pest by CDFA does not necessarily mean that the pest is not a problem; rather, the rating system is meant to prioritize response by CDFA and county agricultural commissioners. Plants on CDFA's highest priority "A" list are defined as plants "of known

economic importance subject to state-county enforced action involving eradication, quarantine regulation, containment, rejection or other holding action."

Cal-IPC has developed a list of plant pests specific to California wildlands. The Cal-IPC list is based on information submitted by land managers, botanists, and researchers throughout the state and on published sources. To determine plant pests potentially occurring in the Shasta Lake and vicinity portion of the primary study area, this list was reviewed and local agencies (BLM, USFS, California Department of Transportation, and Shasta County Department of Agriculture) were contacted to gather knowledge of known weed locations (Table 12-5). Incidental observations of noxious weeds by NSR biologists and botanists were also recorded. Attachment 5 describes each weed source location, the potential mode of spread, and the risk of spread at each of the known sites.

Management actions have been required to prevent the loss of habitat caused by some of the more invasive exotic species that outcompete native vegetation. However, these management actions have been limited and have been confined primarily to areas adjacent to campgrounds and USFS facilities.

**Table 12-5. Nonnative Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area**

| Common Name | Scientific Name | Cal-IPC Rating[1] | CDFA Ranking[2] | Habitat |
|---|---|---|---|---|
| Tree of heaven | Ailanthus altissima | Moderate | None | Grassland, oak woodland, riparian |
| Slender wild oats | Avena barbata | Moderate | None | Coastal scrub, grassland, oak woodland, forest |
| Common wild oats | Avena fatua | Moderate | None | Coastal scrub, grassland, oak woodland, forest |
| Rattlesnake grass | Briza maxima | Limited | None | Grassland |
| Ripgut brome | Bromus diandrus | Moderate | None | Dunes, scrub, grassland, woodland, forest |
| Soft brome | Bromus hordeaceus | Limited | None | Grassland, sage brush, serpentine soils |
| Red brome | Bromus madritensis ssp. rubens | High | None | Interior scrub, woodlands, grassland |
| Cheatgrass | Bromus tectorum | High | None | Interior scrub, woodlands, grassland |
| Lenspod whitetip | Cardaria chalapensis | Moderate-ALERT | B | Central Valley wetlands |
| Italian thistle | Carduus pycnocephalus | Moderate | None | Forest, scrub, grasslands, woodlands. |

**Table 12-5. Nonnative Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)**

| Common Name | Scientific Name | Cal-IPC Rating[1] | CDFA Ranking[2] | Habitat |
|---|---|---|---|---|
| White knapweed | Centaurea diffusa | Moderate | A | Great Basin scrub, coastal prairie |
| Spotted knapweed | Centaurea maculosa | High | A | Riparian, grassland, wet meadows, forests |
| Yellow star-thistle | Centaurea solstitialis | High | C | Grassland, woodlands, occasionally riparian |
| Squarrose knapweed | Centaurea virgata var. squarrosa | Moderate | A | Scrub, grassland, pinyon-juniper woodland |
| Rush skeleton weed | Chondrilla juncea | Moderate | A | Grassland |
| Canada thistle | Cirsium arvense | Moderate | B | Grassland, riparian areas, forests |
| Bull thistle | Cirsium vulgare | Moderate | None | Riparian areas, marshes, meadows |
| Field bindweed | Convolvulus arvensis | Evaluated, not listed | C | Agricultural weed |
| Bermuda grass | Cynodon dactylon | Moderate | C | Riparian scrub, common landscape weed |
| Scotch broom | Cystis scoparius | High | C | Coastal scrub, oak woodland |
| Longbeak stork's bill | Erodium botrys | Evaluated, not listed | None | Many upland habitats |
| Redstem stork's bill | Erodium cicutarium | Limited | None | Many upland habitats |
| Leafy spurge | Euphorbia esula | High-ALERT | A | Forests, woodlands, juniper forests |
| Fig | Ficus carica | Moderate | None | Riparian woodland |
| Fennel | Foeniculum vulgare | High | None | Grassland, scrub |
| French broom | Genista mospessulana | High | C | Coastal scrub, oak woodland, grassland |
| English ivy | Hedera helix | High | None | Coastal forest, riparian areas |
| Mediterranean barley, foxtail | Hordeum marinum, H. murinum | Moderate | None | Grassland |
| Common St. John's wort | Hypericum perforatum | Moderate | C | Many habitats, disturbed |
| Dyer's woad, Marlahan mustard | Isatis tinctoria | Moderate | B | Great Basin scrub and grassland |
| Dalmation toadflax | Linaria dalmatica | Moderate | A | Grassland, forest clearings |
| Italian ryegrass | Lolium multiflorum | Moderate | None | Grassland, oak woodlands, pinyon-juniper woodland |
| Oleander | Nerium oleander | Evaluated, not listed | None | Riparian areas |
| Pokeweed | Phytolacca americana | None | None | Riparian forest, riparian woodland |

**Table 12-5. Nonnative Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)**

| Common Name | Scientific Name | Cal-IPC Rating[1] | CDFA Ranking[2] | Habitat |
|---|---|---|---|---|
| Black locust | Robinia pseudoacacia | Limited | None | Riparian areas, canyons |
| Himalayan blackberry | Rubus discolor | High | None | Riparian areas, marshes, oak woodlands |
| Cutleaf blackberry | Rubus laciniatus | None | None | Riparian areas, marshes, oak woodlands |
| Curly dock | Rumex crispus | Limited | None | Grassland, vernal pools, meadows, riparian |
| Tansy ragwort | Senecio jacobaea | Limited | B | Grassland, riparian |
| Johnsongrass | Sorghum halepense | None | C | Disturbed sites, moist places |
| Spanish broom | Spartium junceum | High | None | Coastal scrub, grassland, wetlands, oak woodland, forests |
| Medusa-head | Taeniatherum caput-medusae | High | C | Grassland, scrub, woodland |
| Spreading hedgeparsley | Torilis arvensis | Moderate | None | Widespread |
| Common mullein | Verbascum thapsus | Limited | None | Meadows, riparian, sagebrush, pinyon-juniper woodland |
| Periwinkle | Vinca major | Moderate | None | Riparian, oak woodlands, coastal scrub |
| Rat-tail fescue | Vulpia myuros | Moderate | None | Coastal sage scrub, chaparral |

Notes:

[1] Cal-IPC Inventory Categories:

- High — Severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Widely distributed ecologically.
- Moderate — Substantial and apparent ecological impacts on physical processes, plant and animal communities, and vegetation structure. Reproductive biology and other attributes are conducive to moderate to high rates of dispersal, although generally dependent on ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.
- Limited — Invasive but ecological impacts are minor. Reproductive biology and other attributes result in moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but may be locally persistent and problematic (Cal-IPC 2007).

[2] CDFA Pest Ratings of Noxious Weed Species and Noxious Weed Seed

A – Eradication, containment, rejection, or other holding action at the state-county level.

B – Intensive control or eradication, where feasible, at the county level.

C – Control or eradication as local conditions warrant, at the county level.

Q – Rating as "A" is pending at the state or county level.

Key:

Cal-IPC = California Invasive Plant Council

CDFA = California Department of Food and Agriculture

### *Upper Sacramento River (Shasta Dam to Red Bluff) and Lower Sacramento River and Delta*

A number of nonnative species have been introduced and become abundant in the riparian areas and marshes (fresh emergent wetlands) of the Sacramento Valley and Delta (Hunter et al. 2003). Several of these invasive nonnatives, including red sesbania (*Sesbania punicea*), Himalayan blackberry (*Rubus discolor*), giant reed (*Arundo donax*), and perennial pepperweed (*Lepidium latifolium*), form dense, monotypic stands that preclude the establishment of native species (Bossard et al. 2000). In general, these species displace native plants, reduce biodiversity, alter river flows, and reduce wildlife habitat values. Table 12-6 lists the most problematic of those species in Sacramento Valley and Delta riparian areas and marshes—invasive species rated "high" by Cal-IPC; these species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure (Cal-IPC 2006).

**Table 12-6. Cal-IPC High-Rated Invasive Plants of Sacramento Valley and Delta Riparian and Marsh Habitats**

| Scientific Name<br>Common Name | Cal-IPC Rating | Primary Riparian/ Marsh Habitat(s) | Plant Type |
|---|---|---|---|
| *Arundo donax*<br>Giant Reed | H | Riparian Forest/Scrub | Perennial Grass |
| *Cortaderia selloana*<br>Pampas Grass | H | Riparian Scrub | Perennial Grass |
| *Foeniculum vulgare*<br>Fennel | H | Riparian Scrub | Perennial Herb |
| *Lepidium latifolium*<br>Perennial Pepperweed | H | Tidal and Nontidal Marsh, Riparian Scrub | Perennial Herb |
| *Lythrum salicaria*<br>Purple Loosestrife | H | Tidal And Nontidal Marsh | Perennial Herb |
| *Rubus armeniacus (= R. discolor)*<br>Himalayan Blackberry | H | Riparian Forest and Scrub, Nontidal Marsh | Vine |
| *Sesbania punicea*<br>Red Sesbania | H, A | Riparian Forest and Scrub | Tree |
| *Tamarix chinensis, T. gallica, T. parviflora, T. ramosissima*<br>Chinese Tamarisk, French Tamarisk, Small Flower Tamarisk, Salt Cedar | H | Riparian Forest and Scrub | Tree, Shrub |

*Source: Cal-IPC 2006*

Notes:

Cal-IPC Inventory Ratings:

A = Alert – Plants with the potential to spread explosively; infestations currently small and localized.

H = High – These species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

### 12.1.4 Waters of the United States, Including Wetlands, in Shasta Lake and Vicinity

NSR delineated waters of the United States (wetlands and other waters under Federal jurisdiction) in the impoundment area around the perimeter of Shasta Lake, and on public lands in the relocation areas. Cumulatively, 29,992 acres of Federal jurisdictional waters of the United States occur along the impoundment area, including Shasta Lake at full pool. Wetlands, totaling 25 acres, consist of fresh emergent/riparian wetland, intermittent swale, riparian wetland, seasonal wetland, seep/spring wetland, and vegetated ditch. Other waters, totaling 29,967 acres consist of ephemeral, intermittent, and perennial streams, roadside ditches, seep/spring other waters and lacustrine. Some demolition and construction activities associated with the impoundment area and relocation areas will extend into Shasta Lake below the existing full pool elevation. Therefore, the acreage of the surface of Shasta Lake has been included with the acreage of waters of the United States for the impoundment area. Acreage totals for relocation areas will be provided in the FEIS.

The delineation was conducted in accordance with the routine onsite method identified in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) (Corps Manual) and the *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (USACE 2006) (Arid West Manual). Each on site wetland determination was based on field observations of soil, vegetation, and hydrologic characteristics. Delineation of "other waters" was based on the presence of an ordinary high-water mark (OHWM) and whether the feature is tributary to waters of the United States. Data points were characterized and documented for 10 percent of all feature types along the perimeter of Shasta Lake. In each relocation area, at least one pair of data points was recorded for each feature type. Soil pits were dug to a depth sufficient to document the presence or confirm the absence of hydric soil or hydrology indicators. Indicator status of wetland plants was determined using the *National List of Plant Species That Occur in Wetlands: California Region 0* (Reed 1988). Positive indicators of hydric soils were observed in the field in accordance with the criteria outlined in *Field Indicators of Hydric Soils in the United States* (NRCS 2006). The hydric status of each soil map unit located in the study area was reviewed using the *Web Soil Survey* (Soil Survey Staff 2010). Indicators of depth and duration of soil saturation, ponding, and drainage patterns and the OHWM were observed in the field. The boundaries of each wetland feature and the three-parameter data points were mapped using rectified color aerial photography. A Trimble Pathfinder Pro XH Global Positioning System capable of sub-foot accuracy was primarily used to delineate features in the relocation areas.

The fieldwork for the impoundment area was conducted in 2004, 2006, and 2010. Along the McCloud Arm, the impoundment area extends beyond the McCloud River Bridge. Fieldwork will be completed in this area during the spring/summer of 2011. The fieldwork in the relocation areas was completed in

early January 2011 and is currently being processed. These data will be provided in the FEIS.

### *Main Body*

The wetland delineation of the impoundment area along the Main Body was conducted from January to April 2010. Delineated waters of the United States consisted of wetlands (seep/spring and riparian wetland, and vegetated ditch) and other waters (ephemeral, intermittent, and perennial streams, seep/spring other waters, and roadside ditch). Table 12-7 specifies the acres of each of the types of jurisdictional waters that occur in the impoundment area.

**Table 12-7. Jurisdictional Waters in the Impoundment Area**

| Jurisdictional Water Type | Area (Acres) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Arm | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| **Wetlands** | | | | | | |
| Fresh emergent/ riparian wetland | 0.00 | 0.00 | 3.14 | 0.00 | 0.00 | 0.00 |
| Intermittent swale | 0.00 | 0.002 | 0.00 | 0.00 | 0.00 | 0.04 |
| Riparian wetland | 1.16 | 1.71 | 5.42 | 8.26 | 1.48 | 0.82 |
| Seasonal wetland | 0.00 | 0.00 | 0.18 | 0.00 | 0.14 | 0.02 |
| Seep/spring wetland | 0.77 | 0.23 | 0.80 | 0.31 | 0.13 | 0.41 |
| Vegetated ditch | 0.13 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Total Wetlands | 2.06 | 1.94 | 9.54 | 8.59 | 1.75 | 1.29 |
| Other Waters of the United States | | | | | | |
| Ephemeral stream | 0.28 | 0.02 | 0.54 | 0.26 | 0.12 | 0.13 |
| Intermittent stream | 1.42 | 0.25 | 2.06 | 0.94 | 0.8 | 2.61 |
| Perennial stream | 1.53 | 3.00 | 8.67 | 20.27 | 2.29 | 1.46 |
| Roadside ditch | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Seep/spring other waters | 0.03 | 0.00 | 0.001 | 0.01 | 0.00 | 0.00 |
| Lacustrine | 10,196.88 | 1,014.12 | 7,225.14 | 5,032.68 | 2,081.60 | 4,372.80 |
| Total Other Waters | 10,200.14 | 1,017.39 | 7,236.43 | 5,054.16 | 2,084.09 | 4,375.00 |
| Total Waters of the U.S. | 10,202.20 | 1,019.33 | 7,245.97 | 5,062.75 | 2,085.84 | 4,376.29 |

Note:
* Acreage values are approximate

### *Big Backbone Arm*

The wetland delineation along the Big Backbone Arm was conducted during November 2006. Delineated waters of the United States consisted of wetlands

(seep/spring and riparian wetlands) and other waters (ephemeral, intermittent, and perennial streams). Table 12-7 specifies the acres of each of the types of jurisdictional waters occurring along the Big Backbone Arm.

#### *Sacramento Arm*

The wetland delineation along the Sacramento Arm was conducted primarily from September through early December 2010 and intermittently in March, April, and June 2010. Delineated waters of the United States consisted of wetlands (seep/spring, riparian, seasonal, and riparian/fresh emergent wetlands) and other waters (ephemeral, intermittent, and perennial streams, seep/spring other waters, and roadside ditch). Table 12-7 specifies the acres of each of the types of jurisdictional waters occurring along the Sacramento Arm.

#### *McCloud Arm*

The wetland delineation along the McCloud Arm was conducted primarily during December 2009 and then intermittently in April, June, and November 2010. Delineated waters of the United States consisted of wetlands (seep/spring and riparian wetlands, and vegetated ditch) and other waters (ephemeral, intermittent, and perennial streams, and seep/spring other waters). Table 12-7 specifies the acres of each of the types of jurisdictional waters occurring along the McCloud Arm.

#### *Squaw Creek Arm*

The wetland delineation along the Squaw Creek Arm was conducted from late August through September 2004. Delineated waters of the United States include wetlands (seep/spring, riparian wetlands, and seasonal wet meadow) and other waters (ephemeral, intermittent, perennial streams, and seep/spring other waters). Table 12-7 specifies the acres of each of the types of jurisdictional waters occurring along the Squaw Creek Arm.

#### *Pit Arm*

The wetland delineation along the Pit Arm was conducted from late November 2006 through April 2007. Delineated waters of the United States consisted of wetlands (riparian, seep/spring, seasonal wetlands, and intermittent swale) and other waters (ephemeral, intermittent, and perennial streams). Table 12-7 specifies the acres of each of the types of jurisdictional waters occurring along the Pit Arm.

#### *Characterization of Features*

Wetlands mapped in the Shasta Lake and vicinity portion of the primary study area include fresh emergent/riparian wetland, intermittent swale, riparian wetland, seasonal wetland, seep/spring wetland, and vegetated ditch. The jurisdictional limit of each feature was delineated where all three wetland parameters (wetland vegetation, soils, and hydrology) were met.

One fresh emergent riparian wetland occurs along the Sacramento Arm at the confluence of Salt Creek and Shasta Lake. The Interstate 5 crossing coupled

with USFS attempts to develop the area for recreation has impounded the flows of Salt Creek, resulting in the development of fresh emergent riparian wetlands. Depending on water depths, wooded riparian areas and fresh emergent vegetation have established throughout the feature.

Dominant overstory species include Goodding's black willow (OBL[1]), arroyo willow (FACW), red willow (assume FACW), and shining willow (OBL). Fresh emergent species include pennyroyal (*Mentha pulegium*–OBL), willow dock (*Rumex salicifolius*–OBL), and broadleaf cattail (*Typha latifolia*). Inundation was observed during the field visit on December 16, 2010. Wetland hydrology and hydric soil criteria were met through evidence of frequent flooding, including sediment deposits, watermarks, drift lines, and drainage patterns.

Intermittent swales occur along the Big Backbone and Pit arms. Intermittent swales are characterized as linear, or somewhat linear, drainage features lacking evidence of scour, but where wetland plant species have established as a result of soil saturation. Typical species occurring in this feature include monkey flower (*Mimulus guttatus*–OBL), spiny fruit buttercup (*Ranunculus muricatus*–FACW), slender rush (*Juncus tenuis*–FACW), and centaury (*Centaurium venustum*–NL).

Riparian wetlands generally occur as "stringers," or narrow features found only immediately adjacent to intermittent or perennial streams throughout the primary study area. Typical species found in riparian wetlands in the study area include arroyo willow (FACW), Goodding's black willow (OBL), white alder (FACW), Oregon ash (FACW), Indian rhubarb (*Darmera peltata*-NL), mugwort (*Artemesia douglasiana*-FACW), California wild grape (FACW), and Himalayan blackberry (FACW). Wetland hydrology and hydric soil criteria are met through evidence of frequent flooding, including sediment deposits, watermarks, drift lines, and drainage patterns.

The seasonal wetlands occurring along the Sacramento, Squaw Creek, and Pit arms are influenced by adjacent water features or are depressions that frequently pond. Plant species found in these features include slender rush (FACW), sword leaf rush (*Juncus ensifolius*–FACW), monkey flower (OBL), yampah (*Perideridia californica*–FACW), annual checker bloom (*Sidalcea calycosa*–OBL), little quaking grass (*Briza minor*–FACW), California oatgrass (*Danthonia californica*–FACW), and spiny fruit buttercup (FACW). Wetland hydrology and soils criteria are met through evidence of long-duration saturation, including saturation in the upper 12 inches, aquic moisture regime, and drainage patterns.

[1] OBL = Obligate Wetland Plants—Estimated probability of occurring in wetland >99 percent.
FACW = Facultative Wetland Plants—Estimated probability of occurring in wetland >67 percent to 99 percent.
FAC = Facultative Plants—Estimated probability of occurring in wetland 33 percent to 67 percent.
FACU = Facultative Upland Plants—Estimated probability of occurring in wetland 1 percent to <33 percent.
UPL = Obligate Upland Plants—Estimated probability of occurring in wetland <1 percent.
NI = No Indicator—Plants for which insufficient information was available to determine an indicator status.
NL = Not listed—Plants not listed in Reed 1988.

Seep/spring wetlands are found throughout the primary study area; they form when groundwater flows out of the ground where the aquifer meets the ground surface. Hydrophytic vegetation colonizes the area where water is provided by the seep/spring. Typical species in these features include white alder (FACW), chain fern (*Woodwardia fimbriata*–FACW), goat's beard (*Aruncus dioicus*–FACW), Indian rhubarb (NL), monkey flower (*Mimulus guttatus*–OBL), horsetail (*Equisetum arvense* –FAC), red stem dogwood (*Cornus stolonifera*–FACW), spicebush (NL), Himalayan blackberry (FACW), and western azalea (FAC). The criteria for wetland hydrology and soils are met through evidence of long-duration saturation, including inundation, saturation in the upper 12 inches, watermarks, and drainage patterns.

There are few vegetated ditches in the Shasta Lake and vicinity area; they occur only along the Main Body and the McCloud Arm, and in relocation areas. Vegetated ditches are ditches that have been excavated to drain adjacent uplands, parking areas, roads, or railways. Because the gradients of these features are so slight, pooling and/or saturation occurs, allowing hydrophytic vegetation to colonize. Dominant plant species include nutsedge (*Cyperus eragrostis*-FACW), seep monkey flower (OBL), broadlead cattail, and rush (*Juncus* sp.-assume FACW). Wetland hydrology criteria were met through the observation of surface water on March 19, 2010, and a thin muck surface indicating long-duration inundation. Hydric soil criteria were met through the observation of inundation and 1 centimeter of muck, indicating long-duration saturation. Other waters of the United States mapped in the Shasta Lake and vicinity portion of the primary study area include seep/spring other waters and ephemeral, intermittent, and perennial streams. The jurisdictional limit of each feature was delineated at the OHWM.

Ephemeral streams are characterized by indicators of scour and deposition, minor drift lines, and sediment deposits, but they lack a groundwater component that contributes to their flow. Hydrology is provided by sheet flow. The poorly defined hydrology indicators, proximity to the headwaters, and the small size of the ephemeral drainages indicate short duration of flow lacking a groundwater component.

Intermittent streams are the most abundant jurisdictional feature along the three arms. Intermittent streams range from small, poorly defined tributaries to larger, well-defined streams that flow into the summer. Like ephemeral streams, intermittent streams flow seasonally, but, in addition to precipitation and sheet flow from adjacent slopes, groundwater extends the duration of flow. Intermittent streams were identified as exhibiting the defined characteristics of a stream, generally a bed and bank and scour and depositions. Other characteristics, such as algae growth or hydrophytic vegetation in or adjacent to the stream, indicate inundation for a longer duration. Substrates observed were primarily cobble. Hydrology and hydric soil criteria are met through evidence of frequent flooding, including water marks, algal matting, drift lines, and sediment deposits.

Perennial streams exhibit the same characteristics as intermittent streams, but tend to be larger and to have a consistent source of groundwater. The substrate consists of boulders, bedrock, cobble, sand, and gravel. Riparian features often occur within the OHWM, but evident riparian "stringers" were delineated as wetlands. Hydrology and hydric soil criteria are met through evidence of frequent flooding, including water marks, algal matting, drift lines, and sediment deposits.

Roadside ditches are found along the Sacramento Arm near roadways and railroad tracks. These features have been excavated solely to drain uplands. Boundaries were established at the OHWM as indicated by sediment and drift deposits.

Seep/spring other waters are found along the Main Body, the Sacramento Arm, and the McCloud Arm. They form when groundwater flows out of the ground where the aquifer meets the ground surface. Hydrophytic vegetation is lacking. A channel may form, but in most cases water does not have the velocity to scour a bed and bank. Duff and organic soil substrates absorb the water and slow water movement downslope.

## 12.2 Regulatory Framework

Biological resources in California are protected and/or regulated by a variety of Federal and State laws and policies. In addition, in many parts of California, there are local or regional habitat and species conservation planning efforts in which a project applicant may participate. Key regulatory and conservation planning issues applicable to the project and alternatives under consideration are discussed below.

### 12.2.1 Federal

#### *Endangered Species Act*

Pursuant to the Federal Endangered Species Act (ESA), USFWS and NMFS have authority over projects that may result in "take" of a Federally listed species. In general, ESA Section 7 prohibits persons (including private parties) from "taking" listed endangered or threatened fish and wildlife species on private property, and from "taking" listed endangered or threatened plant species in areas under Federal jurisdiction or in violation of State law (16 U.S. Code (USC) 1532, 50 Code of Federal Regulations (CFR) 17.3). Under the ESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" as part of an intentional or negligent act or omission. The term "harm" includes acts that result in death or injury to wildlife. Such acts may include significant habitat modification or degradation if it results in death or injury to wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Section 7(a) of the ESA, as amended, requires Federal

agencies to evaluate their actions with respect to any species that is proposed for listing or is listed as endangered or threatened. Section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with USFWS.

As defined in the ESA, critical habitat is a specific geographic area that is essential for the conservation of a threatened or endangered species and that may require special management and protection. It may include an area that is not currently occupied by the species but that will be needed for its recovery. Critical habitats are designated to ensure that actions authorized by Federal agencies will not destroy or adversely modify critical habitat, thereby protecting areas necessary for the conservation of the species.

#### *Clean Water Act*

The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. USACE regulates discharges of fill or dredged materials into waters of the United States under Section 404 of the CWA (33 USC 1251–1376). Waters of the United States include lakes, rivers, streams, and their tributaries and adjacent wetlands. Wetlands are defined under Section 404 as areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support (and that do support under normal circumstances) a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3, 40 CFR 230.3). Activities that require a permit under Section 404 include, but are not limited to, placing fill or riprap, grading, mechanized land clearing, and dredging. Any activity that results in the deposit of dredged or fill material below the ordinary high-water mark of waters of the Unites States or within a jurisdictional wetland usually requires a Section 404 permit, even if the area is dry at the time the activity takes place. To comply with the Section 404 policy that there be no net loss of wetlands, the project cannot affect the total acreage of wetlands within the project boundary.

#### *Section 401 Water Quality Certification*

Under Section 401 of the CWA, an applicant for a Section 404 permit must obtain a certificate from the appropriate State agency stating that the intended dredging or filling activity is consistent with the State's water quality standards and criteria. In California, the authority to grant water quality certification is delegated by the State Water Resources Control Board to the nine Regional Water Quality Control Boards (RWQCB).

#### *Rivers and Harbors Act*

USACE regulates the construction of structures in, over, or under; excavation of material from; or deposition of material into "navigable waters of the United States" under Section 10 of the Federal Rivers and Harbors Act (33 USC 401 et

seq.). Navigable waters of the United States are defined as those waters subject to the ebb and flow of the tide shoreward to the mean high-water mark or those that are currently used, have been used in the past, or may be susceptible to use to transport interstate or foreign commerce. A letter of permission or permit from USACE is required before any work may be completed within navigable waters. Projects are permitted under either individual or general (i.e., nationwide) permits. The specific applicability of the permit types is determined by USACE on a case-by-case basis. Based on a preliminary conversation with the USACE (San Francisco District, Eureka Field Office), the project is expected to be permitted under Nationwide Permit Number 27.

#### *U.S. Forest Service Sensitive Species*

The National Forest Management Act requires USFS to "provide for a diversity of plant and animal communities" (16 USC 1604(g)(3)(B)) as part of its multiple-use mandate. USFS must maintain "viable populations of existing native and desired nonnative species in the planning area" (36 CFR 219.19). The Sensitive Species program is designed to meet this mandate and to demonstrate USFS's commitment to maintaining biodiversity on National Forest System lands. The program is a proactive approach to conserving species to prevent a trend toward listing under the ESA and to ensure the continued existence of viable, well-distributed populations. A "Sensitive Species" is any species of plant or animal that has been recognized by the Regional Forester to need special management to prevent the species from becoming threatened or endangered.

#### *Shasta-Trinity National Forest Land and Resource Management Plan*

The *Shasta-Trinity National Forest Land and Resource Management Plan* (STNF LRMP) contains forest goals, standards, and guidelines designed to guide the management of the Shasta-Trinity National Forest. The following goals, standards, and guidelines related to botanical resource issues associated with the study area were excerpted from the STNF LRMP (USFS 1995a).

#### U.S. Forest Service Survey and Manage

*Standards and Guidelines* In 1994, the BLM and USFS adopted standards and guidelines developed as part of the *Northwest Forest Plan*. These standards and guidelines address management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. The *Northwest Forest Plan* was designed to address human and environmental needs served by the Federal forests of the western part of the Pacific Northwest and Northern California. The development of the *Northwest Forest Plan* was triggered in the early 1990s by the listing of the northern spotted owl and marbled murrelet as threatened under the ESA.

To mitigate potential impacts on plant and wildlife species that have the potential to occur within the range of the northern spotted owl, surveys are required for species thought to be rare, or whose status is unknown because of a lack of information. These species became known as the Survey and Manage

species. The *Northwest Forest Plan* has gone through several revisions since its implementation in 1994, including the elimination of the Survey and Manage Mitigation Measure Standards and Guidelines in 2004. However, these guidelines were reinstated in January 2006 as the result of a court order.

*Biological Diversity*

*Goals (LRMP, p. 4-4)* Integrate multiple resource management on a landscape level to provide and maintain diversity and quality of habitats that support viable populations of plants, fish, and wildlife.

*Standards and Guidelines (LRMP, p. 4-14)*

- Natural Openings – Management of natural openings will be determined at the project level consistent with desired future conditions.

- Snags – Over time, provide the necessary number of replacement snags to meet density requirements as prescribed for each land allocation and/or management prescription. Live, green culls and trees exhibiting decadence and/or active wildlife use are preferred.

- Hardwood – Apply the following standards in existing hardwood types:

  – Manage hardwood types for sustainability.

  – Conversion to conifers will only take place to meet desired future ecosystem conditions.

  – Where hardwoods occur naturally within existing conifer types on suitable timber lands, manage for a desired future condition for hardwoods as identified during ecosystem analysis consistent with management prescription standards and guidelines. Retain groups of hardwoods over single trees.

*Threatened, Endangered, and Sensitive Species (Plants and Animals)*

*Goals (LRMP, p. 4-5)*

Monitor and protect habitat for Federally listed threatened and endangered and candidate species. Assist in recovery efforts for threatened and endangered species. Cooperate with the State to meet objectives for state listed species.

Manage habitat for sensitive plants and animals in a manner that will prevent any species from becoming a candidate for threatened and endangered status.

*Botany (Sensitive and Endemic Plants)*

*Standards and Guidelines (LRMP, pp. 4-14 through 4-16)*

Map, record, and protect essential habitat for known and newly discovered sensitive and endemic plant species until conservation strategies are developed.

Analyze the potential effects of all ground-disturbing projects on sensitive and endemic plants and their habitat. Mitigate project effects to avoid a decline in species viability at the Forest level.

Monitor the effects of management activities on sensitive and endemic plants. If monitoring results show a decline in species viability, alter management strategy.

Provide reports of sensitive plant populations to the DFG annually.

Coordinate sensitive plant inventory and protection efforts with the DFG, the USFWS, the Nature Conservancy, the California Native Plant Society, and other concerned agencies, organizations, and adjacent landowners.

Protect type localities of sensitive and endemic plants for their scientific value.

Management Guide for the Shasta and Trinity Units of the Whiskeytown-Shasta-Trinity National Recreation Area

A portion of the Shasta Unit of the Whiskeytown-Shasta-Trinity National Recreation Area is included in the Shasta Lake and vicinity portion of the primary study area. The Management Guide for the Whiskeytown-Shasta-Trinity National Recreation Area, including the Shasta Unit, contains management strategies intended to achieve or maintain a desired condition. These strategies take into account opportunities, management recommendations for specific projects, and mitigation measures needed to achieve specific goals. The following strategies related to botanical and wetland resource issues associated with the Shasta Lake and vicinity portion of the primary study area were excerpted from the Management Guide (USFS 1996).

**Vegetation (Management Guide, pp. IV-18 through IV-19)**

- Prescribed burning, fuel break construction, and other forms of vegetation manipulation will be used to reduce fire hazards and improve forest health.

- Hazard trees in traditionally high-use recreation areas which pose safety hazards to people or property will be identified and removed.

- Recreation sites will be inventoried and vegetative management plans will be developed to ensure healthy and safe vegetation complexes are maintained over time.

- Protect known populations of Threatened and Endangered Species plant species and their habitat and implement mitigation measures if necessary to maintain or enhance their continued viability. Conservation strategies for Threatened and Endangered Species plant species will be utilized as they are developed.

- Implement management practices which promote restoration of native plant diversity.

- Implement a program to restore native vegetation to highly disturbed or degraded areas using native plants. Local in-kind, on-site seed or other propagation sources will be used in order to maintain genetic integrity.

- Chaparral and woodland habitat management will occur to meet wildlife objectives.

- Interpretive materials will address the need to conserve rare plant communities in accordance with the National Recreation Area Interpretive Plan.

- Rare plants in or near camping areas will be monitored on a regular basis.

- Diversity of native species will be emphasized. Eradication program will be implemented for nonnative, introduced species in areas where healthy, botanically diverse plant communities are necessary to meet ecosystem management objectives.

- Native plants from local gene pools will be utilized when landscaping campgrounds, interpretive facilities, etc.

- Partnerships will be utilized to assist with collection of seed, propagation of seeds/propagules, and planting.

***U.S. Forest Service Noxious Weed Management Policy 2081***

USFS Manual Policy 2080, Noxious Weed Management (USFS 1995b), includes a policy statement requiring a risk assessment for noxious weeds for every project. Specifically, the manual states:

> *2081.03. When any ground disturbing action or activity is proposed, determine the risk of introducing or spreading noxious weeds associated with the proposed action.*
>
> - *For projects having moderate to high risk of introducing or spreading noxious weeds, the project decision*

*document must identify noxious weed control measures that must be undertaken during project implementation.*

- *Use contract and permit clauses to prevent the introduction or spread of noxious weeds by contractors and permittees. For example, where determined to be appropriate, use clauses requiring contractors or permittees to clean their equipment prior to entering National Forest System lands.*

*2081.2. Determine the factors which favor the establishment and spread of noxious weeds and design management practices or prescriptions to reduce the risk of infestation or spread of noxious weeds.*

*Where funds and other resources do not permit undertaking all desired measures, address and schedule noxious weed prevention and control in the following order:*

- *First Priority: Prevent the introduction of new invaders,*
- *Second Priority: Conduct early treatment of new infestations, and*
- *Third Priority: Contain and control established infestations.*

### *Executive Order 11990: Protection of Wetlands*

Executive Order 11990 established the protection of wetlands and riparian systems as the official policy of the Federal government. It requires all Federal agencies to consider wetland protection as an important part of their policies and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

### *Executive Order 11312: Invasive Species*

Executive Order 11312 directs all Federal agencies to prevent and control introductions of invasive nonnative species in a cost-effective and environmentally sound manner to minimize their economic, ecological, and human health impacts. Executive Order 11312 established a national Invasive Species Council made up of Federal agencies and departments and a supporting Invasive Species Advisory Committee composed of State, local, and private entities. The Invasive Species Council and Advisory Committee oversee and facilitate implementation of the Executive Order, including preparation of a National Invasive Species Management Plan.

## 12.2.2 State

### *California Endangered Species Act*

Under the California Endangered Species Act (CESA), DFG has the responsibility for maintaining a list of endangered and threatened species (California Fish and Game Code, Section 2070). DFG also maintains a list of "candidate species," which are species for which DFG has issued a formal notice that they are under review for addition to the list of endangered or threatened species. Pursuant to the requirements of CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any State-listed endangered or threatened species may be present in the project study area and, if so, whether the proposed project would have a potentially significant impact on any of these species. In addition, DFG encourages informal consultation on any proposed project that may affect a species that is a candidate for state listing.

Project-related impacts on species listed as endangered or threatened under the CESA would be considered significant. "Take" of protected species incidental to otherwise lawful management activities may be authorized under Section 2081 of the California Fish and Game Code. Under the CESA, "take" is defined as an activity that would directly or indirectly kill an individual of a species, but the definition does not include "harm" or "harass," as the Federal act does. Therefore, the threshold for take may be higher under CESA than under ESA because habitat modification is not necessarily considered take under CESA.

Authorization from DFG would be in the form of an incidental take permit or as a consistency determination (Section 2080.1[a] of the Fish and Game Code). Section 2080.1[a] of the Fish and Game Code authorizes DFG to accept a Federal biological opinion as the take authorization for a state-listed species when a species is listed under both the ESA and the CESA.

### *California Native Plant Protection Act*

The Native Plant Protection Act (NPAA) (California Fish and Game Code Sections 1900-1913) prohibits the taking, possessing, or sale within the state of any plants with a State designation of rare, threatened, or endangered, as defined by DFG. The NPPA's definition of "endangered" and "rare" closely parallel the CESA definitions of "endangered" and "threatened" plant species.

### *Section 1602 of the California Fish and Game Code—Streambed Alteration*

Diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by DFG, pursuant to Section 1602 of the California Fish and Game Code. The regulatory definition of stream is a body of water that flows at least periodically or intermittently through a bed or channel that has banks and supports wildlife, fish, or other aquatic life. This includes watercourses that have a surface or subsurface flow that supports or has

supported riparian vegetation. DFG's jurisdiction within altered or artificial waterways is based on the value of those waterways to fish and wildlife. A DFG streambed alteration agreement must be obtained for a project that would result in an impact on a river, stream, or lake.

### *Porter-Cologne Water Quality Control Act*

The Porter-Cologne Water Quality Control Act requires that each of the nine RWQCBs prepare and periodically update basin plans for water quality control. Each basin plan sets forth water quality standards for surface water and groundwater and actions to control nonpoint and point sources of pollution to achieve and maintain these standards. Basin plans offer an opportunity to protect wetlands through the establishment of water quality objectives. The RWQCB's jurisdiction includes Federally protected waters as well as areas that meet the definition of "waters of the state." Waters of the state is defined as any surface water or groundwater, including saline waters, within the boundaries of the state. The RWQCB has the discretion to take jurisdiction over areas not Federally protected under Section 401 provided they meet the definition of waters of the state. Mitigation requiring no net loss of wetlands functions and values of waters of the state is typically required by the RWQCB.

### *California Department of Fish and Game Species Designations*

DFG maintains an informal list of species called "species of special concern." These are broadly defined as plant and wildlife species that are of concern to DFG because of population declines and restricted distributions, and/or because they are associated with habitats that are declining in California. These species are inventoried in the CNDDB regardless of their legal status. Impacts on species of special concern may be considered significant.

### *California Department of Fish and Game/California Native Plant Society Plant Species Designations*

CNPS is a statewide nonprofit organization that seeks to increase understanding of California's native flora and to preserve this rich resource for future generations. DFG and CNPS assign rare plant ranks through the collaborative efforts of the Rare Plant Status Review Group composed of over 300 botanical experts from government, academia, non-government organizations, and the private sector and managed jointly by DFG and CNPS. California native plants meeting the rarity or endangerment criteria are assigned a CRPR. These plants were formerly referred to as CNPS listed species; however, as of March 2010, DFG has adopted the name CRPR for the rarity and endangerment categories to eliminate the false impression that these assignments are the exclusive work of CNPS and that CNPS has had undue influence over the regulatory process. CRPR 1 and 2 species generally qualify as endangered, rare, or threatened within the definition of State CEQA Guidelines CCR Section 15380. In general, CRPR 3 and 4 species do not meet the definition of endangered, rare, or threatened pursuant to CEQA Section 15380; however, these species may be evaluated by the lead agency on a case-by-case basis to determine significance criteria under CEQA.

### 12.2.3 Local

Shasta, Tehama, Glenn, Sutter, Sacramento, and Yolo counties and the Cities of Redding, Colusa, and Sacramento have established codes and policies that address protection of natural resources, including vegetation, sensitive species, and trees, and are applicable to the project.

Shasta County's general plan emphasizes that the maintenance and enhancement of quality fish and wildlife habitat is critical to the recreation and tourism industry, and acknowledges that any adverse and prolonged decline of these resources could result in negative impacts on an otherwise vibrant industry. The general plan identifies efforts to protect and restore these habitats to sustain the long-term viability of the tourism and recreation industry (Shasta County 2004).

The City of Redding's general plan strives to strike a balance between development and conservation by implementing several measures such as creek-corridor protection, sensitive hillside development, habitat protection, and protection of prominent ridge lines that provide a backdrop to the city (City of Redding 2000).

Tehama County's general plan (Tehama County 2009) update provides an overarching guide to future development and establishes goals, policies, and implementation measures designed to address potential changes in county land use and development. The general plan identifies the importance of retaining agriculture as one of the primary uses of land in Tehama County.

Glenn County's general plan provides a comprehensive plan for growth and development in Glenn County for the next 20 years (2007 to 2027). This plan recognizes that public lands purchased for wildlife preservation generate economic activity as scientists and members of the public come to view and study remnant ecosystems (Glenn County 1993).

The City of Colusa's general plan seeks to promote its natural resources through increased awareness and improved public access (City of Colusa 2007).

Sutter County's general plan contains policies that generally address preservation of natural vegetation, including wetlands. It requires that new development mitigate the loss of Federally protected wetlands to achieve "no net loss," but it does not include any other specific requirements.

Sacramento County's general plan contains policies that promote protection of marsh and riparian areas, including specification of setbacks and "no net loss" of riparian woodland or marsh acreage (Sacramento County 1993). It also addresses the need to conserve vernal pools and ephemeral wetlands to ensure no net loss of vernal pool acreage. Several policies specifically promote protection of native oak trees, and, in some areas of the county, seek to ensure

that there is no net loss of canopy area. The general plan for the County of Sacramento is currently under revision.

The City of Sacramento Municipal Code addresses the protection of trees within the city boundaries, including general protection of all trees on city property and specific protection of heritage trees.

Yolo County's general plan aims to provide an active and productive buffer of farmland and open space separating the Bay Area from Sacramento, and integrating green spaces into its communities.

### 12.2.4 Federal, State, and Local Programs and Projects

#### *California Bay-Delta Authority*

The California Bay-Delta Authority was established as a State agency in 2003 to oversee implementation of CALFED for the 25 Federal and State agencies working cooperatively to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem. The CALFED Ecosystem Restoration Program has provided a funding source for projects that include those involving acquisition of lands within the Sacramento River Conservation Area, initial baseline monitoring and preliminary restoration planning, and preparation of long-term habitat restoration management and monitoring plans.

#### *Cantara Trustee Council*

The Cantara Trustee Council administers a grant program that has provided funding for numerous environmental restoration projects in the primary study area, including programs in the Fall River watershed, Sulphur Creek, the upper Sacramento River, Middle Creek, lower Clear Creek, Battle Creek, Salt Creek, and Olney Creek. The Cantara Trustee Council is a potential local sponsor for future restoration actions in the primary study area. The Cantara Trustee Council includes representatives from DFG, USFWS, the Central Valley Regional Water Quality Control Board, California Sportfishing Protection Alliance, and Shasta Cascade Wonderland Association.

#### *Resource Conservation Districts*

There are numerous resource conservation districts (RCD) within the study area. Once known as soil conservation districts, RCDs were established under California law with a primary purpose to implement local conservation measures. Although RCDs are locally governed agencies with locally appointed, independent boards of directors, they often have close ties to county agencies and the National Resources Conservation Service. RCDs are empowered to conserve resources within their districts by implementing projects on public and private lands and to educate landowners and the public about resource conservation. They are often involved in the formation and coordination of watershed working groups and other conservation alliances. In the Shasta Lake and upper Sacramento River vicinity, districts include the

Western Shasta County RCD and the Tehama County RCD. To the east are the Fall River and Pit River RCDs, and to the west and north are the Trinity County and Shasta Valley RCDs.

#### *Riparian Habitat Joint Venture*

The Riparian Habitat Joint Venture (RHJV) was initiated in 1994 and includes signatories from 18 Federal, State, and private agencies. The RHJV promotes conservation and the restoration of riparian habitat to support native bird populations through three goals:

- Promote an understanding of the issues affecting riparian habitat through data collection and analysis.
- Double riparian habitat in California by funding and promoting on-the-ground conservation projects.
- Guide land managers and organizations to prioritize conservation actions.

RHJV conservation and action plans are documented in the Riparian Bird Conservation Plan (RHJV 2004). The conservation plan targets 14 "indicator" species of riparian-associated birds and provides recommendations for habitat protection, restoration, management, monitoring, and policy. The report notes habitat loss and degradation as one of the most important factors causing the decline of riparian birds in California. The RHJV has participated in monitoring efforts within the Sacramento National Wildlife Refuge Complex and other conservation areas. The RHJV's conservation plan identifies lower Clear Creek as a prime breeding area for yellow warblers and song sparrows, advocating a continuous riparian corridor along lower Clear Creek. Other recommendations of the conservation plan apply to the North Delta Offstream Storage Investigation study area in general.

#### *Sacramento River Conservation Area Program*

Senate Bill 1086 called for a management plan for the Sacramento River and its tributaries to protect, restore, and enhance both fisheries and riparian habitat. The Sacramento River Conservation Area Program has an overall goal of preserving remaining riparian habitat and reestablishing a continuous riparian ecosystem along the Sacramento River between Redding and Chico, and reestablishing riparian vegetation along the river from Chico to Verona. The program is to be accomplished through an incentive-based, voluntary river management plan. The *Upper Sacramento River Fisheries and Riparian Habitat Management Plan*, January 1989 (Resources Agency 1989), identifies specific actions to help restore the Sacramento River fishery and riparian habitat between the Feather River and Keswick Dam. The *Sacramento River Conservation Area Forum Handbook* (Resources Agency 2003) is a guide to implementing the program. The Keswick Dam-to-Red Bluff portion of the conservation area includes areas within the 100-year floodplain, existing

riparian bottomlands, and areas of contiguous valley oak woodland, totaling approximately 22,000 acres. The 1989 fisheries restoration plan recommended several actions specific to the study area:

- Fish passage improvements at RBDD (under way; project final Environmental Impact Statement (EIS)/Environmental Impact Report released May 2008)
- Modification of the Spring Creek Tunnel intake for temperature control (completed)
- Spawning gravel replacement program (ongoing)
- Development of side-channel spawning areas, such as those at Turtle Bay in Redding (ongoing)
- Structural modifications to the Anderson-Cottonwood Irrigation District Dam to eliminate short-term flow fluctuations (completed)
- Maintaining instream flows through coordinated operation of water facilities (ongoing)
- Improvements at the Coleman National Fish Hatchery (partially complete)
- Measures to reduce acute toxicity caused by acid mine drainage and heavy metals (ongoing)
- Various fisheries improvements on Clear Creek (partially complete)
- Flow increases, fish screens, and revised gravel removal practices on Battle Creek (beginning summer 2006)
- Control of gravel mining, improvements of spawning areas, improvements of land management practices in the watershed, and protection and restoration of riparian vegetation along Cottonwood Creek

#### *Sacramento River National Wildlife Refuge*

The Sacramento River National Wildlife Refuge (SRNWR) is composed of many units between the cities of Red Bluff and Princeton. The SRNWR along the middle Sacramento River is part of the Sacramento National Wildlife Refuge Complex, consisting of five refuges and three wildlife management areas within the Sacramento Valley. Reaches and subreaches of the river are delineated based generally on transitions in fluvial geomorphic riverine conditions, although county boundaries were considered as well. The middle Sacramento River region between Red Bluff and Colusa includes three units

within the Chico Landing Subreach that contain restoration project sites addressed in the *Sacramento River–Chico Landing Subreach Habitat Restoration Draft Environmental Impact Report* (CBDA 2005). In addition, three areas proposed for restoration in this area occur within the larger SRNWR units that were evaluated in the *Environmental Assessment for Proposed Restoration Activities on the Sacramento River National Wildlife Refuge* (USFWS 2001; CBDA 2005).

In June 2005, USFWS issued the *Sacramento River National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment and Finding of No Significant Impact* (USFWS 2005) to serve as an integrated management plan for land that it acquires and manages for inclusion in the SRNWR. The SRNWR final comprehensive conservation plan includes goals, objectives, and strategies to guide management of lands within the SRNWR. It also includes assessments of and establishes parameters for "compatible uses," which are uses that are considered compatible with the primary purposes for which the area was established. Riparian habitat restoration projects are being implemented under cooperative agreements between USFWS and other entities such as The Nature Conservancy (TNC) in accordance with the SRNWR final comprehensive conservation plan.

#### *Sacramento River Preservation Trust*

The Sacramento River Preservation Trust is a private, nonprofit organization active in environmental education and advocacy to preserve the natural environmental values of the Sacramento River. The trust has participated in various conservation and land acquisition projects, including securing lands for the SRNWR. The group is pursuing designation of a portion of the Sacramento River between Redding and Red Bluff as a national conservation area.

#### *Sacramento River Watershed Program*

The Sacramento River Watershed Program is an effort to bring stakeholders together to share information and work together to address water quality and other water-related issues within the Sacramento River watershed. The group is funded congressionally through the U.S. Environmental Protection Agency. The program's primary goal is "to ensure that current and potential uses of Sacramento River watershed resources are sustained, restored, and where possible, enhanced while promoting the long-term social and economic vitality of the region." The Sacramento River Watershed Program manages grants for the Sacramento River Toxic Pollutants Control Program; performs extensive water quality monitoring, data collection, and data management for the watershed; and is instrumental in the study and monitoring of toxic pollutants. Although the program does not implement restoration projects, it is a potential partner for coordinating research and monitoring through consensus-based collaborative partnerships and promoting mutual education among the stakeholders of the Sacramento River watershed.

### *Sacramento Watersheds Action Group*

The Sacramento Watersheds Action Group is a nonprofit corporation that secures funding for, designs, and implements projects that provide watershed restoration, streambank and slope stabilization, erosion control, watershed analysis, and road removal. Sacramento Watersheds Action Group has successfully worked with local groups, agencies, and organizations to fund and complete restoration projects on the Sacramento River and tributaries downstream from Keswick Dam. Their projects include development of the *Sulphur Creek Watershed Analysis and Action Plan*, the Whiskeytown Lake Shoreline Erosion Control Project, the Sulphur Creek Crossing Restoration Project, and the Lower Sulphur Creek Realignment and Riparian Habitat Enhancement Project. Sacramento Watersheds Action Group is a potential local sponsor for watershed restoration actions in the study area.

### *Shasta Land Trust*

The Shasta Land Trust is a regional, nonprofit organization dedicated to conserving open space, wildlife habitat, and agricultural land. The trust works with public agencies and private landowners and is funded primarily through membership dues and donations. It employs various voluntary programs to protect and conserve valuable lands using conservation easements, land donations, and property acquisitions. The trust is a potential local partner for restoration activities in the Shasta Dam-to-Red Bluff area.

### *The Nature Conservancy*

TNC is a private, nonprofit organization involved in environmental restoration and conservation throughout the United States and the world. TNC approaches environmental restoration primarily through strategic land acquisition from willing sellers and obtaining conservation easements. Some of the lands are retained by TNC for active restoration, research, or monitoring activities, while others are turned over to government agencies such as USFWS or DFG for long-term management. Lower in the Sacramento River basin, TNC has been instrumental in acquiring and restoring lands in the SRNWR and managing several properties along the Sacramento River. It also has pursued conservation easements on various properties at tributary confluences, including Cottonwood and Battle creeks.

### *The Trust for Public Land*

The Trust for Public Land is a national, nonprofit organization involved in preserving lands with natural, historic, cultural, or recreational value, primarily through conservation real estate. The trust's Western Rivers Program has been involved in conservation efforts along the Sacramento River between Redding and Red Bluff (the BLM's Sacramento River Bend Management Area), Battle Creek, Paynes Creek, Inks Creek, and Fenwood Ranch in Shasta County. The group promotes public ownership of conservation lands to ensure public access and enjoyment.

# 12.3 Environmental Consequences and Mitigation Measures

This section describes the methods of environmental evaluation, assumptions, and specific criteria used to determine significance for each resource area, then discusses effects of the project and proposes mitigation where necessary.

## 12.3.1 Methods and Assumptions

The following sections describe the methods, processes, procedures, and assumptions used to formulate and conduct the environmental impact analysis. Data for the following analysis were taken from the use of modeling, existing reports on local and site-specific biology, and on site assessments during field reviews.

### *CalSim Modeling*

The CalSim-II computer model was used to aid in the evaluation of potential impacts of the project alternatives on water-related resources, including riparian habitats along the upper and lower Sacramento River and in the Delta. This computer modeling used historical data on California hydrology to represent the variety of weather and hydrologic patterns, including wet periods and droughts, under which water storage and conveyance facilities would be operated. Two scenarios (base cases) of demands for, and storage and conveyance of, water were used in model runs: 2005 facilities and demands ("existing conditions") and forecasted 2030 demands and reasonably foreseeable projects and facilities ("future conditions"). A model run was conducted for each of these base cases combined with each alternative, so that the effects of the No-Action Alternative and other alternatives could be evaluated relative to both existing and future conditions. CalSim-II is a useful tool for this type of comparative analysis where the model is run twice, once to represent a base condition (no action) and a second time with a specific change (action) to assess the change in the outcome due to the input change.

The hydrologic analysis conducted for this EIS used the Common Assumptions Common Modeling Package Version 8D CalSim-II models, which are the best available hydrological modeling tools, to approximate system-wide changes in storage, flow, salinity, and reservoir system reoperation associated with the SLWRI alternatives. The historical flow record of October 1921 to September 2003, adjusted for the influences of land use changes and upstream flow regulation, is used to represent the possible range of water supply conditions. Major Central Valley rivers, reservoirs, and CVP/SWP facilities are represented by a network of arcs and nodes. CalSim-II uses a mass balance approach to route water through this network. Simulated flows are mean flows for the month; reservoir storage volumes correspond to end-of-month storage. A more detailed description of the CalSim-II model, the modeling methodology used to evaluate this project, and key assumptions are provided in the Modeling Appendix. Summaries of the analysis and modeling results are provided in Chapter 6, "Hydrology, Hydraulics, and Water Management."

***Vegetation and Habitat Types***

The effects of construction-related activities are evaluated in the sections addressing Shasta Lake and its vicinity. Besides construction-related activities, the project could potentially affect vegetation and habitat types through any of the following impact mechanisms:

- Increased inundated width of the river during the active growing season
- Reduced frequency and/or magnitude of peak flows
- Altered geomorphic processes (e.g., meander, channel avulsion) along rivers
- Altered availability of groundwater
- Altered rates of stage decline during seed dispersal or germination-establishment

For each vegetation type, environmental effects potentially resulting from each of these impact mechanisms were assessed. This assessment was based on a review of the results of CalSim simulations of mean monthly flows, aerial photographs, background information on the upper Sacramento River and adjacent uplands, and scientific literature on the ecology of each vegetation type. Results of hydraulic modeling of the project's potential effects on peak flows and analyses of the project's potential effects on geomorphic processes along the Sacramento River were not available to support this analysis.

In addition to these impact mechanisms, increased water supplies or increased supply reliability also could reduce a limitation on urban growth and development or on other activities that could affect vegetation in the primary and extended study areas, resulting in potentially significant impacts. The effects of this growth would be analyzed in general plan environmental impact reports and in project-level CEQA compliance documents for the local jurisdictions in which the growth would occur. Mitigation of these impacts would be the responsibility of these local jurisdictions, and not Reclamation. The expected increase in water yield relative to the entire CVP would be small, however, and assuming that this new yield could be provided to any number of geographic areas within the CVP service area (and in part would substitute for ongoing groundwater pumping), the project's impact on urban growth and development that could affect vegetation would be minor.

Similarly, projects potentially affecting streambeds, wetlands, and listed species would require permits from the DFG, USACE, and USFWS, respectively; it is anticipated that impacts on these resources would be avoided, minimized, and/or mitigated during those agency consultations.

Because the extent, location, and timing of induced growth are currently highly uncertain, and in the future the impacts of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects, growth-inducing effects on vegetation and habitat types are not discussed further in this section. However, additional discussion of growth-inducing effects specific to the alternatives is provided in the EIS.

For the purposes of this impact analysis on the loss of general habitats in the Shasta Lake and vicinity portion of the primary study area, California Wildlife Habitat Relationship (CWHR) types will be used to describe habitats for special-status plants affected. Table 12-8 lists the cross references between MCV and CWHR habitat types.

#### *Special-Status Species*

The project could affect special-status plant species through the same impact mechanisms potentially affecting vegetation and habitat types, and also by altering the structure and species composition of vegetative communities, particularly within river corridors.

Potential impacts resulting from these impact mechanisms were assessed for special-status plant species that may occur in the project area. This assessment was based on the potential impacts on vegetation and habitat types for each alternative, and available information on the distribution, ecology, and reproductive biology of each special-status species.

#### *Assumptions*

The following assumptions have been made for the purposes of the impact analysis:

- Activity areas (construction areas for infrastructure and relocation areas) would be completely cleared.
- Mechanized equipment would be used for discrete areas where total clearing would occur.
- All trees would be removed along other areas of the lake, including those that could be considered a hazard in coves used by houseboats for moorage; other vegetation would be left.

Trees would be removed using helicopters and barges.

**Table 12-8. Cross Reference of MCV Vegetation Types and CWHR Habitat Types**

| MCV Type | CWHR Type |
|---|---|
| Barren | Barren |
| Birch-leaf mountain-mahogany chaparral | Mixed chaparral |
| Black willow thicket | Montane riparian |
| Blue oak woodland | Blue oak woodland |
| Brewer oak scrub | Mixed chaparral |
| Buck brush chaparral | Mixed chaparral |
| California annual grassland | Annual grassland |
| California ash chaparral | Mixed chaparral |
| California black oak forest | Montane hardwood |
| California buckeye groves | Mixed chaparral |
| California yerba santa scrub | Mixed chaparral |
| Canyon live oak forest | Montane hardwood |
| Deer brush chaparral | Mixed chaparral |
| Douglas-fir | Douglas-fir |
| Fremont cottonwood | Montane riparian |
| Ghost pine woodland | Montane hardwood–conifer, Blue oak–foothill pine |
| Himalayan blackberry brambles | Montane riparian |
| Interior live oak chaparral | Mixed chaparral |
| Interior live oak woodland | Montane hardwood |
| Knobcone pine forest | Closed-cone pine–cypress |
| Lacustrine | Lacustrine |
| Mixed willow | Montane riparian |
| Oregon ash groves | Montane riparian |
| Oregon white oak woodland | Montane hardwood |
| Ponderosa pine–Douglas-fir forest | Montane hardwood–conifer |
| Ponderosa pine forest | Ponderosa pine |
| Red osier thickets | Montane riparian |
| Riverine | Riverine |
| Sandbar willow thickets | Montane riparian |
| Spicebush thickets | Montane riparian |
| Valley oak woodland | Montane hardwood |
| Urban | Urban |
| White alder groves | Montane riparian |
| White leaf manzanita chaparral | Mixed chaparral |

### 12.3.2 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 environmental impact statement 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)).

#### *Vegetation and Habitat Types*

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 vegetation and habitat types would be significant if project implementation would do any of the following:

- Result in a substantial adverse effect on any riparian vegetation or habitat, oak woodlands or savannas, or other sensitive natural community identified in local or regional plans, policies, regulations, or by DFG or USFWS
- Conflict with a local policy or ordinance that protects vegetation resources, such as a tree preservation policy or ordinance
- Conflict with or violate the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, State, or Federal habitat conservation plan relating to the protection of plant resources
- Result in the potential for spread of nonnative and invasive plant species

#### *Special-Status Species*

Impacts of an alternative on special-status species would be significant if project implementation would do any of the following:

- Result in a substantial adverse effect, either directly or through habitat modifications, on any plant species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by DFG or USFWS

- Have the potential to substantially reduce the number or restrict the range of an endangered or threatened plant species or a plant species that is a candidate for State listing or proposed for Federal listing as endangered or threatened

- Have the potential for substantial reductions in the habitat of an endangered or threatened plant species or a plant species that is a candidate for State listing or proposed for Federal listing as endangered or threatened

- Substantially reduce the number or restrict the range of an endangered, rare, or threatened species, cause a native plant population to drop below self-sustaining levels, or threaten to eliminate a plant community

- Have the potential to cause a native plant population to drop below self-sustaining levels

#### *Wetlands*

Impacts of an alternative on wetlands would be significant if project implementation would do any of the following:

- Have a substantial adverse effect on Federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, etc.) through direct removal, filling, hydrological interruption, or other means

- Conflict with any State or local policies or ordinances protecting wetland and/or riparian resources

- Conflict with or violate the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, State, or Federal habitat conservation plan relating to the protection of wetland resources

#### *Shasta-Trinity National Forest Land and Resource Management Plan*

In addition to the above significance criteria, the *Shasta-Trinity National Forest Land and Resource Management Plan* (USFS 1995a) contains forest goals, standards, and guidelines designed to guide the management of the biological resources within the Shasta-Trinity National Forest, located in the Shasta Lake and vicinity portion of the primary study area. To comply with NEPA, this assessment of impacts evaluates the project's compliance with the STNF LRMP forest goals, standards, and guidelines listed in the "Regulatory Framework" section listed above. Mitigation measures are provided (as needed) to move project actions toward compliance with the STNF LRMP.

### 12.3.3 Topics Eliminated from Further Consideration

No topics related to botanical resources that are included in the significance criteria listed above were eliminated from further consideration. All relevant topics are analyzed below.

### 12.3.4 Direct and Indirect Effects

This section identifies how specific vegetation types could be affected by the project. The project could affect vegetation by doing any of the following:

- Causing construction-related effects at Shasta Dam and around Shasta Lake
- Altering flow regimes downstream from Shasta Lake and downstream from other reservoirs with altered operations
- Increasing water supply reliability that, in turn, could contribute to growth or changes in agricultural land uses in the CVP and SWP service areas

By altering storage and reservoir operations, the project would change flow regimes in downstream waterways. In turn, these alterations to the flow regime could affect vegetation, particularly riparian and wetland vegetation along several waterways.

#### *No-Action Alternative*

Under the No-Action Alternative, Reclamation would not pursue an action to enlarge Shasta Dam. No new facilities would be constructed at Shasta Dam; thus there would be no construction-related impacts. In addition, there would be no changes in releases from Shasta Dam or other CVP reservoirs as a result of a Shasta Dam enlargement.

**Shasta Lake and Vicinity**

*Impact Bot-1 (No-Action): Loss of Federally or State Listed Plant Species* Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

*Impact Bot-2 (No-Action): Loss of MSCS Covered Species* Species covered by the MSCS would not be lost as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

*Impact Bot-3 (No-Action): Loss of USFS sensitive, BLM sensitive, or CRPR Species* USFS sensitive, BLM sensitive or CRPR listed species would not be lost as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

*Impact Bot-4 (No-Action): Loss of Jurisdictional Waters* Waters of the United States would not be lost as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

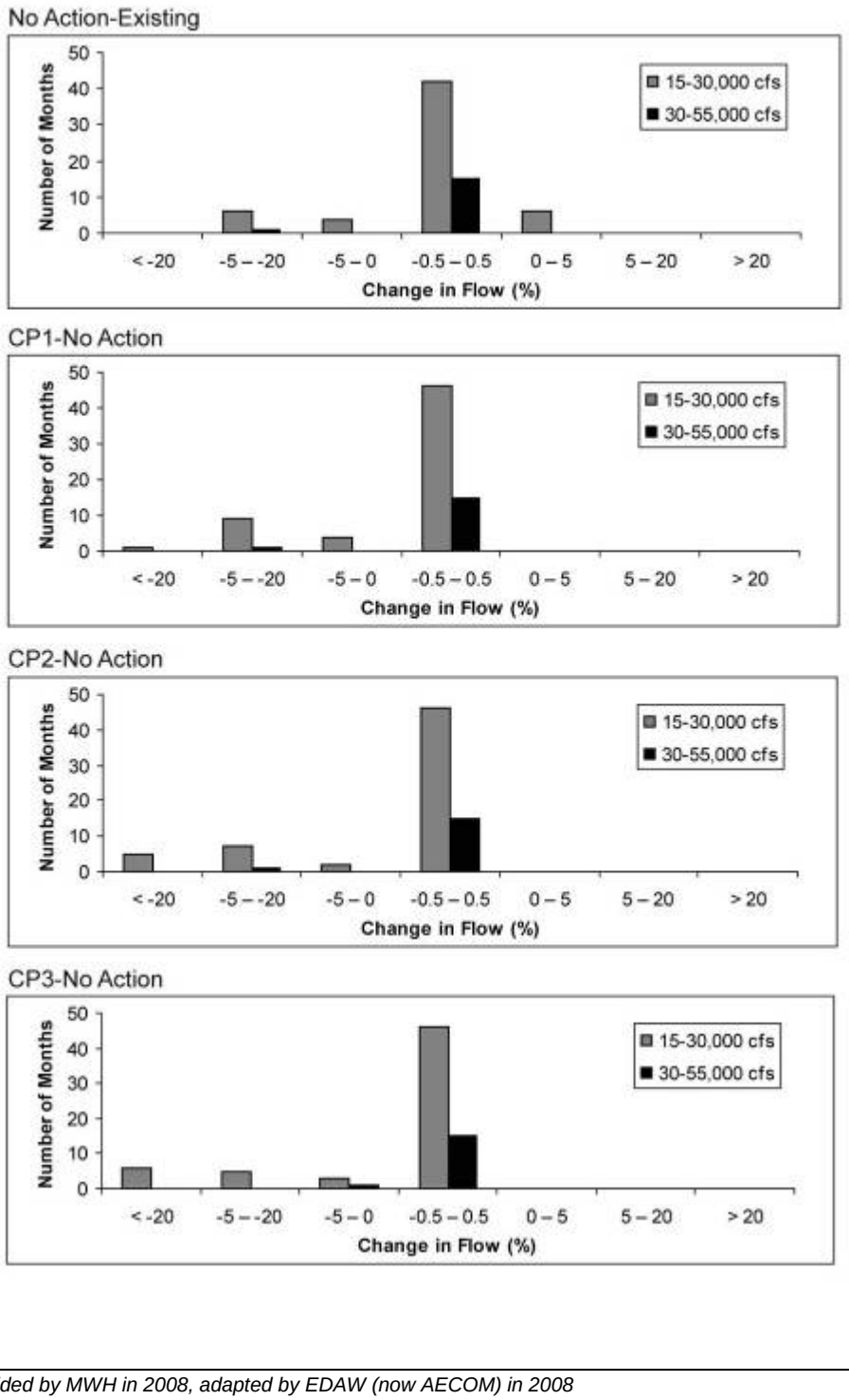
*Impact Bot-5 (No-Action): Loss of General Vegetation Habitats* General vegetation habitats would not be lost as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

*Impact Bot-6 (No-Action): Spread of Noxious and Invasive Weeds* Noxious and invasive weeds would not be spread as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative..

**Upper Sacramento River (Shasta Dam to Red Bluff)**

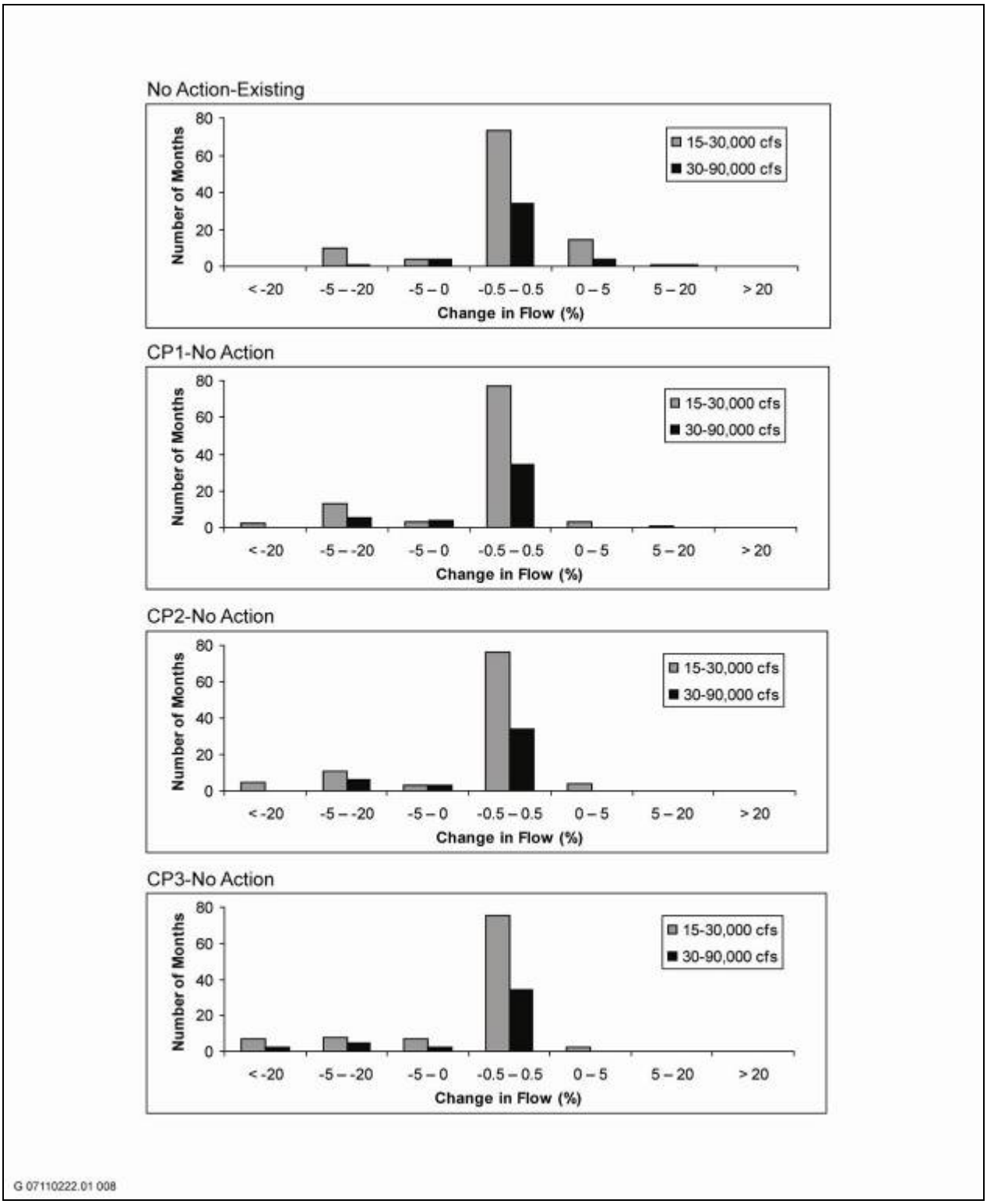
*Impact Bot-7 (No-Action): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes* Altered flow regimes associated with the No-Action Alternative could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities along the upper Sacramento River, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants would be small, and beneficial effects are also anticipated to result from other management and restoration actions. Thus, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. As a consequence of these actions, the flow regime of the upper Sacramento River would change between 2005 and 2030. The CalSim-II modeling results that simulate these changes are provided in the *Hydrology, Hydraulics, and Water Management Technical Report* and the simulated discharges below Keswick Dam and above Red Bluff are summarized on Figures 12-5 and 12-6, respectively. Overall, these modeling results suggest there would be only a very small decrease in flows of 15,000 to 55,000 cubic feet per second (cfs). Flows of this magnitude strongly affect bank erosion and meander migration, and are related to other geomorphic processes affecting the extent of different riparian communities. These relationships are described in greater detail under CP1.




*Source: Data provided by MWH in 2008, adapted by EDAW (now AECOM) in 2008*

**Figure 12-5. Simulated Changes in Larger Mean Monthly Flows of the Sacramento River Below Keswick Dam**




*Source: Data provided by MWH in 2008, adapted by EDAW (now AECOM) in 2008*

**Figure 12-6. Simulated Changes in Larger Mean Monthly Flows of the Sacramento River Above Red Bluff**

This change might not be sufficient to cause significant effects on riparian and wetland communities, or on associated special-status species.

In addition to causing small changes in flow regime, the No-Action Alternative would continue to alter the structure and species composition of riparian and wetland vegetation resulting from continued operation of Shasta Dam. Before the construction of Shasta Dam, river flow and stage would decrease gradually during the period of cottonwood and willow seed dispersal. In many years, this flow pattern would facilitate establishment of these early-successional species along the Sacramento River throughout the primary study area.

Operation of Shasta Dam has increased flow volumes from mid-spring to early summer. Consequently, in most years, operation of the dam precludes or substantially reduces opportunities for establishment of cottonwoods and opportunities for willow establishment. As a result of this (and other alterations to the flow regime of the Sacramento River), the structure and species composition of riparian vegetation has been changing within the primary study area (Fremier 2003, Roberts et al. 2002). The extent of early-successional riparian communities (e.g., cottonwood forest) has been decreasing while the extent of mid-successional communities (e.g., mixed riparian forest) has been increasing. Such changes would continue under the No-Action Alternative for several decades, but would diminish with time.

However, under the No-Action Alternative a number of management and restoration plans and programs would be implemented. These actions are described in Section 12.2, “Regulatory Setting,” of this EIS. These actions would cause beneficial effects that would likely be of similar magnitude as the anticipated adverse effects of small changes in flow regime and of continued effects from past actions, and thus would largely offset those adverse effects.

For the reasons described above, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

*Impact Bot-8 (No-Action): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management*
Numerous local and regional plans promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Expected future effects of the No-Action Alternative on riparian communities have largely been considered in the existing plans. The No-Action Alternative would not conflict with approved local or regional plans. This impact would be less than significant**.**

Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River in the primary study area. These plans, which are discussed in more detail in the “Regulatory Setting” section of this EIS, include the Sacramento River Conservation Area Program, which promotes the conservation and the

restoration of riparian habitat. Under the No-Action Alternative, adverse effects would result from the continued consequences of past actions (e.g., construction of Shasta Dam and the introduction of nonnative species) and from the effects of reasonably foreseeable actions. Most adverse effects that are the continued consequences of past actions have been considered in the development of existing local and regional plans. In addition, foreseeable water resources and levee actions are expected to be consistent with local and regional plans, and anticipated adverse effects are likely to be fully mitigated and not conflict with a local or regional plan. Therefore, the No-Action Alternative would not conflict with approved local or regional plans with objectives of riparian habitat protection or watershed management. This impact would be less than significant**.** Mitigation is not required for the No-Action Alternative.

*Impact Bot-9 (No-Action): Disturbance or Removal of Designated Critical Habitat for Special-Status Species* Designated critical habitat for vernal pool species in the upper Sacramento River area is not expected to be adversely affected. This impact would be less than significant.

Designated critical habitat for four vernal pool special-status plant species exists in the upper Sacramento River portion of the primary study area: slender orcutt grass, Hoover's spurge, hairy orcutt grass, and Greene's tuctoria. Critical habitat for these species in the primary study area is confined to vernal pool communities (USFWS 2006). Vernal pools are generally not present within the active floodplain. However, if vernal pool habitats for these special-status species are present in the active floodplain of the upper Sacramento River, they could be affected by the small reduction in the frequency and magnitude of overbank flows. It is not known if this would be an adverse or beneficial effect. Because this effect of the No-Action Alternative is somewhat speculative and not necessarily adverse, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

*Impact Bot-10 (No-Action): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth* Although Shasta Dam would not be altered, water storage, conveyance, and deliveries to water districts would likely increase because of reasonably foreseeable projects. However, environmental regulations would continue to provide protection for botanical resources, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Therefore, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable projects that would occur with or without enlarging Shasta Dam. Consequently, deliveries to water districts along the upper Sacramento River in the primary study area would likely increase between now and 2030, and this could reduce a limitation on urban growth and development. However, environmental regulations would continue to protect wetlands, riparian

habitats, other sensitive botanical communities, and special-status plant species, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Furthermore, CVP water delivered in this area would primarily be for agricultural purposes, and agricultural acreages are not expected to expand. For the reasons described above, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

**Lower Sacramento River and Delta**

*Impact Bot-11 (No-Action): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or the Reading Island Restoration Plan, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under the No-Action Alternative. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

*Impact Bot-12 (No-Action): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under the No-Action Alternative. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

*Impact Bot-13 (No-Action): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under the No-Action Alternative. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

*Impact Bot-14 (No-Action): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimeson the Lower Sacramento River* Altered flow regimes associated with the No-Action Alternative could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities along the lower Sacramento River and in the Delta, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants would be small, and beneficial effects are also anticipated to result from

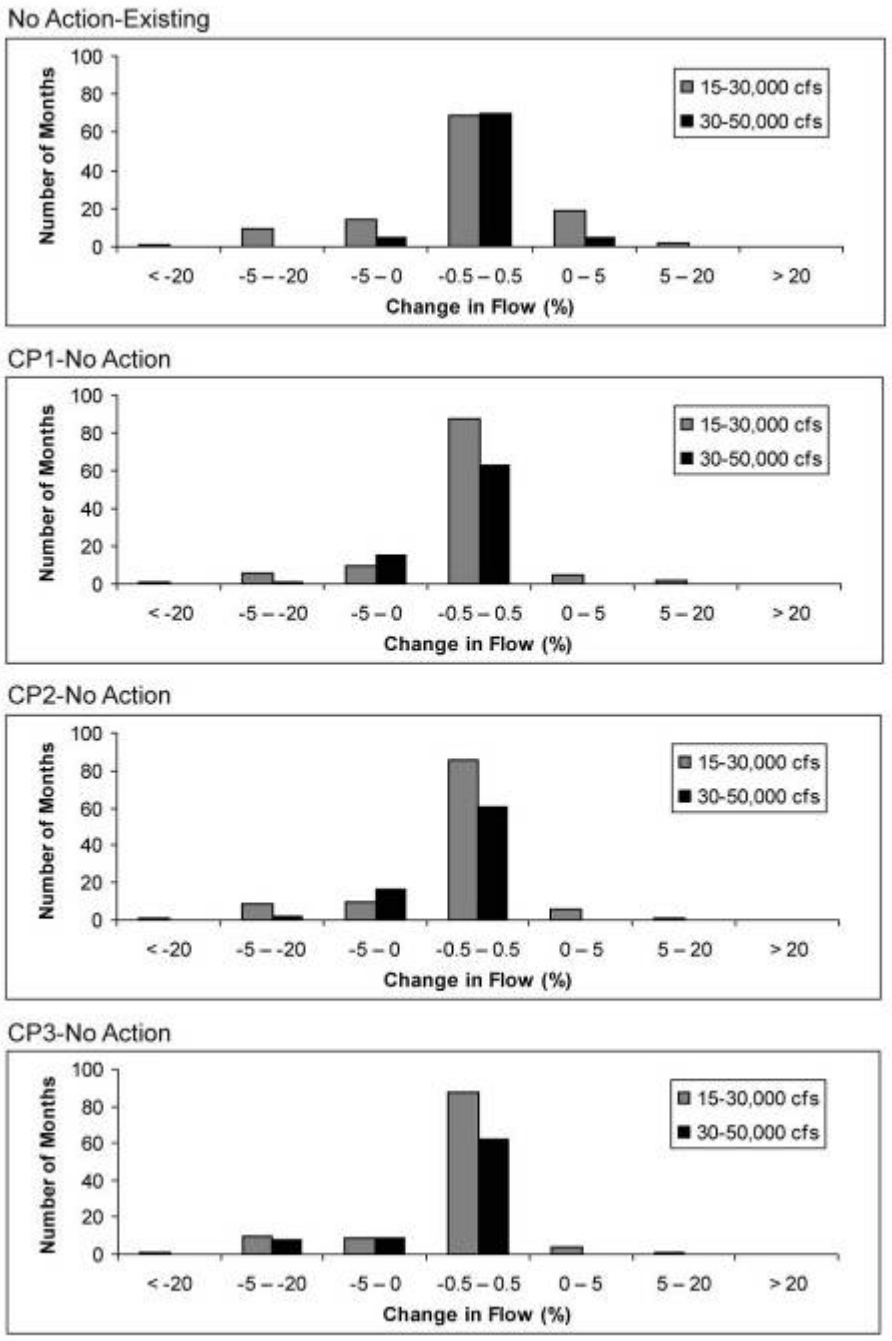
management and restoration actions. Thus, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. As a consequence of these actions, the flow regime of the lower Sacramento River could change between 2005 and 2030. The CalSim-II modeling results that simulate these changes are provided in the *Hydrology, Hydraulics, and Water Management Technical Report* and the larger simulated discharges above Red Bluff and at Wilkins Slough and Freeport are summarized on Figures 12-6, 12-7, and 12-8, respectively. (These locations are shown on Figure 12-9.) Overall, these modeling results suggest only a very small decrease in flows greater than 15,000 cfs along the uppermost portion of the lower Sacramento River. This change might not be sufficient to cause significant effects on riparian and wetland communities, or on associated special-status species.

However, besides causing additional, very small changes in flow regime, the No-Action Alternative would continue to alter the structure and species composition of riparian and wetland vegetation along the lower Sacramento River resulting from the continued operation of Shasta Dam. Before the construction of Shasta Dam, flow volume would decrease gradually during the period of cottonwood and willow seed dispersal. In many years, this flow pattern would facilitate establishment of these early- successional species along the Sacramento River throughout the extended study area. As described for the upper Sacramento River above, along the lower Sacramento River, the extent of early-successional riparian communities would continue decreasing while the extent of mid-successional communities would continue increasing under the No-Action Alternative.

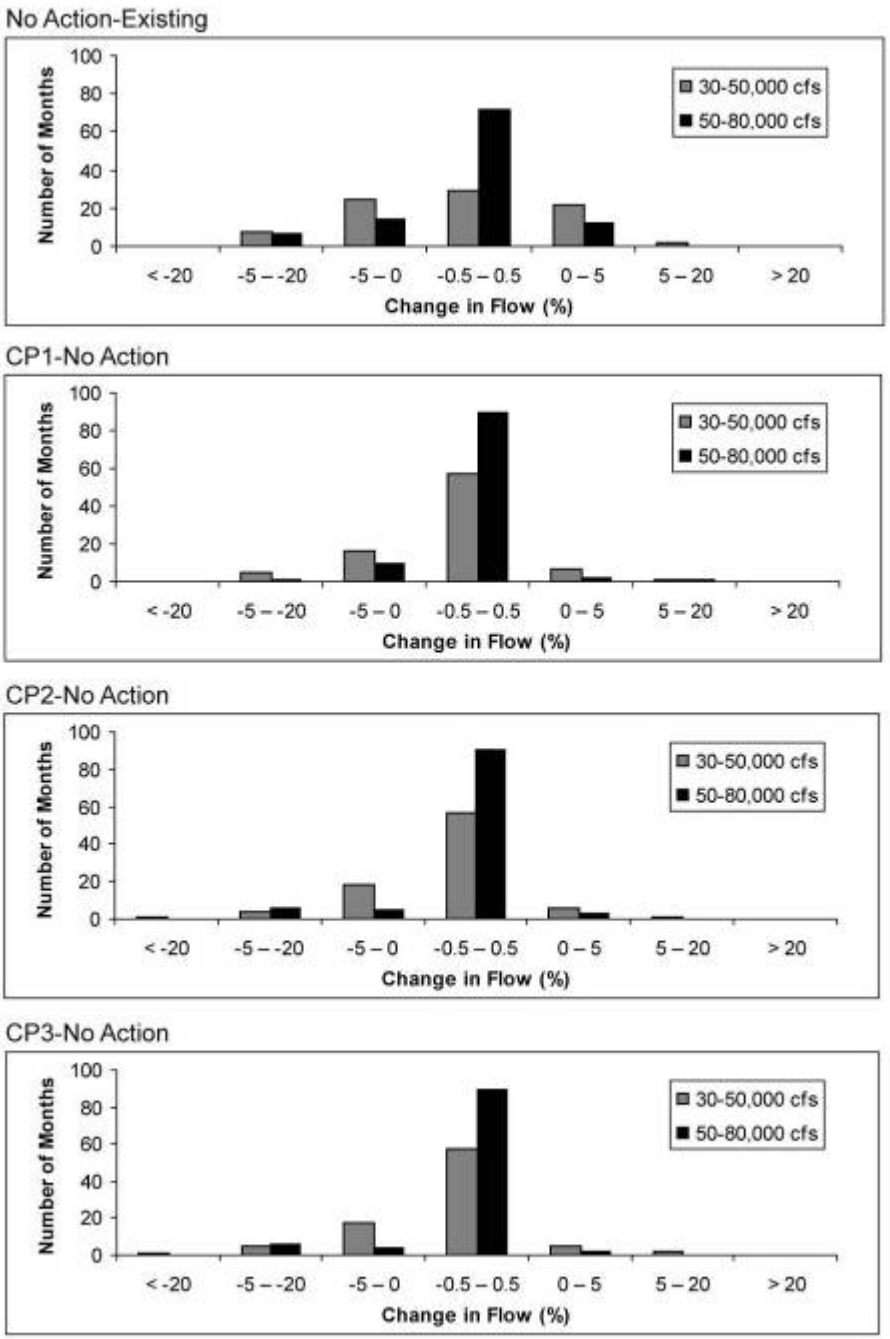
However, under the No-Action Alternative, a number of management and restoration plans and programs carried out by a large number of agencies would be implemented. These actions are described in the “Regulatory Setting” section of this EIS. These actions would cause beneficial effects that would likely be of similar magnitude as the anticipated adverse effects of small changes in flow regime and of continued effects from past actions, and thus would largely offset those adverse effects.

For the reasons described above, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.




*Source: Common Assumptions Common Modeling Package Version 8D. CALSIM II. 2005 and 2030 Simulation (NODE 129).*

**Figure 12-7. Simulated Changes in Larger Mean Monthly Flows of the Sacramento River at Wilkins Slough**




*Source: Common Assumptions Common Modeling Package Version 8D. CALSIM II. 2005 and 2030 Simulation (NODE 169).*

**Figure 12-8. Simulated Changes in Larger Mean Monthly Flows of the Sacramento River at Freeport**

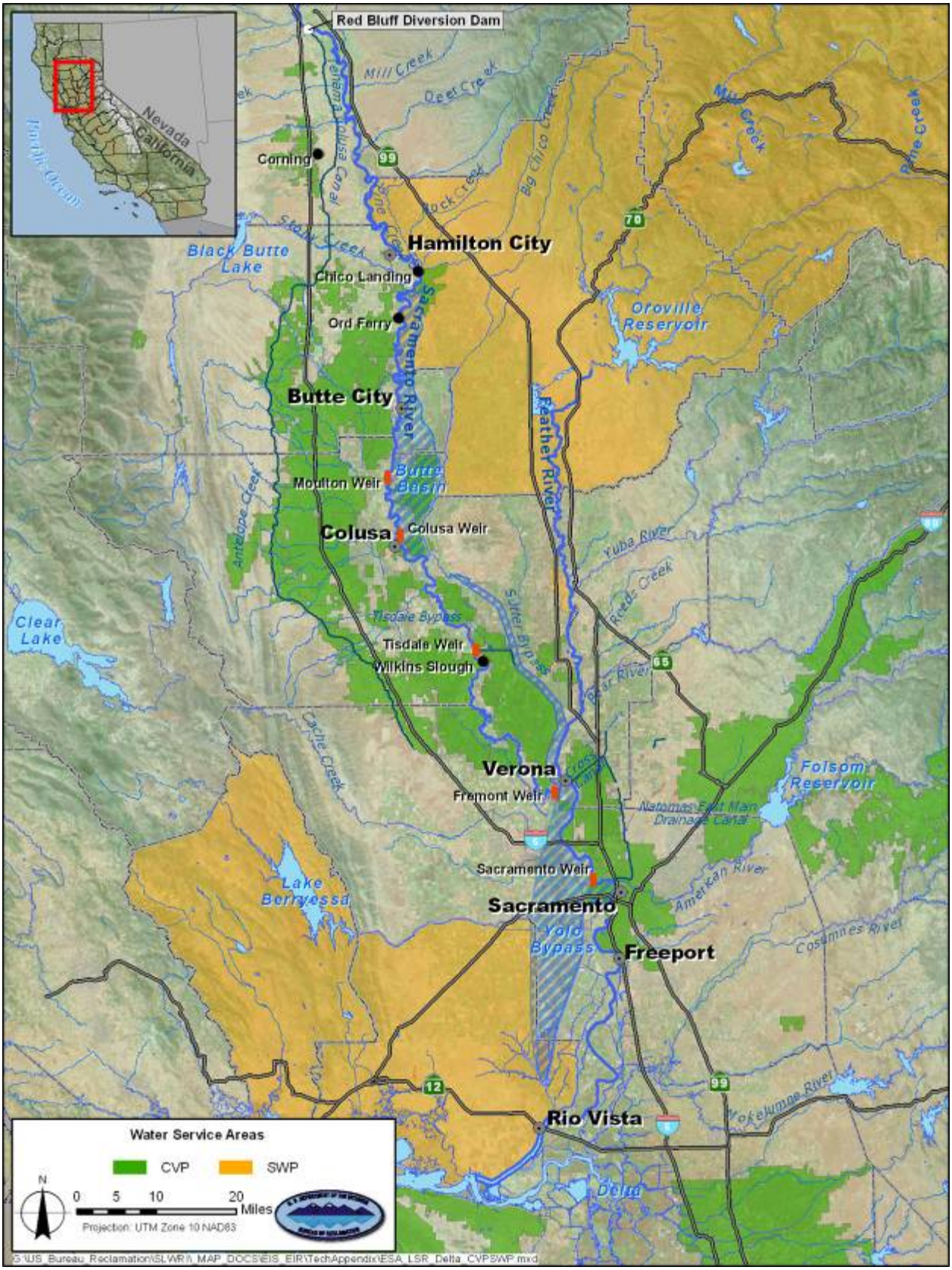



**Figure 12-9. Locations along Lower Sacramento River**

*Impact Bot-15 (No-Action): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Along the Lower Sacramento River* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River and in the Delta. In the development of regional and local plans, most on-going adverse effects of past actions were considered, but not all effects of reasonably forseeable actions. Unmitigated effects from these actions could be sufficient to conflict with these plans. Therefore, the No-Action Alternative could conflict with approved local or regional plans. This impact would be potentially significant.

There are adopted local and regional plans that address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River and in the Delta in the extended study area. These plans, which are discussed in more detail in the "Regulatory Framework" section of this EIS, include the Sacramento River Conservation Area Program and the CALFED Ecosystem Restoration Program, both of which promote the conservation and the restoration of riparian habitat. Under the No-Action Alternative, adverse effects would result from the continued consequences of past actions (e.g., construction of Shasta Dam and the introduction of nonnative species) and from the effects of foreseeable actions. Most adverse effects that are the continued consequences of past actions have been considered in the development of existing local and regional plans. However, the adverse effects of all foreseeable water resource and levee actions were not considered in the development of local and regional plans, and these adverse effects are not likely to be completely avoided or fully mitigated. The unmitigated effects of these actions could be sufficient overall to conflict with a local or regional plan. Therefore, the No-Action Alternative could conflict with approved local or regional plans with objectives of riparian habitat protection or watershed management. This impact would be potentially significant**.** Mitigation is not required for the No-Action Alternative.

*Impact Bot-16 (No-Action): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Along the Lower Sacramento River and in the Delta* Although Shasta Dam would not be altered, water storage, conveyance, and deliveries to water districts would likely increase because of reasonably foreseeable actions. However, environmental regulations would continue to provide protection for botanical resources, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for site-specific projects. Therefore, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries would likely increase because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. Thus, deliveries to water districts in the extended study area along the lower Sacramento River and in the Delta would likely

increase between now and 2030, and this could reduce a limitation on urban growth and development. However, environmental regulations would continue to protect wetlands, riparian habitats, other sensitive botanical communities, and special-status plant species, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for site-specific projects. Therefore, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

**CVP/SWP Service Areas**

*Impact Bot-17 (No-Action): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas* Altered flow regimes associated with the No-Action Alternative could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities in the CVP and SWP service areas, and of habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs would be less than below Shasta Dam along the Sacramento River, and may not be sufficient to alter the distribution of plant communities, or the extent or quality of associated special-status species habitat. Therefore, this impact would be less than significant.

Altered flow regimes associated with the No-Action Alternative could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected by the altered flow regime. Effects on oak communities and upland habitats for special-status plants would be somewhat speculative and may not all be adverse; thus, on oak communities and special-status plants of upland habitats, this impact would be less than significant. Although riparian and wetland communities could be affected, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. Below CVP and SWP reservoirs, these alterations may not be sufficient to alter the extent of early-successional riparian and wetland communities, or the extent or quality of associated special-status species habitat. Therefore, this impact would be less than significant below CVP and SWP reservoirs in the extended study area. Mitigation is not required for the No-Action Alternative.

*Impact Bot-18 (No-Action): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas* The No-Action Alternative would not have substantial effects on riparian vegetation and habitats, and thus, would not conflict with existing local and regional plans in the CVP and SWP service areas. This impact would be less than significant.

There are adopted local and regional plans that address and promote the conservation of riparian vegetation and associated habitats along rivers below

reservoirs in the CVP and SWP service areas. However, implementation of the No-Action Alternative would not have substantial effects on riparian vegetation and habitats. Therefore, implementation of this alternative would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact in the CVP and SWP service areas would be less than significant. Mitigation is not required for the No-Action Alternative.

*Impact Bot-19 (No-Action): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas* Although Shasta Dam would not be altered, water storage, conveyance, and deliveries to the CVP and SWP service areas would likely increase because of reasonably foreseeable actions. However, environmental regulations would continue to protect botanical resources, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Therefore, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries to the CVP and SWP service areas would likely increase because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. Thus, CVP and SWP deliveries would likely increase between now and 2030, and this could reduce a limitation on growth. However, environmental regulations would continue to protect wetlands, riparian habitats, other sensitive botanical communities, and special-status plant species, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Therefore, 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*

CP1 focuses on increasing water supply reliability while contributing to increased survival of anadromous fish, actions that are consistent with the 2000 CALFED Record of Decision (ROD) (CALFED 2000b). In addition to the features common to all comprehensive plans, CP1 consists primarily of raising Shasta Dam 6.5 feet, an elevation change that would increase the reservoir's full pool by 8.5 feet and enlarge the total storage space in the reservoir by 256,000 acre-feet. Under this plan, operational guidelines for Shasta Dam would continue unchanged, with the additional storage retained for water supply reliability and increased survival of anadromous fish.

**Shasta Lake and Vicinity**

*Impact Bot-1 (CP1): Loss of Federally or State-Listed Plant Species* Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact on Federally listed, State-listed, or candidate plant species would occur under CP1. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-2 (CP1): Loss of MSCS Covered Species* Implementation of the project could result in the loss of MSCS covered species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be significant.

The only MSCS species known to occur in the project area is Shasta snow-wreath. Inundation caused by a 6.5-foot dam raise could impact all or portions of 12 (52 percent) of the Shasta snow-wreath populations found on the Sacramento River, McCloud River, and Pit River arms and the Main Body of the lake. Within its range (the Shasta Lake region), there are 23 known populations.

Portions of two Shasta snow-wreath populations are found within one relocation area at Ellery Creek. Activities to decommission the campground could impact the Shasta snow-wreath populations present.

Because complete surveys have not been conducted in the entire impoundment area, other MSCS plant species may be present. In these areas, all or portions of MSCS plant populations could be inundated. This would be a potentially significant impact.

Additional analysis of impacts will be conducted in relation to suitable habitats present in the Shasta Lake watershed. An analysis of indirect impacts and temporary impacts will be provided in the FEIS. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS.

This loss of MSCS covered species and their habitat would be significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-3 (CP1): Loss of USFS sensitive, BLM sensitive, or CRPR Species* Implementation of the project could result in the loss of USFS sensitive, BLM sensitive, or CRPR species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

For areas where botanical surveys have been conducted, direct impacts have been determined using geographic information systems to ascertain the populations within the impoundment area, relocation areas, and construction footprints.

Based on results of surveys to date, special-status plant species known to occur in the primary study area include Shasta County arnica, northern clarkia, Butte County fritillary, Cantelow’s lewisia, Shasta snow-wreath, slender false lupine, Shasta huckleberry, and oval-leaved viburnum.

Direct impacts on Shasta snow-wreath caused by CP1 are addressed in Impact Bot-2 (CP1). As a Forest Service sensitive species, the Shasta snow-wreath is

recognized by the Forest Service to need special management to prevent the species from becoming threatened or endangered. Because the snow-wreath is a local Shasta County endemic species, the impacts are likely to result in a decline in habitat and result in a trend towards listing.

Inundation caused by a 6.5-foot dam raise and vegetation removal could impact all or portions of Shasta County arnica, northern clarkia, Butte County fritillary, Cantelow's lewisia, slender false lupine, Shasta huckleberry, and oval-leaved viburnum populations occurring in the impoundment and relocation areas. Potential populations occurring in the unsurveyed portions of the impoundment area could be flooded and would result in a potentially significant impact. Impacts on known populations are provided below.

Inundation of the impoundment area would impact all or portions of the Shasta arnica population south of Bridge Bay Resort on the Main Body of the lake and the population north of Slaughterhouse Island on the Sacramento Arm. Vegetation removal may impact the Shasta arnica population near the privately owned cabins on National Forest System lands on the Salt Creek inlet on the Sacramento Arm.

Inundation of the impoundment area and vegetation removal in the relocation areas would impact all or portions of northern clarkia populations in Bailey Cove (McCloud Arm) and in Sugarloaf Cove west of Beehive Point (Sacramento Arm).

Inundation of the impoundment area may impact all or portions of populations of Butte County fritillary located on Flat and Ripgut creeks on the Pit Arm.

Inundation of the impoundment area would impact all or portions of the Cantelow's lewisia population on a rock outcrop on the right bank of the Upper Sacramento River riverine reach near the Shasta Lake/upper Sacramento River transition zone. Inundation may also impact populations found along the Sacramento Arm near Elmore Mountain.

Inundation of the impoundment area and vegetation removal in the relocation areas would impact all or portions of slender false lupine populations throughout the impoundment area and relocation areas.

Within its range (the Shasta Lake region), there are 12 known populations Shasta huckleberry. Inundation caused by a 6.5-foot dam raise could impact portions of the 12 (100 percent) Shasta huckleberry populations on the Squaw Creek Arm and the Main Body. The populations extend beyond the project boundary at each location and no population will be completely lost as a result of CP1.

Portions of one Shasta huckleberry population occur within one relocation area at in the Bully Hill area. Construction activities in this area could impact the Shasta huckleberry population present.

Because complete surveys have not been conducted in the entire impoundment area, other of USFS sensitive, BLM sensitive, and CRPR species plant species may be present. In these areas, all or portions of USFS sensitive, BLM sensitive, and CRPR species plant populations could be inundated. This would be a potentially significant impact.

Collectively, the loss of USFS sensitive, BLM sensitive, and CRPR species and their habitat would therefore be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-4 (CP1): Loss of Jurisdictional Waters* Implementation of the project may result in the loss of jurisdictional waters caused by flooding the impoundment area and discharge of fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine). Therefore, this impact would be significant.

Direct impacts would incur with the conversion of jurisdictional waters (e.g., wetlands and streams) to lacustrine with implementation of CP1. All features within the impoundment area would be converted to lacustrine. Under CP1, 11 acres of wetlands and 18 acres of other waters would be converted to lacustrine (Table 12-9). This will result in a net loss of 11 acres to wetlands and a no net loss to other waters. This is considered a significant impact.

Direct impacts on jurisdictional waters (e.g., intermittent and perennial streams) that will be filled as a result of relocation of facilities or dam construction will be determined. Additionally, some fill may be placed in the existing full pool of Shasta Lake for restoration and enhancement activities. An analysis of impacts on jurisdictional waters in the full pool, relocation areas, indirect impacts, and temporary impacts will be provided in the FEIS. Additional analysis of impacts will be conducted in relation to waters of the United States present in the Shasta Lake watershed. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-5 (CP1): Loss of General Vegetation Habitats* Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Under CP1, 1,221 acres of general vegetation habitat will be directly impacted by the inundation of the impoundment area and 3,127 acres of general vegetation habitat will be impacted by vegetation removal in the construction footprints of the relocation areas (Table 12-10 and Table 12-11). This impact is considered significant.

**Table 12-9. Impacts to Jurisdictional Waters (Acres*) in the Impoundment Area (6.5-Foot Dam Raise)**

| Jurisdictional Water Type | Main Body | Big Backbone Arm | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
|---|---|---|---|---|---|---|
| **Wetlands** | | | | | | |
| Fresh emergent/ riparian wetland | 0.00 | 0.00 | 3.00 | 0.00 | 0.00 | 0.00 |
| Intermittent swale | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.02 |
| Riparian wetland | 0.44 | 0.47 | 2.85 | 1.82 | 0.35 | 0.47 |
| Seasonal wetland | 0.00 | 0.00 | 0.14 | 0.00 | 0.00 | 0.02 |
| Seep/spring wetland | 0.43 | 0.14 | 0.45 | 0.16 | 0.05 | 0.25 |
| Vegetated ditch | 0.00 | 0.00 | 0.00 | 0.002 | 0.00 | 0.00 |
| Total Wetlands | 0.87 | 0.61 | 6.44 | 1.98 | 0.40 | 0.76 |
| **Other Waters of the United States** | | | | | | |
| Ephemeral stream | 0.13 | 0.01 | 0.27 | 0.12 | 0.07 | 0.05 |
| Intermittent stream | 0.65 | 0.12 | 0.91 | 0.42 | 0.35 | 1.22 |
| Perennial stream | 0.81 | 1.00 | 4.25 | 5.77 | 1.05 | 0.75 |
| Roadside ditch | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Seep/spring other waters | 0.01 | 0.00 | 0.001 | 0.01 | 0.00 | 0.00 |
| Total Other Waters | 1.60 | 1.13 | 5.44 | 6.32 | 1.47 | 2.02 |
| Total Waters of the U.S | 2.47 | 1.74 | 11.88 | 8.30 | 1.87 | 2.78 |

Note: *Acreage values are approximate.

**Table 12-10. Impacts to CWHR Habitats in the Impoundment Area (6.5-Foot Dam Raise)**

| Habitat | Area (Acres*) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Creek | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| Annual grassland | 0.07 | 0 | 0.96 | 0.37 | 0 | 0 |
| Barren | 0.57 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 |
| Blue oak–foothill pine | 4.96 | 0 | 0 | 0 | 1.40 | 4.04 |
| Blue oak woodland | 0 | 0 | 0 | 0 | 0 | 1.32 |
| Closed-cone pine–cypress | 17.75 | 0 | 6.30 | 10.74 | 23.95 | 188.29 |
| Douglas-fir | 0 | 0 | 0 | 0.01 | 0 | 0 |
| Mixed chaparral | 14.83 | 6.83 | 80.01 | 7.28 | 5.43 | 27.73 |
| Montane hardwood | 39.08 | 18.13 | 86.75 | 32.23 | 9.44 | 1.28 |
| Montane hardwood–conifer | 34.65 | 0.50 | 69.23 | 68.73 | 55.70 | 5.68 |
| Montane riparian | 1.54 | 2.48 | 15.92 | 4.60 | 0.58 | 0.80 |
| Ponderosa pine | 108.93 | 15.36 | 84.75 | 81.24 | 25.06 | 29.93 |
| Riverine | 0 | 0.35 | 2.30 | 3.81 | 0.59 | 0 |
| Urban | 10.95 | 0 | 1.37 | 4.74 | 0 | 0.75 |
| Total | 233.33 | 43.65 | 347.84 | 213.75 | 122.14 | 259.82 |

Note:
*Acreage values are approximate.

**Table 12-11. Impacts to CWHR Habitats in the Relocation Areas**

| Habitat | Area (Acres*) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Creek | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| Annual grassland | 5.05 | 0.00 | 29.02 | 10.65 | 1.29 | 1.25 |
| Barren | 0.00 | 0.00 | 0.00 | 0.82 | 0.00 | 0.00 |
| Blue oak–foothill pine | 3.61 | 0.00 | 0 | 0 | 0 | 13.74 |
| Blue oak woodland | 0 | 0.00 | 0 | 3.89 | 0 | 2.28 |
| Closed-cone pine–cypress | 0.11 | 0.00 | 56.90 | 8.95 | 1.94 | 33.72 |
| Douglas-fir | 0 | 0.00 | 0 | 3.18 | 0 | 0 |
| Lacustrine | 0 | 0.00 | 0 | 32.64 | 0 | 0 |
| Mixed chaparral | 25.68 | 0.00 | 120.00 | 46.36 | 4.44 | 134.82 |
| Montane hardwood | 48.21 | 0.00 | 198.56 | 214.87 | 6.34 | 3.44 |
| Montane hardwood–conifer | 121.63 | 0.00 | 205.41 | 316.45 | 42.22 | 42.28 |
| Montane riparian | 0.34 | 0.00 | 4.72 | 8.02 | 0.23 | 1.45 |
| Ponderosa pine | 185.06 | 0.00 | 466.94 | 406.43 | 43.08 | 45.30 |
| Riverine | 0 | 0.00 | 0.39 | 3.75 | 0 | 0 |
| Urban | 21.05 | 0.00 | 230.58 | 0.48 | 0 | 2.49 |
| Total | 410.74 | 0.00 | 1,312.51 | 1,023.85 | 99.53 | 280.48 |

Note:
*Acreage values are approximate.

Additional analysis of impacts will be conducted in relation to suitable habitats in the Shasta Lake watershed. An analysis of indirect impacts and temporary impacts will be provided in the FEIS. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-6 (CP1): Spread of Noxious and Invasive Weeds* Implementation of the project could result in the spread of noxious and invasive weeds as a result of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). Therefore, this impact would be potentially significant.

Noxious and invasive weeds are abundant around Shasta Lake specifically in the relocation areas. Vectors that would increase as a result of project implementation include weed seed and seed parts brought in on tools, vehicles, and workers' clothing and boots. The extent of the risk would depend on the construction methods used and site-specific actions implemented to complete the project. As access into specific project areas is improved, road construction, temporary roads, and road maintenance would increase the number of vectors in an area. As traffic along new and existing corridors increases, the risk for weed dispersal would increase. Seed mixtures and mulches may be used during erosion control efforts and revegetation of areas. These mixtures and mulches are potential vectors for noxious weed and invasive plant dispersal.

Construction of the dam would result in inundation of shoreline habitat. Depending on the extent of colonization, many populations of noxious weeds

could be inundated. However, there would be no increase in vector traffic and no soil disturbance due to inundation. Therefore, the risk of weed spread from the inundation of habitat is low.

However, vegetation removal in areas to be inundated may increase risk of weed spread. Habitat vulnerability and project-associated vectors in inundation zones would be variable, based on the extent of the vegetation removal and the location of the proposed activity. All habitats are vulnerable when canopies are opened and soil is disturbed. Increased traffic and soil disturbance coupled with an adjacent, high-ranking noxious weed may result in a moderate to high risk of weed spread.

Because of the dam expansion, other ground-disturbing projects would be implemented to relocate displaced roads, railways, utilities, homes, and recreation facilities. The potential for disturbance of noxious weeds is highly variable, based on the proposed activity and the abundance of weeds present. Depending on the location of high-ranking noxious weeds, the extent of ground-disturbing activities, and the amount of traffic entering a project site, the risk of noxious weed infestation would vary.

This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

**Upper Sacramento River (Shasta Dam to Red Bluff)**
*Impact Bot-7 (CP1): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes* Altered flow regimes associated with project implementation under CP1 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, this impact would be significant.

Potential impacts on flow and stages of the upper Sacramento River from CP1 would be small. On average, in each month, changes in mean monthly flow would be reductions or increases of several percent. Generally, these effects diminish with distance downstream because of the influence of inflows from tributaries and of diversions and flood bypasses.

In average and wet years, river flows would decrease during the November through February period of some years. This would be because of the increased storage space that could be filled in some years, usually following dry or critically dry water years. During these years, mean monthly flow November through February could be reduced by 10 percent or more.

During the June through August period of some years, flow and stage would increase. This increase would be most pronounced during some dry and critical years as more water is released from Shasta Dam for water supply reliability purposes. During May through August in different types of water years, the average changes in mean monthly flow would be reductions or increases of several percent (generally less than 2 percent), although the changes in mean monthly flow would be greater in some years. (September through October and March through April flows would be transitional and intermediate between those described for November through February and for May through August.)

Northern hardpan vernal pools and Northern volcanic mudflow vernal pools are not present at Shasta Dam and are generally not present within the active floodplain immediately adjacent to the channel of the upper Sacramento River or its tributaries in the primary study area. Therefore, northern hardpan vernal pools and associated special-status plant species would likely not be affected by the altered flows in the primary study area downstream from Shasta Dam.

The altered flow regime of the upper Sacramento River associated with implementation of CP1 could affect oak communities and upland habitat for special-status plant species by prolonging inundation and changing the availability of soil moisture. Prolonged inundation during the growing season kills most upland plants. This effect would occur during years when mean monthly stage during March – October is greater than in preceding years. Interannual fluctuations in stage during the growing season already cause upland vegetation to become removed from (or prevent its establishment within) a zone along rivers downstream from Shasta Dam. CP1 could increase the average elevation of this zone slightly (by, on average, increasing stage during the growing season of most years), but it would not increase the zone's elevational range. For some upland vegetation, greater summer flows in some years also could increase summer soil moisture, and reduced intermediate and large flows during winter in some years could reduce spring soil moisture. Because of the important influence of water availability on plant growth and survival, these changes in the availability of moisture could change the structure and species composition of oak communities or affect special-status plants of upland habitats.

These effects, however, are speculative, and may not all prove to be adverse with project implementation and operation. For example, greater summer flows in some years could increase summer soil moisture; in dry years, increased soil moisture could sustain plants that otherwise would be damaged or die. Therefore, the impact on oak communities and on upland habitat for special-status plants resulting from altered flow regimes on the upper Sacramento River within the primary study area would be less than significant.

The flow regime of a river or stream strongly influences the structure and species composition of the riparian and wetland communities associated with it.

For this reason, the altered flow regimes resulting from project implementation would affect riparian and wetland vegetation. These effects are described below.

River flows strongly affect the growth and survival of riparian plants. Riparian plants are strongly affected by the timing and duration of inundation; abrasion and burial by water-borne sediment; and by water table fluctuations (Toner and Keddy 1997; Friedman and Auble 1999; Karrenberg et al. 2002; Bagstad et al. 2005; Lite and Stromberg 2005; Williams and Cooper 2005). As a result, riparian communities often differ in structure and species composition along gradients of elevation or flooding frequency and intensity (Conard et al. 1977; Harris 1987; Toner and Keddy 1997; Bagstad et al. 2005; Vaghti and Greco 2007).

River flows not only affect the survival and growth of established riparian vegetation, but also create sites for establishment of early-successional vegetation. The geomorphic processes of channel meander migration, avulsion, and deposition of sediment on floodplains, which result primarily from intermediate and large flows, bury and uproot herbaceous vegetation and uproot or undercut trees and shrubs. These disturbances also create opportunities for early-successional vegetation to establish, including willow and cottonwood seedlings that grow to form willow scrub and Great Valley cottonwood riparian forest.

Early successional riparian communities change rapidly in structure and species composition (Tu 2000; Fremier 2003; Vaghti and Greco 2007). Over several decades, early-successional vegetation develops into mid- and late-successional vegetation with less willow and cottonwood and a greater abundance of other trees including box-elder, Oregon ash, black walnut, and valley oak (e.g., Great Valley mixed riparian forest) (Fremier 2003).

Thus, for riparian vegetation, the rates of geomorphic processes strongly affect the extent of different riparian communities; and, these rates are strongly related to flow regime. For example, bank erosion, and the average rate of meander migration are closely related to the cumulative portion of flow above a threshold volume. On portions of the Sacramento River, this threshold may be around 30,000 cfs (Larsen et al. 2006; Stillwater Sciences 2007), which is well below the bankfull discharge but well above flows during spring and summer. However, other important thresholds for bank erosion and channel avulsion along the Sacramento River have been estimated within the range from 10,000 to 80,000 cfs (Stillwater Sciences 2007). (For additional discussion of the relationship of geomorphic processes to flow along the Sacramento River, see the *Fisheries and Aquatic Ecosystem Technical Report*.)

Flow regimes during the period of seed dispersal also strongly influence establishment of seedlings of riparian trees and shrubs, particularly willows and cottonwoods. In general, seeds of riparian plants can only successfully germinate and establish on exposed surfaces; prolonged inundation of a surface

during the growing season prevents establishment. Willows and cottonwoods have very small, short-lived seed and are shade-intolerant plants; thus, their seeds must disperse to exposed, moist surfaces that are largely free of vegetation. Such surfaces are often created by channel migration, avulsion, and sediment deposition during larger winter and spring flows. They are then exposed by declining flows during the seed dispersal period of willow and cottonwood species. These seed dispersal periods are staggered across spring and summer; for example, March through April for arroyo willow, April–June for cottonwood, and May through August for black willow. Once willow and cottonwood seeds germinate, slowly declining flows are necessary to maintain their roots in contact with saturated soils, which in turn is necessary for establishment. Rapidly declining flows (i.e., those greater than 1 to 1.5 inches per day) result in desiccation and mortality of seedlings (Mahoney and Rood 1998; Stillwater Sciences 2007). Conversely, flows that increase during the growing season bury, uproot, or scour many seedlings.

Consequently, reductions in the magnitude, duration, and frequency of intermediate and large flows could reduce opportunities for cottonwood and willow species to establish and thus limit the extent of early and mid-successional riparian communities. The absence of slowly declining spring flows also would reduce cottonwood establishment.

The operation of Shasta Dam has limited the frequency, magnitude, and duration of intermediate and larger flows during fall and winter, since the dam's construction, and flow volumes have been greater during the growing season. The operation of Shasta Dam also produces increasing flow volumes during the period of cottonwood seed dispersal (rather than flow volume decreasing during this period), largely precluding establishment of cottonwoods (and to a lesser extent willows) throughout much of the riparian zone (Roberts et al. 2002). The combined effect of these changes in flow regime has been a decrease in early- and mid-successional communities along the Sacramento River that is still ongoing (Fremier 2003).

CP1 would lead to a further reduction in the magnitude, duration, and frequency of intermediate and large flows, but it would not alter the general annual pattern of flows increasing during the cottonwood seed dispersal period. However, CP1's effects on larger flows could further reduce the frequency or extent of suitable conditions for cottonwoods to establish from seed. Overall, the project would increase the existing, ongoing impacts on riparian vegetation resulting from the operation of Shasta Dam. This could reduce the area of riparian vegetation slightly, and reduce the proportion of riparian vegetation that is in early- and mid-successional stages (e.g., willow- and cottonwood-dominated communities) while increasing the extent of mid-successional communities (e.g., mixed riparian forest). This would be an exacerbation of an ongoing transition (which is described under Impact Bot-7 (No-Action)).

These effects would likely occur along the upper Sacramento River throughout the primary study area. Reductions in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian corridor along the upper Sacramento River, downstream from Shasta Dam, throughout the primary study area. These effects on larger flows downstream from Keswick Dam and above Red Bluff are shown on Figures 12-5 and 12-6, respectively. On average, mean monthly flows greater than 15,000 cfs would be reduced only slightly; however, this average reduction reflects a combination of many months with little change in flow and other months with larger changes. For example, at Red Bluff, 142 months had mean monthly flows greater than 15,000 cfs. On average, CP1 would result in a reduction in these flows of less than 2 percent; but in 16 (11 percent) of these months, flows would be reduced by more than 5 percent versus only 1 month with a simulated increase of greater than 5 percent.

Although the establishment of most wetland plants is less strongly influenced by specific attributes of the flow regime than willows and cottonwoods, flow regime still plays an important role in wetland communities. In general, wetland communities on floodplains are strongly influenced by timing and duration of inundation, scour and deposition of sediment, and fluctuations in water table elevations within and among years (Keddy 2000; Leyer 2005; van Eck et al. 2006). Changes in flow during some years would change the extent of some wetland communities (e.g., seeps, seasonal wetlands) during that year and/or subsequent years, and thus the average extent of those communities. Overall, wetland communities could experience effects similar to those described for riparian communities.

For the reasons outlined above, and because riparian and wetland communities are sensitive natural communities, this impact would be significant. Mitigation for this impact is proposed in Section 12.3.5.

Eleven special-status plant species could occur in riparian or wetland habitats in the primary study area (including mesic upland-associated species; Table 12-4). Of these, within the primary study area and nearby counties (Butte and Glenn), four are known to occur along the edge of the Sacramento River channel, or along a Sacramento River tributary within 0.2 mile of the river proper, and their establishment and reproduction could potentially be affected by changes in flow regime: fox sedge (CNPS list 2), silky cryptantha (CNPS list 1B), rose mallow (CNPS list 2), and Ahart's paronychia (CNPS list 1B) (CNDDB 2007; University of California 2011). Because altered flow regimes associated with the project could modify habitat for these special-status species, this impact would be significant.

*Impact Bot-8 (CP1): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management*
Numerous local and regional plans promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because

CP1 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant**.**

Local and regional plans addressing riparian habitats in the primary study area are discussed in more detail in the "Regulatory Setting" section of this EIS and include the RHJV and the Sacramento River Conservation Area Program, both of which promote the conservation and the restoration of riparian habitat. As described for Impact Bot-7 (CP1), implementation of this alternative could cause substantial adverse effects on riparian and wetland communities by altering the flow regime of the upper Sacramento River and could, therefore, conflict with existing local and regional plans that aim to conserve riparian habitats. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-9 (CP1): Disturbance or Removal of Designated Critical Habitat for Special-Status Species* Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, such critical habitat is not expected to be adversely affected by CP1. This impact would be less than significant.

Critical habitat for four special-status species – slender orcutt grass, Hoover's spurge, hairy orcutt grass, and Greene's tuctoria – exists within the primary study area. Critical habitat for these species in the primary study areas is confined to vernal pool communities (USFWS 2006). Vernal pools are generally not present within the active floodplain. However, if vernal pool habitats for these special-status species are present in the active floodplain of the upper Sacramento River, they could be affected by the small reduction in the frequency and magnitude of overbank flows. It is not known if this would be an adverse or beneficial effect. Because this effect of CP1 is somewhat speculative and not necessarily adverse, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-10 (CP1): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth* Implementing CP1 could increase water yield for water districts in the primary study area along the upper Sacramento River. This increase in water yield could reduce a limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

Along the upper Sacramento River, the CVP and SWP service areas contain wetland, riparian, oak, and other sensitive plant communities, and a large number of special-status plant species (Attachment 4). Increased water supplies

or increased supply reliability could reduce a limitation on urban growth and development or on other activities that could affect sensitive plant communities or special-status plants in the primary and extended study areas, potentially resulting in significant effects.

The expected increase in water yield relative to the entire CVP and SWP service areas would be small (i.e., less than 1 percent), however, and this new yield would be provided to a number of geographic areas within the CVP and SWP service areas. (In the portions of the CVP service area in the upper Sacramento River region, total agricultural water supplies would increase in some years but by less than 1 percent.) Also, a substantial portion of this water would substitute for groundwater pumping, allow for changes in agricultural irrigation practices, or return idle cropland to production. Consequently, this alternative's effect on growth that could affect vegetation would be minor.

Furthermore, the effects of this growth would be analyzed in general plan Environmental Impact Reports and in project-level CEQA compliance documents for the local jurisdictions in which the growth would occur. Mitigation of these effects would be the responsibility of these local jurisdictions, and not of Reclamation. Similarly, projects potentially affecting riparian and wetland habitats and listed species would require permits from DFG, USACE, and USFWS; it is anticipated that effects on these resources would be avoided, minimized, and/or mitigated during those agency consultations.

The extent of induced growth that could affect botanical resources would likely be minor, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-11 (CP1): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or the Reading Island Restoration Plan, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP1. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-12 (CP1): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP1. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-13 (CP1):Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP1. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

**Lower Sacramento River and Delta**

*Impact Bot-14 (CP1): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River* Altered flow regimes associated with project implementation under CP1 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and loss of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River, but these effects are unlikely to extend to the Delta; thus, this impact would be significant on the lower Sacramento River, and less than significant in the Delta.

This impact would be similar to Impact Bot-7 (CP1) for the upper Sacramento River, but alteration of the Sacramento River's flow regime would be attenuated in the lower river by the effects of inflows from tributaries and of diversions and flood bypasses. Measurable effects on riparian and wetland plant communities are unlikely to extend as far downstream as the Delta, in part because releases from Shasta Dam account for a smaller fraction of total flow with increasing distance downstream as tributaries cumulatively add to the Sacramento River's flow.

Nonetheless, significant impacts on riparian and wetland communities, and associated special-status plants, would be caused on the lower Sacramento River, particularly near the upper Sacramento River. South of RBDD, the portion of the Sacramento River's total annual flow that is accounted for by flows greater than 30,000 cfs would still be reduced, and also the frequency of flows greater than 60,000 to 80,000 cfs (i.e., roughly the size of the current 1.5- to 2-year events) would be reduced. For Red Bluff, Wilkins Slough, and Freeport, these changes are summarized on Figures 12-6, 12-7, and 12-8, respectively. (These three locations are shown on Figure 12-9.) As described for Impact Bot-7 (CP1) (and in the *Fisheries and Aquatic Ecosystem Technical Report*), flows above about 30,000 cfs and 1.5- to 2-year events cause substantial changes in riparian ecosystems. These changes indicate that although they would be small, the alterations to the lower Sacramento River's flow regime could be sufficient to cause significant impacts in the Red Bluff-to-Chico Landing reach. This reach is immediately downstream from the primary

study area but upstream from the flood bypasses and the Feather and American rivers, which substantially attenuate the effects of flows released from Shasta Dam. This reach is mostly unleveed and has few other constraints to channel movement, river meander, and flooding; consequently, it has an extensive acreage of early-, mid-, and late-successional riparian communities (Resources Agency 2003).

Effects are unlikely to extend to the Delta because the flood bypasses and the Feather and American rivers attenuate the effects of flows released from Shasta Dam. In addition, much of the Sacramento River's length south of Colusa, and almost all Delta sloughs, are leveed (often close to the channel), restricting channel movement, river meander and flooding. Further; the acreage of early-, mid-, and late-successional riparian communities is much less extensive along the Sacramento River south of Colusa and in the Delta.

Effects of flow alterations are also unlikely to extend to the Delta because the Central Valley's reservoirs and diversions are managed as a single integrated system (consisting of the CVP and SWP). The guidelines for this management, which are described in the CVP Operations Criteria and Plan, have been designed to maintain standards for Delta inflow. CVP and SWP operations must be consistent with the Operations Criteria and Plan to allow coverage by the Operations Criteria and Plan biological opinion. Thus, implementation of CP1 is not anticipated to alter Sacramento River flows to the Delta sufficiently to alter the dynamics or structure of vegetation in the Delta. Thus, impacts on the Delta portion of the extended study area would be less than significant.

This impact would be significant along the lower Sacramento River and less than significant in the Delta. Mitigation for this impact along the lower Sacramento River is proposed in Section 12.3.5.

*Impact Bot-15 (CP1): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Along the Lower Sacramento River* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. Because CP1 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact on the lower Sacramento River would be potentially significant**.**

Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River and in the Delta. These plans, which are discussed in more detail in the "Regulatory Framework" of this EIS, include the Riparian Habitat Joint Venture and the Sacramento River Conservation Area Program, both of which promote the conservation and the restoration of riparian habitat. As described for Impact Bot-14 (CP1), implementation of this alternative could cause substantial adverse effects on riparian and wetland communities along a portion of the lower

Sacramento River by altering its flow regime, but such effects would not occur in the Delta. Because the project has the potential to result in substantial adverse effects on riparian communities, it could conflict with existing local and regional plans. Therefore, on the lower Sacramento River, this impact would be potentially significant, but in the Delta this impact would be less than significant. Mitigation for this impact on the lower Sacramento River is proposed in Section 12.3.5.

*Impact Bot-16 (CP1): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Along the Lower Sacramento River and in the Delta* Implementation of CP1 could increase water yield for water districts in the extended study area along the lower Sacramento River. This increase in water yield could reduce a limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1) for the upper Sacramento River, but the increased water yield available along the lower Sacramento River would differ from that along the upper Sacramento River. However, this impact would also be less than significant. Mitigation for this impact is not needed, and thus not proposed.

**CVP/SWP Service Areas**

*Impact Bot-17 (CP1): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas* Altered flow regimes associated with project implementation under CP1 could alter the structure and species composition or cause the loss of sensitive plant communities and of habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to alter the extent of early successional riparian and wetland communities or of associated habitat for special-status species. Therefore, this impact would be less than significant below CVP and SWP reservoirs in the extended study area.

This impact would be similar to Impact Bot-7 (CP1) for the upper Sacramento River. However, flow changes below CVP and SWP reservoirs are anticipated to be smaller than along the Sacramento River. These alterations may not be sufficient to alter the extent of early successional riparian and wetland communities or of associated habitat for special-status species. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-18 (CP1): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementing CP1 would not cause a significant impact on riparian vegetation and habitats. Therefore, CP1 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact in the CVP and SWP service areas would be less than significant.

Local and regional plans address and promote the conservation of riparian vegetation and associated habitats in the CVP and SWP service areas. (These plans are discussed in more detail in the "Regulatory Setting" section of this EIS.) However, as described for Impact Bot-17 (CP1), implementation of CP1 would not cause significant impacts on riparian and wetland communities in the CVP and SWP service areas. Therefore, CP1 would not conflict with existing local and regional plans. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-19 (CP1): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas* Implementation of CP1 could increase water yield for water districts in the CVP and SWP service areas. This increase in water yield could reduce a limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1) for the upper Sacramento River, but the increased water yield available in the CVP and SWP service areas would differ from that along the upper Sacramento River. However, this impact would also 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, this comprehensive plan focuses on enlarging Shasta Dam and Shasta Lake consistent with the goals of the 2000 CALFED ROD (CALFED 2000b), and was formulated for the primary purposes of increasing water supply reliability and survival of anadromous fish. In addition to the features common to all comprehensive plans, CP2 consists of raising Shasta Dam 12.5 feet, an elevation change that would increase the reservoir's full pool by 14.5 feet and enlarge the total storage space in the reservoir by 443,000 acre-feet. This alternative would help reduce future shortages by increasing water supply reliability in drought and average years. The increased cold-water pool also

would contribute to improved seasonal water temperatures for anadromous fish on the upper Sacramento River.

**Shasta Lake and Vicinity**

*Impact Bot-1 (CP2): Loss of Federally or State-Listed Plant Species* Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact on Federally listed, State-listed, or candidate plant species would occur under CP2. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-2 (CP2): Loss of MSCS Covered Species* Implementation of the project could result in the loss of MSCS covered species because of inundation, vegetation removal, or construction activities. Therefore, this impact would be significant.

Impacts related to dam construction and vegetation clearing within the relocation areas would be similar to CP1. However, inundation caused by a 12.5-foot raise of Shasta Dam could result in the loss of more individual plants. Therefore, this impact would be significant.

Additional analysis of impacts will be conducted in relation to suitable habitats in the Shasta Lake watershed. An analysis of indirect impacts and temporary impacts will be provided in the FEIS. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-3 (CP2): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species* Implementation of the project could result in the loss of USFS sensitive, BLM sensitive, or CRPR species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Impacts related to dam construction and vegetation clearing within the relocation areas would be similar to CP1. However, inundation caused by a 12.5-foot raise of Shasta Dam could result in the loss of more individual plants and their suitable habitat. Therefore, this impact would be potentially significant.

Additional analysis of impacts will be conducted in relation to suitable habitats in the Shasta Lake watershed. An analysis of indirect impacts and temporary impacts will be provided in the FEIS. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-4 (CP2): Loss of Jurisdictional Waters* Implementation of the project may result in the loss of jurisdictional waters caused by flooding the impoundment area and discharge of fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine). Therefore, this impact would be significant.

Direct impacts would incur with the conversion of jurisdictional waters (e.g., wetlands and streams) to lacustrine with implementation of CP2. All features within the impoundment area would be converted to lacustrine. Under CP2, 15 acres of wetlands and 25 acres of other waters would be converted to lacustrine (Table 12-12). This will result in a net loss of 15 acres to wetlands and a no net loss to other waters. This is considered a significant impact.

**Table 12-12. Impacts to Jurisdictional Waters (Acres*) in the Impoundment Area (12.5-Foot Dam Raise)**

| Jurisdictional Water Type | Main Body | Big Backbone Arm | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
|---|---|---|---|---|---|---|
| **Wetlands** | | | | | | |
| Fresh emergent/ riparian wetland | 0.00 | 0.00 | 3.13 | 0.00 | 0.00 | 0.00 |
| Intermittent swale | 0.00 | 0.001 | 0.00 | 0.00 | 0.00 | 0.03 |
| Riparian wetland | 0.79 | 0.66 | 4.40 | 2.79 | 0.67 | 0.69 |
| Seasonal wetland | 0.00 | 0.00 | 0.14 | 0.00 | 0.08 | 0.02 |
| Seep/spring wetland | 0.57 | 0.17 | 0.59 | 0.21 | 0.07 | 0.34 |
| Vegetated ditch | 0.08 | 0.00 | 0 | 0.01 | 0.00 | 0.00 |
| Total Wetlands | 1.44 | 0.84 | 8.26 | 3.01 | 0.82 | 1.08 |
| **Other Waters of the United States** | | | | | | |
| Ephemeral stream | 0.19 | 0.01 | 0.37 | 0.17 | 0.09 | 0.08 |
| Intermittent stream | 1.00 | 0.15 | 1.34 | 0.61 | 0.55 | 1.70 |
| Perennial stream | 1.14 | 1.32 | 6.57 | 7.55 | 1.52 | 0.88 |
| Roadside ditch | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Seep/spring other waters | 0.02 | 0.00 | 0.001 | 0.01 | 0.00 | 0.00 |
| Total Other Waters | 2.39 | 1.48 | 8.29 | 8.34 | 2.16 | 2.66 |
| Total Waters of the U.S. | 3.83 | 2.32 | 16.55 | 11.35 | 2.98 | 3.74 |

Note:
*Acreage values are approximate.

Direct impacts on jurisdictional waters (e.g., intermittent and perennial streams) that will be filled as a result of relocation of facilities or dam construction will be determined. Additionally, some fill may be placed in the existing full pool of Shasta Lake for restoration and enhancement activities. An analysis of impacts

on jurisdictional waters in the full pool, relocation areas, indirect impacts, and temporary impacts will be provided in the FEIS. Additional analysis of impacts will be conducted in relation to waters of the United States present in the Shasta Lake watershed. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-5 (CP2): Loss of General Vegetation Habitats* Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Under CP2, a total of 1,715 acres of general vegetation habitats will be directly impacted by the inundation of the impoundment area (Table 12-13).

**Table 12-13. Impacts to CWHR Habitats (Acres*) in the Impoundment Area (12.5-Foot Dam Raise)**

| Habitat | Area (Acres*) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Creek | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| Annual grassland | 0.36 | 0 | 1.53 | 0.53 | 0 | 0 |
| Barren | 0.77 | 0 | 0.36 | 0.00 | 0 | 0.00 |
| Blue oak – foothill pine | 7.05 | 0 | 0 | 0 | 2.46 | 5.27 |
| Blue oak woodland | 0 | 0 | 0 | 0 | 0 | 1.65 |
| Closed-cone pine – cypress | 24.40 | 0 | 8.95 | 14.89 | 32.72 | 262.31 |
| Douglas-fir | 0 | 0 | 0 | 0.06 | 0 | 0 |
| Mixed chaparral | 20.58 | 9.56 | 112.76 | 10.97 | 7.35 | 40.11 |
| Montane hardwood | 53.30 | 25.75 | 120.48 | 45.31 | 13.31 | 1.77 |
| Montane hardwood – conifer | 48.77 | 0.70 | 99.06 | 97.70 | 78.41 | 7.73 |
| Montane riparian | 2.72 | 3.23 | 20.57 | 6.12 | 1.00 | 1.19 |
| Ponderosa pine | 152.04 | 21.54 | 123.71 | 114.78 | 35.08 | 40.92 |
| Riverine | 0 | 0.42 | 4.02 | 4.51 | 0.84 | 0 |
| Urban | 16.65 | 0 | 1.63 | 6.42 | 0 | 1.24 |
| Total | 326.64 | 61.20 | 492.71 | 301.28 | 171.18 | 362.19 |

Note:
*Acreage values are approximate.

Additional analysis of impacts will be conducted in relation to suitable habitats in the Shasta Lake watershed. An analysis of indirect impacts and temporary impacts will be provided in the FEIS. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional

discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-6 (CP2): Spread of Noxious and Invasive Weeds* Implementation of the project could result in the spread of noxious and invasive weeds as a result of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). Therefore, this impact would be potentially significant.

Impacts resulting from the spread of noxious weeds under CP2 are anticipated to be similar to, but greater than, those described for CP1. This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

**Upper Sacramento River (Shasta Dam to Red Bluff)**

*Impact Bot-7 (CP2): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes* Altered flow regimes associated with project implementation under CP2 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. For example, greater summer flows in some years could increase summer soil moisture, especially during some dry and critical years as more water is released from Shasta Dam for water supply reliability purposes. This increased soil moisture in dry years could reduce losses of upland vegetation during drought years. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, this impact would be significant.

This impact would be similar to Impact Bot-7 (CP1). The extent of the impact under CP2 would be greater than that under CP1, but less than that under CP3, which would entail more substantial alterations of flow regimes. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative below Keswick Dam and above Red Bluff are summarized on Figures 12-5 and 12-6, respectively.) This impact would be significant for riparian and wetland plant communities and associated special-status plants. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-8 (CP2): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management*
Numerous local and regional plans promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP2 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Bot-8 (CP1). The extent of the impact under CP2 would be greater than that under CP1 but less than that under CP3, and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-9 (CP2): Disturbance or Removal of Designated Critical Habitat for Special-Status Species* Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, critical habitat for vernal pool species is not expected to be adversely affected by CP2 because vernal pools are generally not present within the active floodplain. For this reason, this impact would be less than significant.

This impact would be similar to Impact Bot-9 (CP1). The extent of the impact under CP2 would be greater than that under CP1 but less than that under CP3, and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-10 (CP2): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth* Implementation of CP2 could increase water yield for water districts in the primary study area along the upper Sacramento River. This increase in water yield could reduce a limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1). In the portions of the CVP service area in the upper Sacramento River region, total agricultural water supplies would increase in some years by up to 1 percent. The extent of the impact under CP2 would be greater than that under CP1 but less than that under CP3, which would entail more substantial alterations of flow regimes. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-11 (CP2): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or the Reading Island Restoration Plan, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP2. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-12 (CP2): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp,*

*or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP2. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-13 (CP2):Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP2. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

**Lower Sacramento River and Delta**

*Impact Bot-14 (CP2): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower sacramento River* Altered flow regimes associated with project implementation under CP2 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River, but these effects are unlikely to extend to the Delta; thus, for riparian and wetland communities and special-status plants, this impact would be significant on the lower Sacramento River, and less than significant in the Delta.

This impact would be similar to Impact Bot-14 (CP1). The extent of the impact under CP2 would be greater than that under CP1, but less than that under CP3, which would entail more substantial alterations of flow regimes. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative above Red Bluff and at Wilkins Slough and Freeport are summarized on Figures 12-6, 12-7, and 12-8, respectively.) This impact would be significant on the lower Sacramento River for riparian and wetland plant communities and associated special-status plant species. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-15 (CP2): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Along the Lower Sacramento River* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. Because CP2 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact on the lower Sacramento River would be potentially significant.

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-16 (CP2): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Along the Lower Sacramento River and in the Delta* Implementation of CP2 could increase water yield for water districts in the extended study area along the lower Sacramento River. This increase in water yield could reduce a limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-16 (CP1). The extent of the impact under CP2 would be greater than that under CP1 but less than that under CP3, which would result in greater increases in water yield. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

**CVP/SWP Service Areas**

*Impact Bot-17 (CP2): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas* Altered flow regimes associated with project implementation under CP2 could alter the structure and species composition or cause the loss of sensitive plant communities and of habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to affect the extent of early-successional riparian and wetland communities or of associated habitats for special-status plant species. Therefore, this impact would be less than significant below CVP and SWP reservoirs in the extended study area.

This impact would be similar to Impact Bot-17 (CP1). The extent of the impact under CP2 would be greater than that under CP1 but less than that under CP3, which would entail more substantial alterations of flow regimes. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-18 (CP2): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of CP2 would not cause a significant impact on riparian vegetation and habitats.

Therefore, CP2 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact in the CVP and SWP service areas would be less than significant.

This impact would be to the same as Impact Bot-18 (CP1). The extent of the impact under CP2 would be greater than that under CP1 but less than that under CP3, and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-19 (CP2): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas* Implementation of CP2 could increase water yield to water districts in the CVP and SWP service areas. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-19 (CP1). The extent of the impact under CP2 would be greater than that under CP1 but less than that under CP3, which would result in greater increases in water yield. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

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

CP3 is similar to CP1 and CP2. It focuses on the greatest practical enlargement of Shasta Dam and Shasta Lake consistent with the goals of the 2000 CALFED ROD (CALFED 2000b), and was formulated for the primary purposes of increasing water supply reliability and survival of anadromous fish. In addition to the features common to all comprehensive plans, CP3 consists of raising Shasta Dam 18.5 feet, an elevation change that would increase the reservoir's full pool by 20.5 feet and enlarge the reservoir's total storage space by 634,000 acre-feet to 5.19 million acre-feet.

The botany and wetland impact analysis for CP1 assumes maximum vegetation clearing within the relocation areas. Therefore, vegetation clearing impacts within the relocation areas would be identical for CP1 through CP5.

**Shasta Lake and Vicinity**

*Impact Bot-1 (CP3): Loss of Federally or State-Listed Plant Species* Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact on Federally listed, State-listed, or candidate plant species would occur under CP3. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-2 (CP3): Loss of MSCS Covered Species* Implementation of the project could result in the loss of MSCS covered species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be significant.

Impacts related to dam construction and vegetation clearing within the relocation areas would be similar to CP1. However, inundation caused by a 18.5-foot raise of Shasta Dam could result in the loss of more individual plants. This impact would be significant.

Additional analysis of impacts will be conducted in relation to suitable habitats in the Shasta Lake watershed. An analysis of indirect impacts and temporary impacts will be provided in the FEIS. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-3 (CP3): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species* Implementation of the project could result in the loss of USFS sensitive, BLM sensitive, or CRPR species because of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Impacts related to dam construction and vegetation clearing within the relocation areas would be similar to CP1. However, inundation caused by a 18.5-foot raise of Shasta Dam could result in the loss of more individual plants. This impact would be potentially significant.

Additional analysis of impacts will be conducted in relation to suitable habitats in the Shasta Lake watershed. An analysis of indirect impacts and temporary impacts will be provided in the FEIS. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-4 (CP3): Loss of Jurisdictional Waters* Implementation of the project may result in the loss of jurisdictional waters caused by flooding the impoundment area and discharge of fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine). Therefore, this impact would be significant.

Direct impacts would incur with the conversion of jurisdictional waters (e.g., wetlands and streams) to lacustrine with implementation of CP3. All features within the impoundment area would be converted to lacustrine. Under CP3, 25 acres of wetlands and 47 acres of other waters would be converted to lacustrine

(Table 12-14). This will result in a net loss of 25 acres to wetlands and a no net loss to other waters. This is considered a significant impact.

**Table 12-14. Impacts to Jurisdictional Waters (Acres*) in the Impoundment Area (18.5-Foot Dam Raise)**

| Jurisdictional Water Type | Main Body | Big Backbone Arm | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
|---|---|---|---|---|---|---|
| **Wetlands** | | | | | | |
| Fresh emergent/ riparian wetland | 0.00 | 0.00 | 3.14 | 0.00 | 0.00 | 0.00 |
| Intermittent swale | 0.00 | 0.002 | 0.00 | 0.00 | 0.00 | 0.04 |
| Riparian wetland | 1.16 | 1.71 | 5.42 | 8.26 | 1.48 | 0.82 |
| Seasonal wetland | 0.00 | 0.00 | 0.18 | 0.00 | 0.14 | 0.02 |
| Seep/spring wetland | 0.77 | 0.23 | 0.80 | 0.31 | 0.13 | 0.41 |
| Vegetated ditch | 0.13 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Total Wetlands | 2.06 | 1.94 | 9.54 | 8.59 | 1.75 | 1.29 |
| **Other Waters of the United States** | | | | | | |
| Ephemeral stream | 0.28 | 0.02 | 0.54 | 0.26 | 0.12 | 0.13 |
| Intermittent stream | 1.42 | 0.25 | 2.06 | 0.94 | 0.84 | 2.61 |
| Perennial stream | 1.53 | 3.00 | 8.67 | 20.27 | 2.29 | 1.46 |
| Roadside ditch | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Seep/spring other waters | 0.03 | 0.00 | 0.001 | 0.01 | 0.00 | 0.00 |
| Total Other Waters | 3.26 | 3.27 | 11.29 | 21.48 | 3.25 | 4.20 |
| Total | 5.32 | 5.21 | 20.83 | 30.07 | 5.00 | 5.49 |

Note:
*Acreage values are approximate.

Direct impacts on jurisdictional waters (e.g., intermittent and perennial streams) that will be filled as a result of relocation of facilities or dam construction will be determined. Additionally, some fill may be placed in the existing full pool of Shasta Lake for restoration and enhancement activities. An analysis of impacts on jurisdictional waters in the full pool, relocation areas, indirect impacts, and temporary impacts will be provided in the FEIS. Additional analysis of impacts will be conducted in relation to waters of the United States present in the Shasta Lake watershed. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-5 (CP3): Loss of General Vegetation Habitats* Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Under CP3, 2,472 acres of general vegetation habitats will be directly impacted by the inundation of the impoundment area (Table 12-15).

**Table 12-15. Impacts to CWHR Habitats (Acres*) in the Impoundment Area (18.5-Foot Dam Raise)**

| Habitat | Area (Acres*) | | | | | |
|---|---|---|---|---|---|---|
| | Main Body | Big Backbone Creek | Sacramento Arm | McCloud Arm | Squaw Creek Arm | Pit Arm |
| Annual grassland | 0.44 | 0 | 3.10 | 0.70 | 0 | 0 |
| Barren | 1.05 | 0.00 | 0.55 | 0.00 | 0.00 | 0.00 |
| Blue oak – foothill pine | 10.36 | 0 | 0 | 0 | 4.29 | 1.94 |
| Blue oak woodland | 0 | 0 | 0 | 0 | 0 | 6.81 |
| Closed-cone pine – cypress | 32.68 | 0 | 12.95 | 20.79 | 44.72 | 373.48 |
| Douglas-fir | 0 | 0 | 0 | 0.36 | 0 | 0 |
| Mixed chaparral | 29.19 | 13.64 | 161.04 | 15.06 | 10.35 | 59.50 |
| Montane hardwood | 73.49 | 38.76 | 171.01 | 66.06 | 19.43 | 2.49 |
| Montane hardwood – conifer | 70.68 | 0.99 | 150.42 | 140.93 | 111.63 | 10.55 |
| Montane riparian | 4.16 | 6.67 | 26.16 | 13.91 | 1.53 | 1.57 |
| Ponderosa pine | 215.11 | 30.72 | 188.19 | 161.74 | 49.56 | 57.50 |
| Riverine | 0 | 0.88 | 5.24 | 15.43 | 1.41 | 0 |
| Urban | 21.95 | 0 | 1.95 | 7.96 | 0 | 1.92 |
| Total | 459.11 | 91.67 | 720.06 | 442.93 | 242.92 | 515.77 |

Note:
*Acreage values are approximate.

Additional analysis of impacts will be conducted in relation to suitable habitats in the Shasta Lake watershed. An analysis of indirect impacts and temporary impacts will be provided in the FEIS. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-6 (CP3): Spread of Noxious and Invasive Weeds* Implementation of the project could result in the spread of noxious and invasive weeds because of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). Therefore, this impact would be potentially significant.

Impacts resulting from the spread of noxious weeds under CP3 are anticipated to be similar to, but greater than, those described for CP1. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

**Upper Sacramento River (Shasta Dam to Red Bluff)**

*Impact Bot-7 (CP3): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes* Altered flow regimes associated with project implementation under CP3 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities

and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, this impact would be significant.

This impact would be similar to Impact Bot-7 (CP1). The extent of the impact would be greater under CP3 than under CP1 and CP2 because it would entail more substantial alterations of flow regimes. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative below Keswick Dam and above Red Bluff are summarized on Figures 12-5 and 12-6, respectively.) This impact would be significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-8 (CP3): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management*
Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP3 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Bot-8 (CP1). The extent of the impact would be greater under CP3 than under CP1 and CP2 because it would result in a greater increase in water yield. This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-9 (CP3): Disturbance or Removal of Designated Critical Habitat for Special-Status Species* Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, such critical habitat is not expected to be adversely affected by CP3. For this reason, this impact would be less than significant.

This impact would be similar to Impact Bot-9 (CP1). The extent of the impact would be greater under CP3 than under CP1 and CP2 because it would result in a greater increase in water yield. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-10 (CP3): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth* Implementation of CP3 could increase water yield for water districts in the primary study area along the upper Sacramento River. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1). In the portions of the CVP service area in the upper Sacramento River region, total agricultural water supplies would increase in some years by up to 2 percent. The extent of the impact would be greater under CP3 than under CP1 and CP2 because it would result in a greater increase in water yield. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-11 (CP3): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or the Reading Island Restoration Plan, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP3. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-12 (CP3): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP3. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-13 (CP3):Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* The proposed gravel augmentation program and Reading Island restoration and construction activities would not be implemented under CP3. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

**Lower Sacramento River and Delta**

*Impact Bot-14 (CP3): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River* Altered flow regimes associated with project implementation under CP3 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River, but these effects are unlikely to extend to the Delta; thus, for riparian and wetland communities and special-status plants, this impact would be significant on the lower Sacramento River, and less than significant in the Delta.

This impact would be similar to Impact Bot-14 (CP1). The extent of the impact would be greater under CP3 than under CP1 and CP2 because it would entail more substantial alterations of flow regimes. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative above Red Bluff and at Wilkins Slough and Freeport are summarized on Figures 12-6, 12-7, and 12-8, respectively.) This impact would be significant on the lower Sacramento River and less than significant in the Delta. Mitigation for this impact on the lower Sacramento River is proposed in Section 12.3.5.

*Impact Bot-15 (CP3): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Along the Lower Sacramento River* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River in the extended study area. Because CP3 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact on the lower Sacramento River would be potentially significant.

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-16 (CP3): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Along the Lower Sacramento River and in the Delta* Implementation of CP3 could increase water for water districts in the extended study area along the lower Sacramento River. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-16 (CP1). The extent of the impact under CP2 would be similar to that under CP1 but less than that under CP3, which would result in a greater increase in water yield. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

**CVP/SWP Service Areas**

*Impact Bot-17 (CP3): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas* Altered flow regimes associated with project implementation under CP3 could alter the structure and species composition or cause the loss of sensitive plant communities and of habitat for special-status plant species. However, alteration of flow regimes

below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to alter the extent of early-successional riparian and wetland communities or associated habitats for special-status plant species. Therefore, this impact would be less than significant below CVP and SWP reservoirs in the extended study area.

This impact would be similar to Impact Bot-17 (CP1). The extent of the impact would be greater under CP3 than under CP1 and CP2. Nonetheless, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-18 (CP3): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of CP3 would not cause a significant impact on riparian vegetation and habitats. Therefore, CP3 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact in the CVP and SWP service areas would be less than significant.

This impact would be the same as Impact Bot-18 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-19 (CP3): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas* Implementation of CP3 could increase water yield to water districts in the extended study area in the CVP and SWP service areas. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-19 (CP1). The extent of the impact under CP2 would be similar to that under CP1 but less than that under CP3, which would result in a greater increase in water yield. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

#### *CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability*

The primary function of CP4 is to address the survival of anadromous fish while still improving water supply reliability. It focuses on increasing the volume of cold water available to the temperature control device through reservoir

reoperations, and on raising Shasta Dam by 18.5 feet. As with CP3 and the common features above, this raise would increase the full pool by 20.5 feet and enlarge total reservoir storage space by 634,000 acre-feet. This additional storage space would expand Shasta Lake's cold-water supply available to the temperature control device by 378,000 acre-feet.

In addition to the activities common to CP1 – CP3, CP4 includes augmenting locations along the Upper Sacramento River segment of the study area with gravel to increase spawning habitat for anadromous fish. Gravel placement would occur at one or more sites per year over a 10-year period and would be accomplished by one of three methods; lateral berms, talus cone, direct placement in river; as appropriate depending on specific conditions, including geomorphology, of the augmentation site. To the extent available, existing river access points would be used to deliver gravel to the river; however, temporary new access roads would be needed in some cases, mostly adjacent to the river.

In addition, under CP4, riparian, floodplain, and side channel habitat restoration would be constructed at Reading Island to restore habitat for anadromous salmonids in the Anderson Creek Slough. This Reading Island project could involve some vegetation clearing.

The botany and wetland impact analysis for CP1 assumes maximum vegetation clearing within the relocation areas. Therefore, vegetation clearing impacts within the relocation areas would be identical for CP1 thorugh CP5. However, greater vegetation clearing would result under CP4 as a result of clearing to access gravel augmentation sites and to allow gravel to fall easily into the river from adjacent banks or terraces.

**Shasta Lake and Vicinity**

*Impact Bot-1 (CP4): Loss of Federally or State-Listed Plant Species* Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact on Federally listed, State-listed, or candidate plant species would occur under CP4. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-2 (CP4): Loss of MSCS Covered Species* Implementation of the project could result in the loss of MSCS covered species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be significant.

This impact would be similar to Impact Bot-2 (CP3) and would be significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-3 (CP4): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species* Implementation of the project could result in the loss of USFS sensitive, BLM sensitive, or CRPR species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Bot-3 (CP3) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-4 (CP4): Loss of Jurisdictional Waters* Implementation of the project may result in the loss of jurisdictional waters because of flooding the impoundment area and fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine). Therefore, this impact would be significant.

This impact would be similar to Impact Bot-4 (CP3) and would be significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-5 (CP4): Loss of General Vegetation Habitats* Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities.

This impact would be similar to Impact Bot-5 (CP3) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-6 (CP4): Spread of Noxious and Invasive Weeds* Implementation of the project could result in the spread of noxious and invasive weeds as a result of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). This impact would be potentially significant.

Impacts resulting from the spread of noxious weeds under CP4 are anticipated to be similar to those described for CP3. This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

**Upper Sacramento River (Shasta Dam to Red Bluff)**

*Impact Bot-7 (CP4): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes* Altered flow regimes associated with project implementation under CP4 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, for riparian and wetland communities and special-status plants, this impact would be significant.

This impact would be the same as Impact Bot-7 (CP1) and would be significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-8 (CP4): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management*

Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP4 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant**.**

This impact would be the same as Impact Bot-8 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-9 (CP4): Disturbance or Removal of Designated Critical Habitat for Special-Status Species* Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, such critical habitat is not expected to be adversely affected by CP4. This impact would be less than significant.

This impact would be the same as Impact Bot-9 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-10 (CP4): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth* Implementation of CP4 could increase water yield for water districts in the primary study area along the upper Sacramento River. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be the same as Impact Bot-10 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-11 (CP4): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or the Reading Island Restoration Plan, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* Implementing the gravel augmentation program could result in the removal of riparian and wetland vegetation or the degradation of riparian and wetland habitats, including wetlands qualifying as waters of the United States. In addition, habitat restoration, boat ramp rehabilitation, and fishing area construction at Reading Island could remove riparian vegetation, or result in discharge of fill material into waters of the United States. This impact would be potentially significant.

A gravel augmentation program would be implemented under CP4, as described in Chapter 2, “Alternatives.” Gravel placement falls under Nationwide Permit (NWP) 27, “Aquatic Habitat Restoration, Establishment, and Enhancement.” Activities qualifying for NWPs have been determined by USACE to have no more than minimal adverse effects on the aquatic environment (72 Federal

Register 11092). Therefore, the direct placement of gravel into the Sacramento River would not be considered a significant impact on waters of the United States. There are no vernal pools or other seasonal wetlands present at any of the proposed augmentation sites. However, gravel augmentation could result in removal of riparian vegetation during construction of access routes to the gravel placement sites. To the extent feasible, existing access roads would be used, but access to some of the proposed placement sites does not currently exist. Clearing and grubbing would be needed to create access to these gravel placement sites, and in some areas, vegetation clearing along banks would be used to allow gravel to fall easily from the banks into the river. These activities could result in removal of riparian vegetation.

In addition, actions would be implemented to restore connectivity between the Sacramento River and the Reading Island side channel, to restore floodplain and riparian habitat in the Reading Island side channel, to rehabilitate the boat ramp at Reading Island, and to create a handicap fishing access area at Reading Island, as described in Chapter 2, "Alternatives."

Breaching or creating an engineered opening in the levee at Reading Island to restore flow from the Sacramento River to Anderson Slough would fall under NWP 27, "Aquatic Habitat Restoration, Establishment, and Enhancement." Rehabilitation of the existing boat ramp and construction of fishing access would also qualify for an NWP. Activities qualifying for NWPs have been determined by USACE to have no more than minimal adverse effects on the aquatic environment (72 Federal Register 11092). Therefore, these activities would not be considered to have a significant impact on waters of the United States. The Reading Island Restoration Plan would involve acquiring and revegetating floodplain terraces and adjacent riparian areas with native riparian vegetation. This is expected to provide a beneficial effect on floodplain and riparian habitat in the side channel. However, construction activities associated with restoring river connectivity, rehabilitating the boat ramp, or creating handicap fishing access could result in removal of riparian vegetation.

With implementation of the gravel augmentation program and habitat restoration, boat ramp rehabilitation, and fishing area construction at Reading Island, the impact on sensitive natural communities would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-12 (CP4): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* Vegetation removal and gravel placement could result in the loss of special-status plants if they are present, and implementing the Reading Island projects could result in the removal of riparian vegetation. This impact would be potentially significant.

Special-status plant species could be killed during vegetation clearing and grubbing or gravel placement if they are present at the gravel placement sites or areas that would be cleared for access. In addition, actions would be implemented to restore connectivity between the Sacramento River and the Reading Island side channel, to restore floodplain and riparian habitat in the Reading Island side channel, to rehabilitate the boat ramp at Reading Island, and to create a handicap fishing access area at Reading Island, as described in Chapter 2, "Alternatives." Special-status plants are not likely to be affected by rehabilitation of the boat ramp because it is an existing structure that would be accessed through existing paved surfaces. However, if special-status plant species are present on the levee or elsewhere on Reading Island, they could be killed during construction to restore connectivity between the Sacramento River and Anderson Slough or during construction of the handicap fishing access area.

Direct loss of special-status plants would be a potentially significant impact. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-13 (CP4): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* Implementing the gravel augmentation program could result in the spread of noxious and invasive weeds as a result of vegetation clearing and grubbing and an increased number of vectors. In addition, at Reading Island, actions would be implemented to restore connectivity between the Sacramento River and the Reading Island side channel, to restore floodplain and riparian habitat, to rehabilitate the boat ramp, and to create a handicap fishing access area at Reading Island. The activities at Reading Island could also result in the spread of noxious and invasive weeds as a result of vegetation clearing and grubbing and an increased number of vectors. This impact would be potentially significant.

Vegetation removal and grubbing at gravel placement sites and access routes could result in increased risk of introduction and spread of noxious and invasive weeds. The risk of introducing or spreading noxious weeds would vary depending on the proximity of existing noxious weed infestations, extent of ground-disturbing activities, and the amount of traffic entering a project site. Vectors that would increase as a result of project implementation include weed seed and seed parts brought in on tools, vehicles, and workers' clothing and boots. Vegetation clearing and construction of temporary access routes would increase the number of weed vectors in an area. As traffic along new and existing corridors increases, the risk for weed dispersal would increase. Seed mixtures and mulches may be used during erosion control efforts and revegetation of disturbed areas. These mixtures and mulches are potential vectors for noxious weed and invasive plant dispersal.

Reading Island restoration activities would include use of a mechanical harvester to remove invasive aquatic vegetation from the side channel and

Anderson Slough. This aspect of the restoration plan is expected to result in a beneficial effect by reducing the existing population of invasive aquatic plants. However, vegetation removal at the levee, boat ramp, and handicap fishing access construction sites and along 0.8 mile of the channel for conveyance could result in increased risk of introduction and spread of noxious and invasive weeds on Reading Island. The risk of introducing or spreading noxious weeds would vary depending on the proximity of existing noxious weed infestations, extent of ground-disturbing activities, and the amount of traffic entering a project site. Vectors that would increase as a result of project implementation include weed seed and seed parts brought in on tools, vehicles, and workers' clothing and boots. Vegetation clearing from the levee or for fishing access would increase the number of weed vectors in an area. As traffic along existing corridors increases, the risk for weed dispersal would increase. Seed mixtures and mulches used during erosion control efforts and revegetation of riparian areas are potential vectors for noxious weed and invasive plant dispersal.

Spread and introduction of noxious and invasive weeds would be a potentially significant impact. Mitigation for this impact is proposed in Section 12.3.5.

**Lower Sacramento River and Delta**

*Impact Bot-14 (CP4): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River* Altered flow regimes associated with project implementation under CP4 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River, but these effects are unlikely to extend to the Delta; thus, this impact would be significant on the lower Sacramento River, and less than significant in the Delta.

This impact would be the same as Impact Bot-14 (CP1) and would be significant on the lower Sacramento River and less than significant in the Delta. Mitigation for this impact on the lower Sacramento River is proposed in Section 12.3.5.

*Impact Bot-15 (CP4): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Along the Lower Sacramento River* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. Because CP4 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact on the lower Sacramento River would be potentially significant.

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-16 (CP4): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Along the Lower Sacrramento River and in the Delta* Implementation of CP4 could increase water yield to water districts in the extended study area along the lower Sacramento River. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be the same as Impact Bot-16 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

**CVP/SWP Service Areas**

*Impact Bot-17 (CP4): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas* Altered flow regimes associated with implementation of CP4 could alter the structure and species composition or cause the loss of sensitive plant communities and of habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to alter the extent of early-successional riparian and wetland communities or associated habitats for special-status plant species. Therefore, this impact would be less than significant below CVP and SWP reservoirs in the extended study area.

This impact would be the same as Impact Bot-17 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-18 (CP4): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of CP4 would not cause a significant impact on riparian vegetation and habitats. Therefore, CP4 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact in the CVP and SWP service areas would be less than significant.

This impact would be the same as Impact Bot-18 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-19 (CP4): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas* Implementation of CP4 could increase water yield for water districts in the extended study area along the lower Sacramento River. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be the same as Impact Bot-19 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

#### *CP5 – 18.5-Foot Dam Raise, Combination Plan*

CP5 would address both the primary and secondary planning objectives. In addition to the features common to all comprehensive plans, CP5 includes enlarging Shasta Dam 18.5 feet, which is consistent with the objectives of the 2000 CALFED ROD. CP5 also involves (1) implementing environmental restoration features along the lower reaches of major tributaries to Shasta Lake, (2) constructing shoreline fish habitat around Shasta Lake, and (3) constructing either additional or improved recreation features at various locations around Shasta Lake to increase the value of the recreational experience. Formulation of specific environmental restoration features and increased recreation components is included in the Draft Feasibility Report.

CP5 would also include implementing the same gravel augmentation program and the same riparian, floodplain, and side channel habitat restoration at Reading Island as described for CP4.

**Shasta Lake and Vicinity**

*Impact Bot-1 (CP5): Loss of Federally or State-Listed Plant Species* Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact on Federally listed, State-listed, or candidate plant species would occur under CP5. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-2 (CP5): Loss of MSCS Covered Species* Implementation of the project could result in the loss of MSCS covered species as a result of ground-disturbing construction activities or inundation. Therefore, this impact would be significant.

This impact would be similar to Impact Bot-2 (CP3) and would therefore be significant.

Additional impacts may occur depending on specific restoration and recreation enhancement details. These impacts will be quantified when the details of the

proposed actions are developed. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-3 (CP5): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species* Implementation of the project could result in the loss of USFS Sensitive, BLM Sensitive, or CRPR species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Bot-3 (CP3) and would be potentially significant.

Additional impacts may occur depending on specific restoration and recreation enhancement details. These impacts will be quantified when the details of the proposed actions are developed. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-4 (CP5): Loss of Jurisdictional Waters* Implementation of the project may result in the loss of jurisdictional waters because of flooding the impoundment area and fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine). This impact would be significant.

This impact would be similar to Impact Bot-4 (CP3) and would be significant.

Additional impacts may occur depending on specific restoration and recreation enhancement details. These impacts will be quantified when the details of the proposed actions are developed. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-5 (CP5): Loss of General Vegetation Habitats* Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities. This impact would be potentially significant.

This impact would be similar to Impact Bot-5 (CP3) and would be potentially significant.

Additional impacts may occur depending on specific restoration and recreation enhancement details. These impacts will be quantified when the details of the proposed actions are developed. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-6 (CP5): Spread of Noxious and Invasive Weeds* Implementation of the project could result in the spread of noxious and invasive weeds because of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). This impact would be potentially significant.

Impacts resulting from the spread of noxious weeds under CP5 are anticipated to be similar to those described for CP3. This impact would be potentially significant.

Additional impacts may occur depending on specific restoration and recreation enhancement details. These impacts will be quantified when the details of the proposed actions are developed. Mitigation for this impact is proposed in Section 12.3.5.

**Upper Sacramento River (Shasta Dam to Red Bluff)**

*Impact Bot-7 (CP5): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes* Altered flow regimes associated with project implementation under CP5 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, this impact would be significant.

This impact would be the same as Impact Bot-7 (CP3) and would be significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-8 (CP5): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management* Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP5 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be the same as Impact Bot-8 (CP3) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-9 (CP5): Disturbance or Removal of Designated Critical Habitat for Special-Status Species* Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, such critical habitat is not expected to be adversely affected by CP5. This impact would be less than significant.

This impact would be the same as Impact Bot-9 (CP3) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-10 (CP5): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth* Implementation of CP5 could increase water yield to water districts in the primary study area along the upper Sacramento River. This increase in water yield could reduce a limitation on

growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be the same as Impact Bot-10 (CP3) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-11 (CP5): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or the Reading Island Restoration Plan, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* Implementing the gravel augmentation program could result in the removal of riparian and wetland vegetation or the degradation of riparian and wetland habitats, including wetlands qualifying as waters of the United States. Habitat restoration, boat ramp rehabilitation, and fishing area construction at Reading Island could remove riparian vegetation, or result in discharge of fill material into waters of the United States. This impact would be potentially significant.

This impact would be the same as Impact Bot-11 (CP4) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-12 (CP5): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* Vegetation removal and gravel placement could result in the loss of special-status plants if they are present, and implementing the Reading Island projects could result in the removal of riparian vegetation. This impact would be potentially significant.

This impact would be the same as Impact Bot-12 (CP4) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-13 (CP5): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area* Implementing the gravel augmentation program could result in the spread of noxious and invasive weeds as a result of vegetation clearing and grubbing and an increased number of vectors. In addition, at Reading Island, actions would be implemented to restore connectivity between the Sacramento River and the Reading Island side channel, to restore floodplain and riparian habitat, to rehabilitate the boat ramp, and to create a handicap fishing access area at Reading Island. The activities at Reading Island could also result in the spread of noxious and invasive weeds as a result of vegetation clearing and grubbing and an increased number of vectors. This impact would be potentially significant.

This impact would be the same as Impact Bot-13 (CP4) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

**Lower Sacramento River and Delta**

*Impact Bot-14 (CP5): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River* Altered flow regimes associated with project implementation under CP1 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River, but these effects are unlikely to extend to the Delta; thus, this impact would be significant on the lower Sacramento River, and less than significant in the Delta.

This impact would be the same as Impact Bot-14 (CP3) and would be significant on the lower Sacramento River and less than significant in the Delta. Mitigation for this impact on the lower Sacramento River is proposed in Section 12.3.5.

*Impact Bot-15 (CP5): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Along the Lower Sacramento River* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. Because CP5 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact on the lower Sacramento River would be potentially significant.

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5.

*Impact Bot-16 (CP5): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Along the Lower Sacramento River and in the Delta* Implementation of CP5 could increase water yield for water districts in the extended study area along the lower Sacramento River. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be the same as Impact Bot-16 (CP3) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

**CVP/SWP Service Areas**

*Impact Bot-17 (CP5): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas* Altered flow regimes associated with project implementation under CP5 could alter the structure and species composition or cause the loss of sensitive plant communities and of habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to alter the extent of early-successional riparian and wetland communities or associated habitats for special-status plant species. Therefore, this impact would be less than significant below CVP and SWP reservoirs in the extended study area.

This impact would be the same as Impact Bot-17 (CP3) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-18 (CP5): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas* Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of CP5 would not cause a significant impact on riparian vegetation and habitats. Therefore, CP5 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact in the CVP and SWP service areas would be less than significant.

This impact would be the same as Impact Bot-18 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

*Impact Bot-19 (CP5): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas* Implementation of CP5 could increase water yield for water districts in the CVP and SWP service areas. This increase in water yield could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water yield for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be the same as Impact Bot-19 (CP3) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

### 12.3.5 Mitigation Measures

Table 12-16 presents a summary of mitigation measures for botanical resources and wetlands.

**Table 12-16. Summary of Mitigation Measures for Botanical Resources**

| Impact | | No-Action Alternative | CP1 | CP2 | CP3 | CP4 | CP5 |
|---|---|---|---|---|---|---|---|
| Impact Bot-1: Loss of Federally or State Listed Plant Species | LOS before Mitigation | NI | NI | NI | NI | NI | NI |
| | Mitigation Measure | None required. | None needed; thus, none proposed. | | | | |
| | LOS after Mitigation | NI | NI | NI | NI | NI | NI |
| Impact Bot-2: Loss of MSCS Covered Species | LOS before Mitigation | NI | S | S | S | S | S |
| | Mitigation Measure | None required. | Mitigation Measure Bot-2: Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas. | | | | |
| | LOS after Mitigation | NI | SU | SU | SU | SU | SU |
| Impact Bot-3: Loss of USFS Sensitive, BLM Sensitive, or CRPR Species | LOS before Mitigation | NI | PS | PS | PS | PS | PS |
| | Mitigation Measure | None required. | Mitigation Measure Bot-3: Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive, and CRPR Plants and Revegetate Affected Areas. | | | | |
| | LOS after Mitigation | NI | SU | SU | SU | SU | SU |
| Impact Bot-4: Loss of Jurisdictional Waters | LOS before Mitigation | NI | S | S | S | S | S |
| | Mitigation Measure | None required. | Mitigation Measure Bot-4: Mitigate Loss of Jurisdictional Waters. | | | | |
| | LOS after Mitigation | NI | SU | SU | SU | SU | SU |
| Impact Bot-5: Loss of General Vegetation Habitats | LOS before Mitigation | NI | PS | PS | PS | PS | PS |
| | Mitigation Measure | None required. | Mitigation Measure Bot-5: Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats. | | | | |
| | LOS after Mitigation | NI | SU | SU | SU | SU | SU |

**Table 12-16. Summary of Mitigation Measures for Botanical Resources (contd.)**

| Impact | | No-Action Alternative | CP1 | CP2 | CP3 | CP4 | CP5 |
|---|---|---|---|---|---|---|---|
| Impact Bot-6: Spread of Noxious and Invasive Weeds | LOS before Mitigation | NI | PS | PS | PS | PS | PS |
| | Mitigation Measure | None required. | Mitigation Measure Bot-6: Develop a Weed Management Plan. | | | | |
| | LOS after Mitigation | NI | LTS | LTS | LTS | LTS | LTS |
| Impact Bot-7: Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes | LOS before Mitigation | LTS | S | S | S | S | S |
| | Mitigation Measure | None required. | Mitigation Measure Bot-7: Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities. | | | | |
| | LOS after Mitigation | LTS | LTS | LTS | LTS | LTS | LTS |
| Impact Bot-8: Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management | LOS before Mitigation | LTS | PS | PS | PS | PS | PS |
| | Mitigation Measure | None required. | Mitigation Measure Bot-8: Implement Mitigation Measure Bot-7: Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities. | | | | |
| | LOS after Mitigation | LTS | LTS | LTS | LTS | LTS | LTS |
| Impact Bot-9: Disturbance or Removal of Designated Critical Habitat for Special-Status Species | 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 Bot-10: Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth | 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 |

**Table 12-16. Summary of Mitigation Measures for Botanical Resources (contd.)**

| Impact | | No-Action Alternative | CP1 | CP2 | CP3 | CP4 | CP5 |
|---|---|---|---|---|---|---|---|
| Impact Bot-11: Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or the Reading Island Restoration Plan, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area | LOS before Mitigation | NI | NI | NI | NI | PS | PS |
| | Mitigation Measure | None required. | None needed; thus, none proposed. | | | Mitigation Measure Bot-11: Revegetate Disturbed Areas, Consult with DFG. | |
| | LOS after Mitigation | NI | NI | NI | NI | LTS | LTS |
| Impact Bot-12: Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area | LOS before Mitigation | NI | NI | NI | NI | PS | PS |
| | Mitigation Measure | None required. | None needed; thus, none proposed. | | | Mitigation Measure Bot-12 : Conduct Preconstruction Surveys for Special-Status Plants and Avoid Special-Status Plant Populations During Construction. | |
| | LOS after Mitigation | NI | NI | NI | NI | LTS | LTS |
| Impact Bot-13: Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program, Restoring Sacramento River Flow Through Anderson Slough, Rehabilitating the Reading Island Boat Ramp, or Constructing a Handicap Fishing Access Area | LOS before Mitigation | NI | NI | NI | NI | PS | PS |
| | Mitigation Measure | None required. | None needed; thus, none proposed. | | | Mitigation Measure Bot-13: Implement Weed Management Measures and Revegetation. | |
| | LOS after Mitigation | NI | NI | NI | NI | LTS | LTS |

**Table 12-16. Summary of Mitigation Measures for Botanical Resources (contd.)**

| Impact | | No-Action Alternative | CP1 | CP2 | CP3 | CP4 | CP5 |
|---|---|---|---|---|---|---|---|
| Impact Bot-14: Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River | LOS before Mitigation | LTS | S (lower Sacramento River); LTS (Delta) | S (lower Sacramento River); LTS (Delta) | S (lower Sacramento River); LTS (Delta) | S (lower Sacramento River); LTS (Delta) | S (lower Sacramento River); LTS (Delta) |
| | Mitigation Measure | None required. | Mitigation Measure Bot-14: Implement Mitigation Measure Bot-7: Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities. | | | | |
| | LOS after Mitigation | LTS | LTS | LTS | LTS | LTS | LTS |
| Impact Bot-15: Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Along the Lower Sacramento River | LOS before Mitigation | PS | PS | PS | PS | PS | PS |
| | Mitigation Measure | None required. | Mitigation Measure Bot-15: Implement Mitigation Measure Bot-7: Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities. | | | | |
| | LOS after Mitigation | PS | LTS | LTS | LTS | LTS | LTS |
| Impact Bot-16: Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Along the Lower Sacramento River and in the Delta | 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 Bot-17: Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas | 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 |

**Table 12-16. Summary of Mitigation Measures for Botanical Resources (contd.)**

| Impact | | No-Action Alternative | CP1 | CP2 | CP3 | CP4 | CP5 |
|---|---|---|---|---|---|---|---|
| Impact Bot-18: Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas | 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 Bot-19: Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in CVP/SWP Service Areas | 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 |

Notes:
LOS = level of significance
LTS = less than significant
NA = not applicable
NI = no impact
PS = potentially significant
S = significant
SU = significant and unavoidable

### *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 is needed.

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

No mitigation is needed for Impacts Bot-1 (CP1), Bot-9 (CP1), Bot-10 (CP1), Bot-11 (CP1) through Bot-13 (CP1), and Bot-16 (CP1) through Bot-19 (CP1). Mitigation is provided below for the remaining impacts of CP1 on botanical resources.

**Mitigation Measure Bot-2 (CP1): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas**

The following mitigation measures will reduce impacts on MSCS plants:

- When feasible in relocation areas, avoid or minimize actions that could result in harm or mortality to individuals or to the viability of populations.

- When feasible, Reclamation will relocate populations of MSCS plants that would be directly affected to suitable habitat within undisturbed portions of the Shasta Lake and vicinity portion of the primary study area.

- A mitigation and monitoring plan will be developed to monitor success of MSCS plant populations that have been relocated or revegetated. The plan will identify suitable sites for mitigation, species to be planted, and numbers and sizes of plantings. It will describe planting techniques, prescribe methods to remove existing noxious weeds, and establish reasonable performance standards and contingency measures. Further, it will establish conservation easements as appropriate. The vegetation restoration plan will be developed in consultation with the USACE, USFWS, USFS, and DFG.

- Where appropriate, MSCS covered plant species will be used for revegetation.

Implementation of this mitigation measure would reduce impacts on MSCS plant species; however, because successful relocation, transplanting, and artificial propagation of Shasta snow-wreath are unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of

mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-3 (CP1): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas** The following mitigation measures will reduce impacts on USFS sensitive, BLM sensitive and CRPR plants:

When feasible in relocation areas, avoid or minimize actions that could result in harm or mortality to individuals or to the viability of populations.

- When feasible, Reclamation will relocate populations of USFS sensitive, BLM sensitive and CRPR plants that would be directly affected to suitable habitat within undisturbed portions of the Shasta Lake and vicinity portion of the primary study area.

- A mitigation and monitoring plan will be developed to monitor success of USFS sensitive, BLM sensitive, and CRPR plant populations that have been relocated or revegetated. The plan will identify suitable sites for mitigation, species to be planted, and numbers and sizes of plantings. It will describe planting techniques, prescribe methods to remove existing noxious weeds, and establish reasonable performance standards and contingency measures. Further, it will establish conservation easements as appropriate. The vegetation restoration plan will be developed in consultation with USACE, USFWS, USFS, and DFG.

- To the extent feasible, USFS sensitive, BLM sensitive, and CRPR plant species will be used for revegetation.

Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive, and CRPR plant species; however, because successful relocation and transplantation of these species are unproven, impacts would remain potentially significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-4 (CP1): Mitigate Loss of Jurisdictional Waters** Specific mitigation measures have not been determined for this impact. Within relocation areas, jurisdictional waters of the United States will be avoided when feasible. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation will be provided in the FEIS. A discussion of

mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

Until the details of this mitigation measure are developed, Impact Bot-4 (CP1) is considered significant and unavoidable.

**Mitigation Measure Bot-5 (CP1): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats** It is anticipated that mitigation lands will be acquired and placed in conservation easements to mitigate for the loss of vegetation habitat. Additionally, opportunities for restoration and enhancement of habitat will be explored and defined. Potential mitigation lands containing comparable habitat in locations where these species are known to occur have been identified adjacent to the project. Additional discussion of how these lands could be applied as mitigation will be presented in the FEIS. However, the effectiveness of providing compensatory mitigation by acquiring and conserving habitat mitigation lands to mitigate inundation impacts cannot be accurately determined without additional details. This impact, therefore, is considered significant and unavoidable. Until the details of this mitigation measure are developed, Impact Bot-5 (CP1) is considered significant and unavoidable.

**Mitigation Measure Bot-6 (CP1): Develop a Weed Management Plan** Reclamation will develop a weed management plan to avoid or minimize the potential for project-related impacts from noxious and invasive plants. This plan would include the following:

- Conduct annual weed monitoring of relocation and construction areas for three seasons after project completion.
- Design and implement appropriate USFS approved eradication methods for weed species detected.
- Treat and monitor existing source weed populations within and adjacent to construction and relocation areas.
- In relocation areas, seed disturbed soils with native grass and forb seeds to discourage occupation by noxious weeds.
- Include C Provision 6.35, Equipment Cleaning (4/04), in all contracts.

Use only weed-free road fill, gravel, mulches, and seed sources. Implementation of these measures would reduce Impact Bot-6 (CP1) to a less than significant level.

**Mitigation Measure Bot-7 (CP1): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** Reclamation will develop and implement a riverine ecosystem mitigation and adaptive management plan to mitigate to the extent feasible any identified impacts of an altered Sacramento River flow regime on existing riparian and wetland communities, and associated instream, riparian, and wetland habitat values for aquatic and terrestrial special-status species along the Sacramento River from Shasta Dam to Colusa (River Mile 144). The plan will be consistent with and supporting implementation of the Senate Bill 1086 program, and will be developed in coordination with USFWS, the NMFS, DFG, and the Sacramento River Conservation Area Forum. The Plan will be developed before project construction. The plan is limited to the Sacramento River from Shasta Dam to Colusa (River Mile 144). The existing conditions as of 2010 are the baseline conditions.

The goals of the plan will be to result in no net reduction in the average amount of any of the following along the Sacramento River from Shasta Dam to Colusa:

- Channel migration in selected areas of natural vegetation dominated by native species
- Overbank inundation of natural vegetation dominated by native species in selected areas
- Regeneration of early-successional riparian vegetation (e.g., cottonwood regeneration) in selected areas

The riverine ecosystem mitigation plan will include all of the following elements:

- Modeling or monitoring at representative locations to quantify direct and indirect impacts resulting from adaptive management of project implementation. A method of quantifying impacts will be used that ensures repeatability.
- An evaluation of feasible modifications to the procedures for operating Shasta Dam (e.g., ramping rates) to do any of the following:
  - Reduce or eliminate adverse impacts on ecologically important bankfull and overbank flows (as feasible within existing flood reduction constraints)
  - Reduce or eliminate adverse impacts (e.g., reduction) on meander migration rates

  - Facilitate establishment of cottonwoods and early-successional vegetation at intervals sufficient to sustain cottonwoods and early-successional riparian vegetation along the Sacramento River riparian corridor and floodplain (e.g., at 5- to 15-year intervals)

  - Feasible modifications to operational procedures are those not in conflict with applicable laws, agreements, and regulations, or with the purpose of the project. Implementation of this mitigation measure cannot increase flood risk.

- A specific combination of mitigation actions will be developed and implemented to attain the plan's goals. Mitigation actions will consist of feasible modifications of dam operation procedures and/or funding of appropriate and feasible restoration actions that have been developed by Reclamation, other federal agencies, state or local governments, or private nonprofits and received applicable federal and state permits. Appropriate and feasible restoration actions do any of the following:

  - Enhance connectivity of river side channels (e.g., by modifying the elevation of secondary channels, remnant oxbows, or meander scars)

  - Expand the river meander zone at selected locations (e.g., by assisting in funding projects that meet this objective)

  - Increase floodplain connectivity (e.g., by assisting in funding projects that meet this objective)

  - Control and remove nonnative, invasive plant species from riparian areas to shift dominance to native species

  - Create riparian and wetland communities (e.g., through plantings)

  - Increase shaded riverine aquatic habitat (e.g., through plantings)

- The methods and results of an analysis demonstrating that a specified combination of mitigation actions should attain the plan's goals.

- The location of restoration actions specified in the combination of mitigation actions. Restoration actions will be performed on preserved sites and with funding for management in perpetuity. (Preserved sites include sites previously preserved by other entities.)

- Implementation mechanisms (i.e., mechanisms by which Reclamation will fund implementation) and criteria for implementing dam operation procedures that provide mitigation

- Parameters for preparation and content of restoration and management plans, or existing applicable plans.

At a minimum, mitigation in this plan will include the following:

- Feasible modifications to dam operation procedures identified as reducing adverse impacts on meander migration or ecologically important bankfull and overbank flows, or as facilitating cottonwood establishment

- Either of the following elements:

  – Provide actions or funding to increase meander migration, side-channel connectivity, or floodplain connectivity along the Sacramento River, and creation (or conversion of nonnative-dominated to native-dominated) of riparian or wetland communities

  – Provide mitigation that has been determined by USFWS, NMFS, and DFG to be of comparable or greater value and is included in the terms and conditions of permits for impacts on species listed as threatened or endangered by the State or Federal governments

Implementation of this mitigation measure would mitigate the impact of altered flow regimes on instream, riparian, and wetland communities, and thus would reduce Impact Bot-7 (CP1) to a less than significant level.

**Mitigation Measure Bot-8 (CP1): Implement Mitigation Measure Bot-7 (CP1): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** Reclamation will implement Mitigation Measure Bot-7 (CP1) as described above. As described under Mitigation Measure Bot-7 (CP1), developing and implementing a riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the upper Sacramento River in the primary study area. Consequently, implementation of the previous mitigation measure would reduce Impact Bot-8 (CP1) to a less than significant level.

**Mitigation Measure Bot-14 (CP1): Implement Mitigation Measure Bot-7 (CP1): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This measure is identical to Mitigation Measure Bot-7 (CP1) as described above. This mitigation measure involves developing and implementing of a riverine

ecosystem mitigation plan. Implementation of this mitigation measure would reduce Impact Bot-14 (CP1) to a less than significant level.

**Mitigation Measure Bot-15 (CP1): Implement Mitigation Measure Bot-7 (CP1): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** Reclamation will implement Mitigation Measure Bot-7 (CP1) as described above. As described under Mitigation Measure Bot-7 (CP1), developing and implementing a riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the lower Sacramento River in the extended study area. Consequently, implementing the previous mitigation measure would reduce Impact Bot-15 (CP1) to a less than significant level.

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

No mitigation is needed for Impacts Bot-1 (CP2), Bot-9 (CP2), Bot-10 (CP2), Bot-11 (CP2) through Bot-13 (CP2), and Bot-16 (CP2) through Bot-19 (CP2). Mitigation is provided below for the remaining impacts of CP2 on botanical resources.

**Mitigation Measure Bot-2 (CP2): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas** This mitigation measure is identical to Mitigation Measure Bot-2 (CP1). Implementation of this mitigation measure would reduce impacts on MSCS species; however, because relocation of these species is unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-3 (CP2): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas** This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive and CRPR plant species; however, because relocation of these species is unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of

mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-4 (CP2): Mitigate Loss of Jurisdictional Waters** This mitigation measure is identical to Mitigation Measure Bot-4 (CP1). Specific mitigation measures have not been determined for this impact. Within relocation areas, jurisdictional waters of the United States will be avoided when feasible. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

Until the details of this mitigation measure are developed, Impact Bot-4 (CP2) is considered significant and unavoidable.

**Mitigation Measure Bot-5 (CP2): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats** This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Specific mitigation measures have not been determined for this impact. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

Until the details of this mitigation measure are developed, Impact Bot-5 (CP2) is considered significant and unavoidable.

**Mitigation Measure Bot-6 (CP2): Develop a Weed Management Plan** This mitigation measure is identical to Mitigation Measure Bot-6 (CP1). Implementation of this mitigation measure would reduce Impact Bot-6 (CP2) to a less than significant level.

**Mitigation Measure Bot-7 (CP2): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This mitigation measure is identical to Mitigation Measure Bot-7 (CP1), except that mitigation in the riverine ecosystem mitigation plan will include either of the following elements:

- Increased meander migration, side-channel connectivity, or floodplain connectivity along the Sacramento River, and creation (or conversion from nonnative-dominated to native-dominated) of riparian or wetland communities

- Mitigation that has been determined by USFWS, NMFS, and DFG to be of comparable or greater value and is included in the terms and

conditions of permits for impacts on species listed as threatened or endangered by the State or Federal government

Implementation of this mitigation measure would reduce Impact Bot-7 (CP2) to a less than significant level.

**Mitigation Measure Bot-8 (CP2): Implement Mitigation Measure Bot-7 (CP2): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** Reclamation will implement Mitigation Measure Bot-7 (CP2) as described above. Developing and implementing this riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the upper Sacramento River in the primary study area. Implementation of this mitigation measure would reduce Impact Bot-8 (CP2) to a less than significant level.

**Mitigation Measure Bot-14 (CP2): Implement Mitigation Measure Bot-7 (CP2): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This mitigation measure is identical to Mitigation Measure Bot-7 (CP2). This mitigation measure involves the development and implementation of a riverine ecosystem mitigation plan. Implementation of this mitigation measure would reduce Impact Bot-14 (CP2) to a less than significant level.

**Mitigation Measure Bot-15 (CP2): Implement Mitigation Measure Bot-7 (CP2): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** Reclamation will implement Mitigation Measure Bot-7 (CP2) as described above. Developing and implementing this riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the lower Sacramento River in the extended study area. This mitigation measure is identical to Mitigation Measure Bot-7 (CP2). Implementation of this mitigation measure would reduce Impact Bot-15 (CP2) to a less than significant level.

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

No mitigation is needed for Impacts Bot-1 (CP3), Bot-9 (CP3), Bot-10 (CP3), Bot-11 (CP3) through Bot-13 (CP3), and Bot-16 (CP3) through Bot-19 (CP3). Mitigation is provided below for the remaining impacts of CP3 on botanical resources.

**Mitigation Measure Bot-2 (CP3): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas** This mitigation measure is identical to Mitigation Measure Bot-2 (CP1). Implementation of this mitigation measure would reduce impacts on MSCS species; however, because relocation of these species is unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-3 (CP3): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas** This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive and CRPR plant species; however, because relocation of these species is unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-4 (CP3): Mitigate Loss of Jurisdictional Waters** This mitigation measure is identical to Mitigation Measure Bot-4 (CP1). Specific mitigation measures have not been determined for this impact. Within relocation areas, jurisdictional waters of the United States will be avoided when feasible. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

Until the details of this mitigation measure are developed, Impact Bot-4 (CP3) is considered significant and unavoidable.

**Mitigation Measure Bot-5 (CP3): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats** This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Specific mitigation measures have not been determined for this impact. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be

provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

Until the details of this mitigation measure are developed, Impact Bot-5 (CP3) is considered significant and unavoidable.

**Mitigation Measure Bot-6 (CP3): Develop a Weed Management Plan** This mitigation measure is identical to Mitigation Measure Bot-6 (CP1). Implementation of this mitigation measure would reduce Impact Bot-6 (CP3) to a less than significant level.

**Mitigation Measure Bot-7 (CP3): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This mitigation measure is identical to Mitigation Measure Bot-7 (CP1), except that mitigation in the riverine ecosystem mitigation plan will include either of the following elements:

- Increased meander migration, side-channel connectivity, or floodplain connectivity along the Sacramento River, and creation (or conversion from nonnative-dominated to native-dominated) of riparian or wetland communities

- Mitigation that has been determined by USFWS, NMFS, and DFG to be of comparable or greater value and is included in the terms and conditions of permits for impacts on species listed as threatened or endangered by the State or Federal government.

Implementation of this mitigation measure would reduce Impact Bot-7 (CP3) to a less than significant level.

**Mitigation Measure Bot-8 (CP3): Implement Mitigation Measure Bot-7 (CP3): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** Reclamation will implement Mitigation Measure Bot-7 (CP3) as described above. The development and implementation of this riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the upper Sacramento River in the primary study area. Implementation of this mitigation measure would reduce Impact Bot-8 (CP3) to a less than significant level.

**Mitigation Measure Bot-14 (CP3): Implement Mitigation Measure Bot-7 (CP3): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). This mitigation measure involves the development and implementation of a riverine ecosystem mitigation plan. Implementation of this mitigation measure would reduce Impact Bot-14 (CP3) to a less than significant level.

**Mitigation Measure Bot-15 (CP3): Implement Mitigation Measure Bot-7 (CP3): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** Reclamation will implement Mitigation Measure Bot-7 (CP3) as described above. The development and implementation of this riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the lower Sacramento River in the extended study area. Implementation of this mitigation measure would reduce Impact Bot-15 (CP3) to a less than significant level.

#### *CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability*

No mitigation is needed for Impacts Bot-1 (CP4), Bot-9 (CP4), Bot-10 (CP4), and Bot-16 (CP4) through Bot-19 (CP4). Mitigation is provided below for the remaining impacts of CP4 on botanical resources.

**Mitigation Measure Bot-2 (CP4): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas** This mitigation measure is identical to Mitigation Measure Bot-2 (CP1). Implementation of this mitigation measure would reduce impacts on MSCS species; however, because relocation of these species is unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-3 (CP4): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas** This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive and CRPR plant species; however, because relocation of these species is unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-4 (CP4): Mitigate Loss of Jurisdictional Waters** This mitigation measure is identical to Mitigation Measure Bot-4 (CP1). Specific mitigation measures have not been determined for this impact. Within relocation areas, jurisdictional waters of the United States will be avoided when feasible. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

Until the details of this mitigation measure are developed, Impact Bot-4 (CP4) is considered significant and unavoidable.

**Mitigation Measure Bot-5 (CP4): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats** This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Specific mitigation measures have not been determined for this impact. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

Until the details of this mitigation measure are developed, Impact Bot-5 (CP4) is considered significant and unavoidable.

**Mitigation Measure Bot-6 (CP4): Develop a Weed Management Plan** This mitigation measure is identical to Mitigation Measure Bot-6 (CP1). Implementation of this mitigation measure would reduce Impact Bot-6 (CP4) to a less than significant level.

**Mitigation Measure Bot-7 (CP4): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This mitigation measure is identical to Mitigation Measure Bot-7 (CP1). Implementation of this mitigation measure would reduce Impact Bot-7 (CP4) to a less than significant level.

**Mitigation Measure Bot-8 (CP4): Implement Mitigation Measure Bot-7 (CP1): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** This mitigation measure is identical to Mitigation Measure Bot-7 (CP1). Implementation of this mitigation measure would reduce Impact Bot-8 (CP4) to a less than significant level.

**Mitigation Measure Bot-11 (CP4): Revegetate Disturbed Areas, Consult with DFG** Reclamation will implement the following measures to reduce and compensate for loss of sensitive natural communities:

- Before removing any vegetation at the augmentation sites and access areas, a survey will be conducted to map and classify the natural communities present in these areas, including wetland communities.

- Augmentation access will be designed to avoid disturbing wetland plant communities to the extent feasible. Removal of mature riparian vegetation and other sensitive vegetation will be minimized to the extent possible while still allowing access to gravel augmentation sites.

- DFG will be consulted with to determine if a Section 1602 streambed alteration agreement will be required for the gravel augmentation activities affecting the bed and bank of the Sacramento River and side channels.

- Staging and gravel and equipment storage will be confined to developed or disturbed areas to the extent feasible.

- A revegetation plan will be prepared to restore native vegetation in all areas cleared to implement the gravel augmentation program immediately following completion of the gravel augmentation activities at each augmentation site. The revegetation plan will include performance standards and success criteria to ensure that mitigation habitat would be successfully maintained and result in no net loss of sensitive natural communities, including riparian vegetation.

- Implement all conditions of the streambed alteration agreement to the satisfaction of DFG, subject to limitations on its authority set forth in Fish and Game Code Section 1600 et seq.

In addition, Reclamation will implement the following measures to reduce and compensate for potential loss of sensitive natural communities from the Reading Island Plan:

- A survey will be conducted before removing any vegetation at the augmentation sites and access areas, to map and classify the natural

communities present in restoration and potential construction areas at Reading Island.

- DFG will be consulted with to determine if a Section 1602 streambed alteration agreement will be required for the Reading Island restoration and construction activities affecting the bed and bank of the Sacramento River and side channel.

- Handicap fishing access will be designed to avoid disturbing sensitive plant communities to the extent feasible. A 100-foot no disturbance buffer shall be established around sensitive plant communities that are to be avoided during construction. Removal of mature riparian vegetation and other sensitive vegetation will be minimized to the extent possible.

- Staging, equipment storage, and construction access for Reading Island activities will be confined to existing roads and parking lots.

- Native riparian and other sensitive vegetation, if any, removed from the levee, boat ramp, and fishing access sites will be replaced on a no-net-loss basis. Riparian vegetation will be replaced through planting and establishment of comparable native riparian vegetation along the side channel floodplain. Other sensitive plant communities may be replaced through restoration of comparable native vegetation at other sites on Reading Island.

- Planting mix, composition, and density will be determined by a more detailed site analysis, but could include native cottonwood, willow, box elder, valley oak, western sycamore, elderberry, and a variety of understory brush species. Temporary irrigation will be provided on an as-needed basis.

Implement all conditions of the streambed alteration agreement to the satisfaction of DFG, subject to limitations on its authority set forth in Fish and Game Code Section 1600 et seq.

Implementation of this mitigation measure would reduce Impact Bot-11 (CP4) to a less than significant level.

**Mitigation Measure Bot-12 (CP4): Conduct Preconstruction Surveys for Special-Status Plants and Avoid Special-Status Plant Populations During Construction** Reclamation will implement the following measures to avoid impacts on special-status plants from resulting from the gravel augmentation program:

- Botanists will be hired to conduct protocol-level special-status plant surveys before commencing any construction activities that could disturb vegetation.

- All special-status plants identified within 250 feet of the proposed augmentation sites will be mapped and identified for avoidance. Access routes and gravel placement will be designed to avoid impacts on special-status plants.

- Fencing will be installed a minimum of 100 feet from special-status plants and no project activity will be permitted within the area occupied by special-status plants or the 100-foot buffer area around these plants.

- Insecticides, herbicides, fertilizers, or other chemicals that might harm special-status plants will not be used within 100 feet of the plants. Roadways and disturbed areas within 100 feet of special-status plants will be watered at least twice a day and as needed to minimize dust emissions.

In addition, Reclamation will implement the following measures to avoid impacts on special-status plants resulting from the Reading Island Plan:

- Qualified botanists will be hired to conduct protocol-level special-status plant surveys before commencing any construction activities that could disturb vegetation.

- All special-status plants identified within 250 feet of the proposed augmentation sites will be mapped and avoided to the extent feasible. It is unlikely that special-status plants are present on the levee, but if they are, it may not be possible to avoid them and still be able to breach the levee and restore connectivity to the Sacramento River. Handicap fishing access and boat ramp rehabilitation activities shall avoid special-status plants. Protective fencing will be installed around special-status plant locations and a 100-foot buffer zone during construction activities.

- Insecticides, herbicides, fertilizers, or other chemicals that might harm special-status plants will not be used within 100 feet of special-status plants. Roadways and disturbed areas within 100 feet of special-status plants will be watered at least twice a day and as needed to minimize dust emissions.

Implementation of this mitigation measure would reduce Impact Bot-12 (CP4) to a less than significant level.

**Mitigation Measure Bot-13 (CP4): Implement Weed Management Measures and Revegetation** Reclamation will implement the following measures to reduce the risk of introducing and spreading noxious weeds or invasive plant species during gravel augmentation or implementation of the Reading Island Plan:

- Before conducting gravel augmentation activities, invasive plant and noxious weed infestations will be identified and mapped within the augmentation sites, including vegetation clearing sites.

- Noxious weeds will be removed at the onset of construction and disposed of properly. If noxious weeds are not removed at the onset of construction, they will be fenced and avoided during construction.

- Any clothing, footwear, and equipment used during construction will be ensured free of soil, seeds, vegetative matter or other debris or potential seed-bearing material before entering the project sites or before moving from infested sites to uninfested sites.

- Mitigation Measure Bot-11 (CP4) will be implemented to restore native vegetation in all areas disturbed by gravel placement and construction of access routes immediately following completion of the gravel augmentation activities at each augmentation site.

- Only weed-free gravel, fill soil, mulch, seed mixes, and straw materials will be used during construction, implementation of BMPs, and post construction revegetation. Certified weed-free material will be used if available.

Implementation of this mitigation measure would reduce Impact Bot-13 (CP4) to a less than significant level.

**Mitigation Measure Bot-14 (CP4): Implement Mitigation Measure Bot-7 (CP1): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This mitigation measure is identical to Mitigation Measure Bot-7 (CP1). Implementation of this mitigation measure would reduce Impact Bot-14 (CP4) to a less than significant level.

**Mitigation Measure Bot-15 (CP4): Implement Mitigation Measure Bot-7 (CP1): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** This mitigation measure is identical to Mitigation Measure Bot-7 (CP1). Implementation of this mitigation measure would reduce Impact Bot-15 (CP4) to a less than significant level.

***CP5 – 18.5-Foot Dam Raise, Combination Plan***

No mitigation is needed for Impacts Bot-1 (CP5), Bot-9 (CP5), Bot-10 (CP5), and Bot-16 (CP5) through Bot-19 (CP5). Mitigation is provided below for the remaining impacts of CP5 on botanical resources.

**Mitigation Measure Bot-2 (CP5): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas** This mitigation measure is identical to Mitigation Measure Bot-2 (CP1). Implementation of this mitigation measure would reduce impacts on MSCS species; however, because relocation of these species is unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-3 (CP5): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas** This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive and CRPR plant species; however, because relocation of these species is unproven, impacts would remain significant and unavoidable.

Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-4 (CP5): Mitigate Loss of Jurisdictional Waters** This mitigation measure is identical to Mitigation Measure Bot-4 (CP1). Specific mitigation measures have not been determined for this impact. Within relocation areas, jurisdictional waters of the United States will be avoided when feasible. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

Until the details of this mitigation measure are developed, Impact Bot-4 (CP5) is considered significant and unavoidable.

**Mitigation Measure Bot-5 (CP5): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats** This mitigation measure is identical

to Mitigation Measure Bot-3 (CP1). Specific mitigation measures have not been determined for this impact. Potential mitigation lands containing comparable habitat have been identified adjacent to the project. Additional discussion of how these lands may be applied as mitigation and at what ratios will be provided in the FEIS. A discussion of mitigation for loss of habitat through preservation and enhancement in mitigation areas will be included in the FEIS.

**Mitigation Measure Bot-6 (CP5): Develop a Weed Management Plan** This mitigation measure is identical to Mitigation Measure Bot-6 (CP1). Implementation of this mitigation measure would reduce Impact Bot-6 (CP5) to a less than significant level.

**Mitigation Measure Bot-7 (CP5): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Implementation of this mitigation measure would reduce Impact Bot-7 (CP5) to a less than significant level.

**Mitigation Measure Bot-8 (CP5): Implement Mitigation Measure Bot-7 (CP3): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Implementation of this mitigation measure would reduce Impact Bot-8 (CP5) to a less than significant level.

**Mitigation Measure Bot-11 (CP5): Revegetate Disturbed Areas; Consult with DFG** This mitigation measure is identical to Mitigation Measure Bot-11 (CP4). Implementation of this mitigation measure would reduce Impact Bot-11 (CP5) to a less than significant level.

**Mitigation Measure Bot-12 (CP5): Conduct Preconstruction Surveys for Special-Status Plants and Avoid Special-Status Plant Populations During Construction** This mitigation measure is identical to Mitigation Measure Bot-12 (CP4). Implementation of this mitigation measure would reduce Impact Bot-12 (CP5) to a less than significant level.

**Mitigation Measure Bot-13 (CP5): Implement Weed Management Measures and Revegetation** This mitigation measure is identical to Mitigation Measure Bot-13 (CP4). Implementation of this mitigation measure would reduce Impact Bot-13 (CP5) to a less than significant level.

**Mitigation Measure Bot-14 (CP5): Implement Mitigation Measure Bot-7 (CP3): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities** This

mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Implementation of this mitigation measure would reduce Impact Bot-14 (CP5) to a less than significant level.

**Mitigation Measure Bot-15 (CP5): Implement Mitigation Measure Bot-7 (CP3): Develop and Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management** This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Implementation of this mitigation measure would reduce Impact Bot-15 (CP5) to a less than significant level.

### 12.3.6 Cumulative Effects

A large number of past actions have occurred in the study area. These past actions have substantially degraded botanical resources within the primary and extended study areas. This degradation is indicated by the number of species that have been listed as threatened or endangered under the CESA and Federal ESA, and by the large portion of all native plant species that are now listed by CNPS as rare, threatened, or endangered, or that are now on CNPS watch or review lists.

Past actions have caused these effects by converting habitat to developed or agricultural land uses, altering biotic interactions or physical processes, and damaging or causing mortality from human activities (e.g., vegetation removal during road, levee, or utility maintenance).

Most botanical resources in the study area have been adversely affected by most of the mechanisms described above (i.e., conversion of habitat to developed or agricultural land uses, the spread of invasive species, alteration of physical processes, and human disturbance). Overall, these botanical resources have been substantially degraded by past actions, and past actions are continuing to affect them. In particular, the geographic range and abundance (and thus the effects) of many nonnative, invasive plant species that were introduced into the study area in the past are still rapidly increasing.

The construction of Shasta Dam and the subsequent flooding of the area now known as Shasta Lake affected botanical and wildlife resources endemic to the region. For example, based on existing population locations, Shasta snow-wreath populations may have connected at the confluence of the Pit, Squaw, McCloud, and Sacramento rivers before inundation. The creation of Shasta Lake fragmented this species habitat and populations. As a result, these populations are more vulnerable to extirpation.

The effects of climate change on operations at Shasta Lake could potentially affect botanical resources both at the lake and downstream. As described in the Climate Change Projection Appendix, climate change could result in higher reservoir releases in the future because of an increase in winter and early-spring

inflow into the lake from high-intensity storm events. The change in reservoir releases could be necessary to manage for flood events resulting from these potentially larger storms. The potential increase in releases from the reservoir could lead to long-term changes in flooding frequency and acreages and distribution of vegetation.

#### *Shasta Lake and Vicinity*

As described in Section 12.3, without mitigation, CP1 through CP5 could cause potentially significant effects on botanical and wetland resources in the primary and extended study areas. These effects could be caused by project construction activities; increased elevations of the water surface of Shasta Lake; and alteration of the flow regime of the Sacramento River and associated geomorphic processes, and thus of riparian vegetation. Although causing similar effects, CP1 – CP5 differ in the magnitude of their effects. At Shasta Lake and its vicinity, these potential adverse effects would be similar for all alternatives, but differ with the height of the dam raise: the effects of CP2 would be greater than CP1, but less than CP3 – CP5 (which would be identical). Along the upper Sacramento River and in the extended study area, potential adverse effects would be the result of altered flow regimes and would differ with both the height of the dam raise and operation of the dam: the effects of CP2 would be greater than CP1 and CP4 (which would be identical), but less than CP3 and CP5 (which also would have identical effects).

At Shasta Lake and vicinity, CP1 through CP5 would cause the loss of MSCS Covered Species, USFS sensitive, BLM sensitive, or CRPR Species, Jurisdictional Waters, and general habitats, and could cause the spread of noxious and invasive weeds. The mitigation measures described in Section 12.3.6 would reduce impacts on botanical and wetland resources. However, the adverse effects of CP1 through CP5 caused by construction activities and inundation would not be eliminated, with the exception of noxious and invasive weed impacts (Impact Bot-6). Because the overall effect of past actions on wetland and botanical resources has been cumulatively significant, and the likely additional effects of reasonably foreseeable future actions on these at Shasta Lake and in its vicinity, the adverse effects under CP1 through CP5 (except Impact Bot-6) would potentially be cumulatively considerable and these effects would be potentially cumulatively significant. Because mitigation measures to control the spread of weeds would effectively address the project's impact, however; CP1 through CP5 would not make a cumulatively considerable incremental contribution to an overall significant cumulative impact on plants and wetlands.

#### *Upper Sacramento River and Extended Study Area*

Along the Sacramento River and other rivers downstream from CVP and SWP reservoirs, substantial past alterations to geomorphic processes, vegetation, and associated habitats have resulted in an overall significant and substantial effect on these resources. Therefore, additional adverse effects would be cumulatively considerable. This adverse effect would be the result of the continued

consequences of past actions (e.g., construction of Shasta Dam and introduction of nonnative species), and of present and foreseeable water resource and levee actions whose adverse effects may not be fully mitigated.

Most adverse effects that are the continued consequences of past actions have been considered in the development of existing local and regional plans. Consequently, with respect to local and regional plans, there does not already exist an overall significant cumulative effect. However, the adverse effects of all present and reasonably foreseeable water resources and levee actions are not likely to be avoided or fully mitigated. The unmitigated effects of these actions could be sufficiently considerable to have a significant cumulative effect overall.

Habitat loss along the upper Sacramento River and in the extended study area has already resulted in an overall effect on sensitive communities and special-status plants that is significant and substantial. (It is the primary reason that a large number of plant species along the upper Sacramento River and in the extended study area have been listed as threatened or endangered by the State or Federal governments, or have been designated rare, threatened, or endangered by CNPS (i.e., placed on CNPS list 1B).)

**CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability** As described in Chapter 2, "Alternatives" without mitigation, by altering the flow regime and associated geomorphic processes on the Sacramento River, CP1 could affect sensitive plant communities and special-status species (Impact Bot-7 (CP1) and Bot-14 (CP1)) and could potentially affect regional or local plans with objectives of riparian habitat protection or watershed management (Impact Bot-8 (CP1) and Bot-15 (CP1)). These effects could occur on the upper Sacramento River and portions of the lower Sacramento River. Because substantial past alterations to geomorphic processes, vegetation, and associated habitats along the Sacramento River have resulted in an overall significant cumulative effect on these resources, additional adverse effects would be cumulatively considerable. However, with the implementation of Mitigation Measure Bot-7 (CP1), adverse effects from CP1 on botanical resources along the Sacramento River would be fully mitigated. Thus, CP1 would not result in a cumulatively considerable incremental effect on these resources, and the potential to affect regional or local plans would also be eliminated. Therefore, these effects of CP1 would not be cumulatively significant.

By altering the flow regimes below CVP and SWP reservoirs in the extended study area, CP1 could possibly cause similar effects on these rivers as along the Sacramento River. (These effects were identified as Impacts Bot-17 (CP1) and Bot-18 (CP1).) However, the alteration of these flow regimes would be less extensive than along the Sacramento River. Even without mitigation, the effects of CP1 on these rivers might not be sufficient to alter the extent or species composition of sensitive communities or to alter the habitats of special-status

plant species. In addition, Mitigation Measure Aqua-15 (CP1), "Maintain Flows in the Feather River, American River, and Trinity River Consistent with Existing Regulatory and Operational Requirements and Agreements," would reduce these effects to a level that is unlikely to alter the extent or species composition of sensitive communities or to alter the extent or quality of habitat for special-status plant species. Therefore, these effects of CP1 would not be a cumulatively considerable incremental contribution to a significant cumulative impact.

By altering flow regimes on the upper Sacramento River, CP1 also could affect designated critical habitat for special-status species of vernal pool habitats (Impact Bot-9 (CP1)). However, vernal pool plant communities and associated special-status species likely would not be affected by any of the alternatives. Therefore, the project would not have a cumulatively considerable effect, and would not be cumulatively significant.

Along the upper Sacramento River and in the extended study area, CP1 could induce growth that results in the loss of sensitive plant communities and special-status plant species (Impacts Bot-10 (CP1), Bot-16 (CP1), and Bot-19 (CP1)). Habitat loss has resulted in an overall significant cumulative effect on sensitive communities and special-status plants that is substantial. (It is the primary reason that a large number of plant species along the upper Sacramento River and in the extended study area have been listed as threatened or endangered by the State or Federal governments, or have been designated rare, threatened or endangered by CNPS (i.e., placed on CNPS list 1B).) CP1 could induce growth-related effects because it would increase water yield to water districts, and this could reduce a limitation on growth. For example, most CVP water supports agricultural purposes, and agricultural acreages are not expected to increase substantially over time. However, some increment of the CVP water could be used for municipal and industrial contractors, such as Contra Costa Water District or Santa Clara Valley Water District. In this case, some growth-related effects could occur from development and have an incremental effect on botanical resources. Present and foreseeable future projects are also likely to add to this habitat loss. Although the future effects of any growth-related effects induced by CP1 would be analyzed and mitigated during land use planning and environmental review for site-specific development projects, it is unlikely that all effects would be avoided or fully mitigated. Therefore, CP1 would make a small incremental, but cumulatively considerable, contribution to an existing overall significant cumulative impact. This would be a cumulatively significant and unavoidable effect.

As stated previously, effects of climate change on operations at Shasta Lake could include a higher frequency of high flow events, potentially resulting in changes to downstream vegetation. Potentially significant effects on vegetation and special-status species that would occur with implementation of CP1 could contribute to potentially significant affects of climate change on habitat acreages and distribution. Although mitigation measures listed above would be

implemented to reduce project-related impacts of CP1, CP1 would still make a considerable contribution to a potentially significant cumulative effect on botanical resources.

**CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability** The cumulative effects of CP2 would be similar to those of CP1, but greater in magnitude (because CP2 would entail more substantial alterations of flow regimes). Although greater in magnitude than the effects of CP1, the effects of CP2 on sensitive plant communities and special-status species along the upper Sacramento River and in the extended study area (Impacts Bot-7 (CP2), Bot-14 (CP2), and Bot-17 (CP2)), and potential effects on regional or local plans with objectives of riparian habitat protection or watershed management (Impacts Bot-8 (CP2), Bot-15 (CP2), and Bot-18 (CP2)) would not be considerable for the same reasons given for CP1. These would not be cumulatively significant effects.

Similarly, although greater in magnitude than the effects of CP1, the effects of CP2 on designated critical habitat for special-status species of vernal pool habitats (Impact Bot-9 (CP2)) would not be considerable for the same reasons given for CP1. This would not be a cumulatively significant effect.

Also similar to CP1, along the upper Sacramento River and in the extended study area, CP2 could cause growth-related effects that result in the loss of sensitive plant communities and special-status plant species (Impacts Bot-10 (CP2), Bot-16 (CP2), and Bot-19 (CP2)). However, the potential for CP2 to cause growth-related effects would be greater than for CP1. For the same reasons given for CP1, CP2 would make a small incremental, but cumulatively considerable, contribution to an existing overall significant cumulative impact. This would be a cumulatively significant and unavoidable effect.

As stated previously, effects of climate change on operations at Shasta Lake could include a higher frequency of high flow events, potentially resulting in changes to downstream vegetation. Potentially significant effects on vegetation and special-status species that would occur with implementation of CP2 could contribute to potentially significant affects of climate change on habitat acreages and distribution. Although mitigation measures listed above would be implemented to reduce project-related impacts of CP2, CP2 would still make a considerable contribution to a potentially significant cumulative effect on botanical resources.

**CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply** The cumulative effects of CP3 would be similar to those of CP1 and CP2, but greater in magnitude. Although greater in magnitude than the effects of CP1 or CP2 (because CP3 would entail more substantial alterations of flow regimes), the effects of CP3 on sensitive plant communities and special-status species along the upper Sacramento River and in the extended study area (Impacts Bot-7 (CP3), Bot-14 (CP3), and Bot-17 (CP3)), and potential effects on regional or

local plans with objectives of riparian habitat protection or watershed management (Impacts Bot-8 (CP3), Bot-15 (CP3), and Bot-18 (CP3)) would not be considerable for the same reasons given for CP1. These would not be cumulatively significant effects.

Similarly, although greater in magnitude than the effects of CP1 or CP2, the effects of CP3 on designated critical habitat for special-status species of vernal pool habitats (Impact Bot-9 (CP3)) would not be considerable for the same reasons given for CP1. This would not be a cumulatively significant effect.

Also similar to CP1 and CP2, along the upper Sacramento River and in the extended study area, CP3 could cause growth-related effects that result in the loss of sensitive plant communities and special-status plant species (Impacts Bot-10 (CP3), Bot-16 (CP3), and Bot-19 (CP3)). However, the potential for CP3 to cause growth-related effects would be greater than for CP1 or CP2. For the same reasons given for CP1, CP3 would make a small incremental, but cumulatively considerable, contribution to an existing overall significant cumulative impact. This would be a cumulatively significant and unavoidable effect.

As stated previously, effects of climate change on operations at Shasta Lake could include a higher frequency of high flow events, potentially resulting in changes to downstream vegetation. Potentially significant effects on vegetation and special-status species that would occur with implementation of CP3 could contribute to potentially significant affects of climate change on habitat acreages and distribution. Although mitigation measures listed above would be implemented to reduce project-related impacts of CP3, CP3 would still make a considerable contribution to a potentially significant cumulative effect on botanical resources.

**CP4 – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability** The cumulative effects of CP4 would be identical to those of CP3.

**CP5 – 18.5-Foot Dam Raise, Combination Plan** The cumulative effects of CP5 would be identical to those of CP3.